BUILDING DESIGN TEAM COMMUNICATION: PRACTICE AND EDUCATION

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ABSTRACT

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This study examined three propositions:- (i) there are problems in the building design team created by difficulties of communication between different professional disciplines, (ii) communication difficulties are primarily a function of cultural differences instilled by vocational education, and (iii) communication gaps require educational initiatives able to bridge cultural differences instilled by vocational traditions in the educational process.

To achieve the most efficient process and ultimately a more effective product, building design team professionals must maximise their capacity for integrated activity and inter-professional communication. The nature of inter-professional relationships, and their development through the group formation process, is presented as a central consideration in the analysis of building design team communication.

The rationale and methodological development of the study seeks to understand whether differences in inter-professional interaction are largely a matter of values and attitudes, and whether these can be modified by training to improve communication in the building design team. Research examines whether influencing positively professional attitudes at the formative stage addresses inter-disciplinary dissonance.

This study establishes a link between education for the construction industry, and the adverse affects of perceived professional discord. This study goes beyond current conflictual opinion regarding the structure of specialised education for construction, and presents evidence that, handled correctly, future tertiary education can provide the most suitable antecedent for a more efficiently integrated building industry.

CONTENTS

DECLARATION

The candidate has not, whilst registered for this Ph.D. submission, been registered for another award of a University during the research programme.

None of the original material in this thesis has been used in any other submission for an academic award. Acknowledgements for assistance received are given under the heading acknowledgements, and any excerpt for other work has been acknowledged by its source and author.

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INTRODUCTION

INTRODUCTION

The Latham report[1*] is the latest in a long line of government, quasi-government and industry lead reports[2] which suggests that in an increasingly globalised, competitive and complex construction industry, the operational activities from conception to completion of projects are managed in a sub-optimal manner because of an inability of different professionals to work together in teams harmoniously, effectively, efficiently and ultimately synergetically. According to Latham, previous reports on the construction industry have been largely ignored when it comes to the '*integration of the work of designers and specialists involved in the construction design process*'[3]. Yet this report also acknowledges that its recommendations calling for a more integrated industry are not new. So what is the problem and why is it so difficult to change from an apparently inefficient, fragmented process to a more integrated, efficient and progressive system in the UK construction industry?

Much of the debate concerned with these questions which has occurred over the years has concentrated on the effects of the structural and technological fragmentation of the industry. The historical development of protectionism, the separation of design on the one hand and construction on the other, increasingly complex construction techniques, the evolution of reactionary professional institutions, and, the adoption of elaborate methods of procurement and contracts to maintain public accountability, have all contributed to an environment of suspicion in the construction industry. The British building industry is apparently riven by '*obstacles of mutual mistrust and cultural difference*'[4].

If anything, the environment of suspicion surrounding contemporary construction appears to

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* Superscript marked thus[1], refer to notes and references at the end of each chapter

be getting worse. In a keynote paper to the 1992 international construction symposium, Lavers argued that *'the background against which this conference is held is of a process and an industry in which conflict has risen significantly over the last three decades'*[5]. Fenn[6] has for example recorded a 500% increase in the initiation of litigation in the 20 years to 1986 in construction industry disputes between professionals charged with the creation and maintenance of the built environment and Newley[7] has shown a 100% increase in litigation between 1973 and 1980, and a 15% per annum increase in the period 1980 to 1989. Whilst this increase in litigation within the building industry can, in part, be ascribed to changes in the common and statute law, making it easier to bring claims, it is reasonable to assume that some proportion of this exceptionally large increase must stem from other than legislative alterations.

Much of the literature dealing with dissatisfaction of the construction industry also concentrates on the damaging effects of the increase of conflict within the industry, which is argued to come principally from the adversarial positions taken by the disparate professionals involved in the project[8, 9].

There is however some evidence which suggests that inter-disciplinary dispute is simply a function of the design process. Lavers for example cites authors who believe that disputes are almost inevitable and who therefore consider that the management of dispute, rather than its avoidance is necessary. This, they believe can be achieved by adopting generalist management systems and techniques which seek to diagnose the disputations and to intervene appropriately[10].

Some authors also believe that a certain amount of conflict is not only inevitable but desirable, though this may be hard to prove[11, 12]. From an extensive study of 16 construction projects for example, it was found that a significantly higher level of conflict occurred during the design stage than at other stages of the project. However, following analysis of the data the authors were *unable* to draw any conclusions about the positive effect that such conflict in the design team might give to the project overall. Their findings could *not* provide any conclusions nor substantiate their own hypothesis that '*creative management of conflict and change is of benefit to construction*'.

This same study found that conflict and change at the briefing stage, recorded low levels of conflict even though this would appear to be the best time to challenge the project, as the cost to do so is significantly lower than at other stages of the project. Conversely they found that, at the design (and construction) stage, where the financial cost of change is at its greatest, the highest occurrence of conflict was found. Clearly then, from a purely *financial* point of view at least, conflict within the building design team is detrimental to the project. Indeed, additional external financial penalties and fees may be incurred if conflict is carried beyond the ability of the design team to agree amicably and timeously, and solutions to the dispute have to be sought through litigation in arbitration and the courts.

Financial penalties also occur from design team failures in communication in areas more directly recognisable as being in building and design. Wallace's[13] analysis of the input from design team members suggests that the communication and development of cost information within building design teams has scope for improvement (particularly in communicating the capital costs of design which are intended to reduce cost-in-use performance). His findings also show that '*conflict in building design is largely unproductive and results in abortive, costly, design work*'. However, conflict within the design process has the potential to present a much greater long term problem to the industry than individual capital cost over budgeting. Ultimately conflict in the design team may lead to an inferior final product, dissatisfaction with present performance and future enmity between professionals and those they serve. Marriot[14] argues that '*when differences, resulting from different patterns of thinking, lead to a reduction in respect for, or lack of trust in each other, the design suffers*'. Case-studies of complex building projects in general, and hospital food-servicing areas in particular, have shown that over half the specific deficiencies identified by post-occupancy evaluation can be traced back to conflicts within the project organisational structure at the design stage.[15] The link between product performance and design team integration is also emphasised by Turner-Wright[16], who argues that '*diminishing project performance levels are induced by non-interaction, frustration and non-aligned perceptions of the design team members, and the projects, goals*'. This connection between conflict and performance can be examined further in research carried out by Thamhain and Wilemon[17] who surveyed 500 engineering professionals in the USA, with a view to measuring project success. They found that in the measurement of design team accomplishment (the main criteria being: technical / aesthetic success; on-time performance; and on-budget resource performance) one of the '*strongest reported barriers to project team performance was professional power struggles and interpersonal conflict*'.

A CNAA[18] report in 1991 summarised the opinions of industrial representative's (of local authorities, private practices, major consultancies, urban development co-operations, and building contractors) and their concerns over the lack of clear strategic goals, and found that these respondents also believed that '*too often professionals working in building projects spend more of their time jockeying for position than solving the problems in front of them*'. Similarly Franks[19] sought the opinion of 50 client groups[20] to ascertain the needs and expectations of the building team. He found that the clients believed that '*poor communications ... exist between all members of the team at all stages and in all forms of communication, both written and oral*' and that subsequently this resulted in a '*lack of* *liaison between members of the team and a lack of feedback*'[21]. Franks also found that *80%* of the 50 clients who took part in the survey believed that the organisation of their projects could or should be better. He found that the most frequent comment (received from 35% of the sample) was concerned with 'Architectural design and co-ordination', where the principal complaint was about the architects inability to design within pre-determined cost limits. Franks found that '*most clients regard the Architect to be the design leader and criticise the lack of teamwork between members of the design team*'. Franks also found that the next most frequent cause of complaint (25%) was poor communications between the members of the design team at all stages. This could indicate serious problems in building design, stemming from the lack of liaison in the building industry. The client bodies were also critical of their *own* performance and inability to define their requirements in order to obviate variations at a later date (25% occurrence). The performance of contractors was criticised by 10% of the sample, with 8% unhappy about the environment surrounding 'delays' and 'claims' which exists in the building industry.

Lack of effective liaison is again implied in comments made about the failure of the design team to satisfactorily incorporate services engineering installations into the design. The multi-disciplinary team appears not to be multi-disciplinary enough for some clients, who believe that the skills exist, but are under-utilised by their own project team. More than 30% of the sample commented on design team inefficiencies in 'human factors' in connection with, what are perceived to be, communication failures and a lack of teamwork. In addition, Franks found that many of the clients made particular reference to the extent to which 'people' are the 'variable factor' which determines the success or failure of their projects. He suggests that an '*encapsulation of the views of many refers to the need for better co-ordination of information in the team and better communication*'[22]

Clearly the findings of this extensive survey of UK clients, represents an important indication of the dissatisfaction of the building industry. The fact that 80% of clients[23] are dissatisfied with the service and product provided by the construction industry, must not be taken lightly. Indeed the fact that the majority of clients express dissatisfaction about the co-ordination, communication and team-work of the building design team, emphasises strongly the need for, and relevance of, the work presented later in this thesis.

In further studies of conflict within the building industry high levels of antipathy were found between the disparate design team members and the clients whom they served[24]. The study highlights a contrast of attitudes between the Department of Employment and the National Economic Development Office Construction Industry Sector Group, who claim to act as proxies for clients, users and the community on the one hand, and on the other hand representatives for the separate interests of the chartered and non-chartered professional institutions. NEDO have implied that each of the professional institutions are inward looking and as a result unable to recognise that '*the industry is not delivering a satisfactory performance at home and abroad*'[25]. As evidence, NEDO cite a number of recent studies of the market for UK construction which detail: relatively '*high costs and fees and a large incidence of litigation, indicating communication failure between the construction professionals to be a major contributor to process breakdown*'. Andrews and Derbyshire have commented that, when given evidence such as this, the individual professional institutions unconsciously confirm these criticisms, by '*setting out introverted and protectionist policy replies*'[26].

Confrontational debate between the client grouping and the professional institutes is also found to exist over comparison between standards of quality at home and abroad. Collier et al[27] have outlined studies of client bodies which show that they believe that '*in comparison* *to foreign building industries the current structure of the professions, education and training provision in the UK, lag behind*'. However Hutchinson, the 1989 president elect of the Royal Institute of British Architects, believes that the European model is a system which has '*eroded both the ideal and the status of RIBA members*'[28]. The other professional institutions would almost certainly present a similar protectionist outlook towards system(s) which generally do not recognise the profession(s) of Surveying and to a large extent limit legislation protecting specialised professional Engineering, Landscape and Interior Design specialisms.

There appears to be a great temptation for the client to adopt a 'grass is greener on the other side' attitude towards their dissatisfaction with the British construction industry. However it would be ill-advised to combat dissatisfaction at home with an unconditional adoption of systems from abroad. Foreign industry has also been obliged to compromise, to varying degrees, the education and organisation of its own industry, by attempting to marry the specific idiosyncrasies which have evolved in their own markets, with the need to adapt to a changing, increasingly technologically complex building industry. Despite relatively large degrees of commonality of education and knowledge, professionals in overseas building industries are no closer to an optimum design process than the UK. Indeed Hall[29] implies that, even though in Europe the professions of Architecture and Engineering are responsible for all building tasks (performed in the UK by a multi-Professional UK design team), inefficiency in the (overseas) process of design still exists. He states that '*despite different practices in various countries of the European Community, lack of integration is apparent in them all*'. Hall further warns that unless fragmentation of the design process is recognised and addressed, it will result in lower productivity and quality and stifle innovation.

It would appear then that, the root problem of communication difficulties in the UK building design team *cannot* be treated by a simplistic re-organisation of relationships using, for example, alternative contractual approaches. A warning against attempting to treat the symptoms of dissatisfaction rather than addressing the underlying ailment can be found in a study by Hughes[30]. Historical differences and the lack of integration of the British design team members creates obstacles to the implementation of already successful systems. He argues that even although '*evidence that the USA construction industry could perform better than that of the UK (building quicker, cheaper, and more reliably) and that increasing dissatisfaction with the output of the UK industry was felt, the US approach to construction management could not be transferred across the Atlantic*'. Perceptions of the institutionalised professional consultants have altered the basic pattern of responsibilities which contributed to its US success and UK failure. Hughes comments that '*the development in the UK of a standard form of management contract, and the attitudes of many of the parties in such projects, has resulted in management contracting being little more than glorified general contracting*'. Effectively his argument is that the attitudes of members of the design team in the UK (influenced by the Professional Institutions and accredited courses of study) have a detrimental effect on proven systems of successful building.

Hughes studies highlight a dilemma for British construction. Dissatisfaction from all quarters (be they client, litigating professional or Government) with the current state of the industry, cannot be improved by external organisational imports. Improvements must come instead from within, with particular emphasis on the attitudes of the professions who make up the design team.

'The traditional industry structure defines different goals which interfere with the balance between project cost, completion, time and quality', according to Atkin and Kennedy[31] and that these adversarial roles cannot be divorced from the traditional contract structure. Detailed findings from a task group of senior industry members contained the comment that *'a lack of comprehension of others problems and built-in suspicion contributes to the industries poor performance'*. It is also argued that *'it is not the form of contract which primarily determines whether time, cost, and quality targets are made, but the attitude of the parties'*[32]. The corollary drawn by many of the commentators already cited who articulate dissatisfaction with the British construction industry, can be expressed in terms of Donneley's argument that *'if you improve people technology, improvement follows automatically... (and that) the essential element for this is the educational process for the construction professionals'*

There appears to be a consensus that the UK building industry has yet to achieve the optimum process which will lead to an end product able to satisfy fully today's complex building needs. There is also agreement that communication difficulties and conflicts exist in the inter-disciplinary building design team. Some believe inter-disciplinary conflict to be simply a function of specialist interaction that does not influence industry performance. However evidence suggests that inter-disciplinary communication difficulties and conflicts do affect detrimentally the building product and the processes of efficient production. Some commentators believe that inter-disciplinary dissonance may be addressed in practice through creative management. Most of the literature however suggests that inter-professional dissonance must be addressed at the early stages of professional development. The implications for education are many and require further study. Yet the foundation of all the building industries problems may lie much further back in its past and may also be a function of its evolutionary progress rather than a feature of the more recent procedures and processes of the last 50 years. Andrews and Derbyshire for example suggest that the organisational relationships which exist within contemporary construction reflect historical development and that '*traditions die hard*'[33].

The Structure and Methodological Development of the Thesis

The remainder of this thesis is in two parts. **PART 1** consists of Chapters 1 to 4 in which various subjects of the main argument presented in the introduction are dealt with in greater detail by a critical examination of the research literature and other documented evidence. **PART 2** consists of Chapters 5 to 9 and contains the original, empirical work conducted for this thesis. The following pages present a descriptive view of the rationale and methodological development of the research undertaken. This discussion allows an appreciation of the inter-relationship of the various elements of the study as they unfold in later chapters.

The Introduction section suggests that sub-optimal building design team communication prevents the maximisation of integrated activity amongst construction specialists. **Chapter 1** examines the extent to which this problem reflects historically isolated professional associations and their involvement in the explicit accreditation of educational courses. It considers whether present education for the independent professional has kept pace with the inter-disciplinary requirements of a technologically complex industry. **Chapter 2** develops this idea and asks if a professional mind-set of attitudes, detrimental to effective participation, held towards the other design team disciplines exists and if so, to what extent tertiary education is able to address such dissonance. **Chapter 3** examines the link between group mentality (mind-set) and participation in greater depth, and investigates literature which argues that effective participation improves organisational performance and facilitates innovation. Chapter 3 further examines whether individuals in the building design team are more open to changes to improve inter-disciplinary participation during their formative period or the project-specific design team organisational structures of practice. It then explores whether the factors which contribute to group mentality influence organisational communication.

Chapter 4 investigates the extent to which educators must identify factors able to influence participation and organisational communication. In particular this chapter examines whether there is a need to identify and diffuse inter-professional latent conflicts, that can quickly become overt feelings of hostility, before the design process can develop efficiently. This chapter compares communication in a conflictual system with communication in a co-operative system where specialists regard themselves as an indistinguishable entity. Chapter 4 examines whether effective design and construction can be seen as resulting from efficient inter-professional communication and the extent to which optimum building design team communication requires the source and receiver to have a high degree of empathy, that is, high levels of ego involvement and trust.

The aim of the literature review seeks to understand the extent to which measures to improve communication can be instilled into professionals. The figure below describes the research rationale that explores effective *communication* as a function of a *cultural system,* where *culture* is derived from *attached values* and *selected ideas* and where *values* are applied to the *objects* of *need, desire* and *attitude*, and the extent to which attitude is open to modification from inter-disciplinary initiatives during tertiary education.

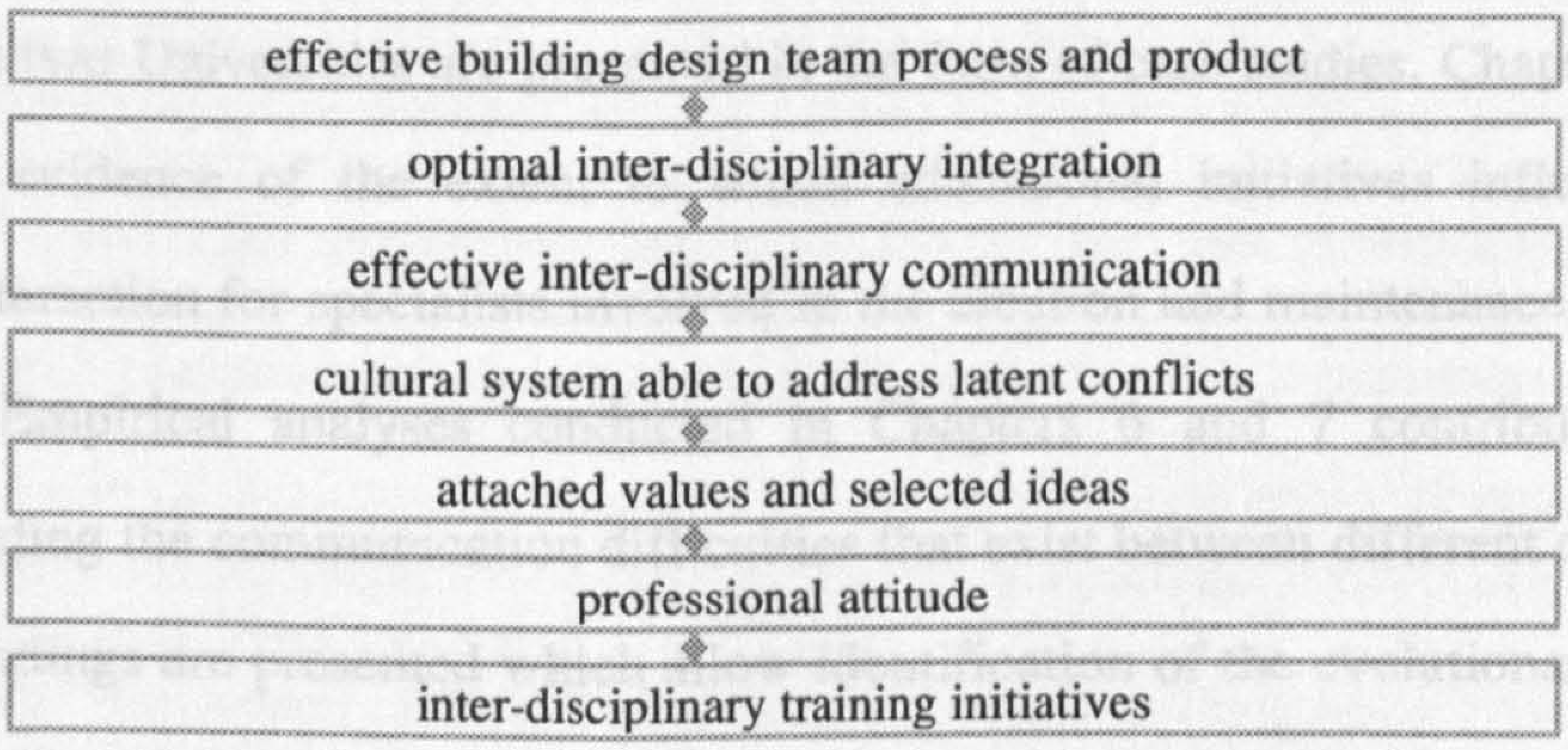

Figure 1Rationale and methodological development

The rationale and methodological development of the thesis seeks to understand whether differences in inter-professional interaction are largely a matter of values and attitudes, and whether these can be modified by training to improve communication in the building design team. PART 1 therefore elaborates and substantiates the arguments which form the elements of the problem explored in the introduction and ends with a postulate for inter-disciplinary education. This postulate is described graphically at the end of Chapter 4 and is tested in PART 2. PART 2 examines empirically the premise that influencing positively professional attitudes at the formative educational stage addresses inter-disciplinary dissonance.

Chapter 5 explains the methods used in the research to look at inter-professional communication; attitude and attitude measurement. It describes the choice and development of an attitude scale questionnaire, and details the development, internal validity, and reliability testing of the scale. It explains work conducted by the thesis to assess the value of current pedagogic philosophies for the integration of construction disciplines and the rationale behind the selection of optimum experimental locations (University course case studies) for this study. Chapter 5 describes scale implementation procedures and the methods adopted for interpretation of the data set generated.

Chapter 6 presents the results of a sample analysis indicating the current state of traditional vocational education and in particular looks at professional disparity and how such disparity is influenced by the educational system. **Chapter 7** presents the results of experimentation which compares in particular the attitudes of design (Architecture) and non-design (Quantity Surveying) trainee professionals. Detailed analysis of results from a comparison of programmes at two Universities are presented in the form of case studies. Chapters 6 and 7 provide clear evidence of the extent to which educational initiatives influence inter-disciplinary interaction for specialists involved in the creation and maintenance of the built environment. Empirical analyses conducted in Chapters 6 and 7 contribute valuable evidence regarding the communication difficulties that exist between different construction disciplines. Findings are presented which allow identification of the evolutionary nature of professional attitude in the individual, detrimental to the design process, over the duration of vocational educational courses.

Empirical evidence indicates the importance of addressing dissonance at the formative educational stage of professional development. Research findings presented in Chapter 7 describe the need, structure and staging of educational initiatives that seek to address successfully cultural differences instilled by vocational traditions in the education process. **Chapter 8** returns to the postulate proposed for education in the final part of PART 1 (Chapter 4) and discusses, in the light of the research described in PART 2 the conditions for the educational initiatives that will be required to overcome the professional disparity in team work which Latham and others have criticised. Chapter 8 tabulates the conditions necessary for successful inter-disciplinary educational initiatives. **Chapter 9** concludes the research and reflects on the original problem outlined in the introduction and subsequently detailed in Chapter 5.

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[18]Collier, Bacon, Burns & Muir (1991) 'Interdisciplinary studies in the built environment' CNAA / DoE Publications
[19]Franks, J. (1990) 'Building procurement systems' Chartered Institute of Building Publications
[20] Clients (50 in number) in the sample (Franks, J. (1990) 'Building procurement systems' Chartered Institute of Building Publications) were grouped as:
A: occasional clients who build for their own use or occupation such as authorities, public service utilities, industrialists, manufacturers, commercial undertakings, medical practitioners, ... (52% of the sample)
B: those acquiring land/property and developing them on their own behalf or to sell to pension funds (18% of the sample)
C: housing associations, both local authority backed and private, and includes associations for the elderly (8% of the sample)
D: local authorities at district and county level (10% of the sample)
E: health care bodies, NHS and private (12% of the sample)
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PART I

ARGUMENTS FROM THE EXISTING LITERATURE

PART I

CHAPTER 1

A BRIEF RESUME OF THE HISTORICAL DEVELOPMENT AND PRESENT STATE OF THE BUILDING INDUSTRY AND ITS PROFESSIONS

Page

CHAPTER 1

A BRIEF RESUME OF THE HISTORICAL DEVELOPMENT AND PRESENT STATE OF THE BUILDING INDUSTRY AND ITS PROFESSIONS

1.1 The Development of the Building Process

Although the training, methods and status of those charged with the creation and maintenance of the built environment have varied greatly throughout history, there has always been some level of authority exerted upon the construction process. Throughout Western civilisation, spanning the ancient classical world of Greece and Rome, through Gothic mediaeval times and into the Renaissance and beyond, it has always been necessary to have some form of controlling hand in the layout and structure of the building works.

The establishment of craft guilds in the thirteenth century created the initial pattern of organisation of the building process in Britain. Masonry and carpentry guilds were predominant, although 'finishing' trades as well as unskilled labourers all contributed to this highly labour intensive building process. The craft guilds were established at local level with a primary objective of reserving all work for its own members to the exclusion of tradesmen from elsewhere.[34]

Co-ordination of large projects became the concern of master masons, who were called upon to design the building as well as organise and supervise its actual construction. Throughout the centuries which followed, their status grew considerably and many highly skilled master craftsmen formed their own design guilds to seek association with the higher sciences of the time, rather than what were perceived as restrictive building work craft guilds. It has been argued that the gradual sub-division of building, by those early design guilds, into design on the one hand and construction on the other, typified the opposing philosophies which had began to develop between commercial life and the so-called gentlemanly pursuits of British society.[35]

During this period of change, a semi-legal administrative staff, former craftsmen in their own right, began to gain employment thereby providing the master mason with a means of recording all building instructions as well as ensuring payment for specialised trade-work, wages and materials. This loose organisational structure adequately kept pace with the slow development of building requirements, up until the early seventeenth century. Bishop[36] cites documentation from that century in which a respected mason-measurer had a dispute with an influential client of the day, Leonard Sowersby, over different modes of measurement to facilitate payment of work done. The record tells of the custom to pitch one measurer, acting on behalf of a specialist master craftsmen, against another acting on behalf of the paymaster. This practice of opposition, examined alongside the split initiated by the guilds of building into design and construction, as well the protectionist seeds sown by the craft guilds, inadvertently nurtured the beginnings of an environment of confrontation within the British construction industry.

The arrival of the Industrial Revolution, brought an end to the declining cottage industries and produced a general expansion of wealth which in turn led to a growing demand for consumer goods. Builders were now required to satisfy the expectations of new manufacturing and domestic property markets and make improvements in infrastructure. The increase in the use of new materials saw the development of technical designers who incorporated mathematics and physics into the design of their construction techniques.

The new order of construction brought with it changes in procedural methods. Different methods of procurement began to occur such as the development of gross tendering, an all encompassing tender price submitted to the client or their representative(s), which included responsibility for the organisation, supervision and discipline of the work force. By the beginning of the nineteenth century Government Departments, in an effort to speed up hospital, barrack and prison building for the Napoleonic Wars, insisted that all tenders be based on detailed drawings and specifications, contracts should provide for single stage payments and extras should be valued on a fair assessment.[37]

Documented legislation and openly accountable tendering also arose in the private sector, its need aggravated by the temptations of gain through less than honest project negotiation. The growth in scientific knowledge led to the proliferation of many skill requirements, which in turn initiated the introduction of protectionist professional institutions who, on pain of expulsion, sought to maintain market share, prestige and a minimum fee. These specialist skills became increasingly subject to their own professional constraints and working methodologies, and fragmentation of interests began to occur in the body making up the controlling hand of design, layout and structure of the building works. The increase of fragmentation in construction is seen by many, to be a barrier to an efficient industry, although others perceive fragmentation as a reflection of necessary specialisation.[38]

Specialist knowledge in specific areas of the technologically complex building industry is increasingly prevalent. Technical development calls for specialist input. The new market expectations and infrastructure requirements of the Industrial Revolution were satisfied by realising the potential of new materials, and by acknowledging the importance of professionals who understood their properties. Similarly, contemporary construction must also be able to utilise new technology and find a place for those able to apply it. Rodgers[39] for example suggests that '*in the future, buildings will become dematerialised. It will be an age not of solids but of transparency and veils - of indeterminate, adaptable and floating structures which respond to the needs of users. The buildings of the future will be less like fixed Classical temples and more like moving, thinking robots.*'

The effective utilisation of new technology is likely to extend beyond any individual brief. To some, this must encompass what has been argued as the need to '*make cities (where two billion people in the next 30 years are estimated to add to the existing urban population) more sustainable by re-interpreting and re-inventing the dense and urban city*' and concluding that '*in the beginning we built to overcome our environment. In the future we must build to nurture it*'.[40] The specialist professions who make up the design team must collectively meet these new challenges.

One such example of the potential of the integrated specialist design team is the new NMB Bank in Amsterdam, where specialist contribution has resulted in a building which successfully marries aesthetic considerations with new technologies, which improve environmental and financial performance.[41] The bank has found that the individuality of its new headquarters attracts appreciative tourists who book 6 months in advance to visit. According to detailed measurements made by the Dutch Research Establishment, the bank is the most energy-efficient building in the world.[42] The development, although costing 3% more to build than similar new bank buildings, is argued to save well over one million pounds sterling a year in fuel bills, using 90% less energy than a typical office block of the 1970s. From the outset the design team was non-hierarchical. Representatives of the NBM bank worked with the architect, the building physicist, structural and services engineers, acoustician, landscape consultants, interior designers and environmental planners. The specialists in the team took collective responsibility for the whole building, and each member was encouraged to comment on the work of the others, avoiding what has been argued to be '*the narrow specialisations that occurs on so many other projects*'[43].

The NBM project is considered by some to be **unique**[44] so if an expression of the true potential for an integration of building specialisms is so rare, there is much work to be done to allow the various professions to realise their collective merit. It has been argued for example that '*it will take time before the (construction) professionals can change their mind set and put behind them the old obstacles of mutual mistrust and cultural difference*'[45]. The efficient and effective integration of building specialists is seen as a fundamental requirement, if the construction industry is to contribute successfully to the creation and maintenance of the built environment of the future[46]. To satisfy today's complex building requirements professionals involved in the construction industry must strive ever harder to maximise scarce resources to ensure an effective and innovative product.

1.2 The Development of the Building Professional

Tradition has long been the process which has shaped the roles and relationships of those involved in the construction process. The mind-set of contemporary building specialists tends to reflect historical, hierarchical skill divisions, and these ultimately form the basis of obstacles to the potential for optimum integration in a modern building design team[47]. Indeed specialist traditions have both shaped, and set a precedent for, training in particular building skills for three thousand years. The 'builder in chief' of ancient classical columnar Greece seldom had the opportunity to devise new and novel plans, or develop new ideas of construction and decoration. Rather they were dictated to by established tradition and found their main role was one of scheduling and patterning the materials, and supervising the construction and finishing of the works. Little is recorded or known about the early innovators of classical form. The training and methods of builders, who sought to express the aspirations of Egyptian religious belief, Assyrian autocracy or Greek ideals of symmetry, is open to conjecture.[48]

The earliest written description of contemporary qualifications for the building designer came from the Roman architect Vitruvius in the first century BC. In the first book of a ten-part manuscript 'De architura libri decem', he wrote that '*only those who have a thorough knowledge of both manual skill learned in practice and theory gained from scholarly pursuits, are in a position to obtain and wield authority*'. This assessment of the need for theoretical design alongside practical construction skills remained unaltered until the separation of these two spheres of activity in the eighteenth century and the emergence of design oriented professional guilds[49].

Principles first presented by Vitruvius were developed later by Lebrun, the director of the Academy of Painting and Sculpture in Paris in 1663, and consequently exerted considerable influence on the academic doctrine of Classicism in 17th Century Europe. Lebrun established strict control over artistic production, leading to a precedent within academic institutions to promote and develop the arts, as distinct from the sciences. The Academie Royale de l'Architecture also of Paris, under the influence of Blondel in 1763, emphasised Architecture as an educational process of perfection in the arts. Architectural education shifted further from a combination of beauty with utility (Batteax's 1746 definition, which endorsed the Vitruvius doctrine of scholarly pursuits in addition to manual skill learned in practice) towards affiliation with painting, sculpture, poetry and music categorised in Diderot's 1751 definition of Les Beaux Arts (the fine arts). The concept of this Beaux Arts method of architectural education prevailed as the traditional form of education well into the 20th Century generally finding favour with the French and other European regional schools, and influencing greatly the British architectural educational system, as well as being exported to America by French and British graduates. The Beaux Arts method perpetrated the 'architect as artist' and function became subjugated to aesthetics.[50]

However, Beaux Arts ideals were not acceptable to everyone. Rejection of the method was voiced by Lethaby, who regarded such a system as ill-preparing a student for a changing society. Lethabys ideas took root chiefly, not in his own country of Britain, but in Germany in 1919 at Das Staatliche Bauhaus Weimar (the Bauhaus school of architecture), where the collaboration between industry, designers and craftsmen was emphasised. Although collaboration was an ostensible aim, the architects prime position as key player remained unchanged however, and this, in addition to the omission of technical engineering skill (to at least acknowledge important contribution from engineering disciplines), is argued by Milner[51] to have reduced its co-operative credentials.

Division between the arts and sciences, and the limited levels of collaboration between disciplines in those early days, appear to be the antecedents of professional dissonance in the construction industry today. Indeed the wish of the individual to maintain a prestigious position in the construction design process can be argued to have resulted in further division. This need for self-preservation and a wish to achieve respectability through association with the *arts* in Britain, prompted many, still working within the sphere of the early design guilds, to form the institution of British Architects, which received the royal charter in 1840. Although this association introduced an examination system, in the early stages, this was a purely voluntary facility to allow an individual to acknowledge personal competence. Classes were started by the Architectural Association in 1862 to allow constructive criticism of design, and the taking of RIBA examinations. These were continued and expanded such that Schools of Architecture developed, and today can be found attached to universities in most major cities.[52]

The increasing importance to society of engineering technology during the Industrial Revolution encouraged specialists in this field to form their own associations. During the nineteenth and twentieth centuries, four professional engineering bodies - civil, mechanical, electrical and structural were created, each concerned with a different facet of engineering knowledge. All four engineering institutions became increasingly interested in education, conducting their own specialist examinations.

In line with the trend for 'professional' disciplines of the 1800's to gather together, another specialist building oriented association was established. The Institution of Surveyors was, in 1868, like many societies of the day, formed not for motives of altruism but to end corrupt and fraudulent practices inside their own discipline. A multiplicity of surveying interests made up the Institution of Chartered Surveyors which itself received royal chartership in 1881. They too concerned themselves with education, with what was to become a system of rigorous examination for membership.[53]

These new professionals gained confidence in their respective construction specialisms. Individuals skilled in the application of technologically complex knowledge, were able to better develop their craft by association with one another. The new professional societies could perfect expertise and technique(s), and provide the construction industry and the client with a valuable service, unobtainable elsewhere. By taking responsibility for the education of future members they could ensure that high standards were maintained, and improvement, where required, was instigated. The construction industry, which was becoming increasingly technologically complex, became multi-disciplinary in nature to meet the challenge of change.

Professional institutions increasingly took responsibility for examining the proficiency and promoting the professional conduct of their members. Meeting the educational requirements deemed necessary by the institutions, became the major step towards practising in a chosen specialism. Even as the provision of education shifts almost exclusively to the Higher Educational Institutions, accreditation of HEI courses, by the professional institutions, remains imperative if universities wish to continue to attract the large numbers of vocationally minded students to their courses.

Industry is now aware that the diversity of input required by construction, requires attention be given to the processes of *integration*, as well as the provision of specialist knowledge to meet the demands of the professional institutions[54]. This is particularly significant in the light of Milner's[55] warning that '*designers have now turned back to a reconstituted Beaux-arts approach and that this renewed emphasis on self-expression and conceptual form is echoed within Architectural education, detracting from the much needed multi-disciplinary more user-responsive approach demanded of today's built environment design team*'.

So specialist building knowledge has been traditionally controlled and dictated by separate professional associations. An increasingly complex building industry places great emphasis on the application of specialist knowledge by individuals in a design team. Satisfying training requirements to allow future professionals to perform specialist tasks in contemporary building design teams carries much responsibility. Professional associations and University courses must be able to provide training

which facilitates industry's need for professionals who are able to apply specialist knowledge to complex multi-disciplinary design problems.

1.3 The Development of the Professional Institutions

The expansion of building specialists, as already argued, stems from the requirements of an increasingly technologically complex and dynamic construction industry. The expansion of the professional *institutions* however, is widely held to have stemmed initially from a growing fear of widespread corruption. It has been suggested, for example, that in Britain during the eighteenth and nineteenth centuries, '*design and building practices were at best unethical and at worst indictable*', and that the '*architectural profession in general was held in very low esteem*'.[56] It was for these reasons that a concerned minority, from each of the specialisms, sought to establish some recognisable guarantee of professional efficiency and integrity, and the restoration of public confidence. The solution, for the ever increasing numbers of professionals, took the form of association, self-preservation of their specialist skill being the prime motive.

Professional institutions which originated within the British building industry, exemplify a desire to protect, control and promote a specific specialist skill. These skills are driven by new technologies and larger more complex projects. Individuals who were increasingly charged to fulfil new roles, sought, not only to perfect their craft, but also to protect it from interlopers. So, a profession may be seen as '*an exclusive association of persons agreeing to combine for the express purpose of controlling some definable area of knowledge*'[57] and it seems logical that individuals should gather together in constitutionalised associations with like-minded colleagues. Indeed further fragmentation of the core professional institutions, by those seeking to consolidate specific sub-divisions of a discipline, clearly shows the need of the individual to specialise and perfect even more specific areas of interest, and yet further protect their worth. At present there are between 40 and 50 Engineering professions making up the Engineering Council in the UK; the Royal Institution of Chartered Surveyors actively promotes a broad spectrum of Surveying discipline sub-membership; Designers specify and associate with many facets of building design, from Architecture, to Landscape Architecture, to Interior Design.

Some commentators regard this growing trend towards subdivision as too restrictive, both for the industry and the individual. They argue that inherent characteristics of self-interest and control go some way to explaining the professional institutions' generally conservative attitude towards change and they suggest that any questioning of a professional institutions knowledge base, and the processes of acquiring that knowledge, is often perceived as a threat to their continued and peaceful existence.[58] They further suggest that this protectionist outlook may create obstacles to effective participation in an industry which requires professionals to continually reassess their role, in terms of the technical and contractual evolutionary processes which occur in building.

A conservative attitude towards change may also cause difficulties in assessing the needs of the education of the members of the future. Due to the large influence which the Professional institutions exert on vocational education, attempts by Higher Educational Institutions to adapt themselves to changes which they perceive to be occurring in industry may cause friction between the two groupings. With regard to the increasingly fractionalised skill requirement of present construction, it has been commented that, if the eventual home of the student is isolationist, then moves by Higher Educational Institutions who argue that a more efficient industry requires greater commonality, may create discord with the professional institutions who are responsible for accreditation of their courses[59].

Although the joint accreditation of degree courses for some engineering options is becoming more common, joint accreditation may be held with some suspicion by the Institutions concerned.[60] The fear of isolation by the professional bodies toward procurement procedures which are seen as marginalising and relegating disciplines on a hierarchical leadership structure, is the main reason why some subject commonality is endorsed. Professional institutions are prepared to accredit such moves in the belief that it will give greater freedom in the contractual legislative process.

Engineering options notwithstanding, when joint accreditation occurs across disparate courses, it produces much media interest, so-much-so that it verifies the scarcity of such an event. Higher Educational Institutions in Bath, Birmingham and Strathclyde have succeeded in achieving accreditation in courses containing relatively large areas of a shared syllabus, but these are very much in the minority. Professional institutions have historically shown an intention to protect their members skill input to industry through solitary and independent means. Happold[61], a vociferous critic of professional protectionism in the construction industry, comments that any recognition of subject areas and greater definition of professional roles by the professional institutions would instinctively be acted upon '*fraternally and not paternally*'. Furthermore, he verbalises a belief that the professional institutions are inherently interested firstly in themselves and only marginally in the industry in which they operate; and he argues, albeit tongue-in-cheek, that they would only endorse closer educational links (commonality) with others, if those links fostered a greater awareness of the importance of maintaining professional status leading inevitably to increased protectionism, increased control over professional liability and ultimately increased professional income.

Specialists from disparate disciplines who charge the professional institutions with protecting their own specific interests are carrying on an historical fragmentation of building and design responsibilities. In the construction industry, the associations which represent the disciplines who make up the 'design-team' have increased their influence steadily over the years, to the extent that many would agree that '*ultimately the real power (to allow those working in building to adapt to an ever-changing industry) resides with the professional institutions*'.[62]

The specialist needs of construction are somewhat confirmed by their market share of the British industry. The wish to protect this market share from the corrupt and the unskilled, makes both moral and economic sense, and clearly professional institutions deserve much credit for the high standards of skill which their members offer the building industry. However, if the pursuit of specialist recognition is taken to extremes, concern arises for the increasingly inward-looking professional which attains the status of the clichéd 'expert who knows more and more, about less and less' and loses sight of the end product.

It is sometimes alleged (mainly by those unassociated with the various building bodies) that the professional institutions exercise a restrictive role, hamper integrative innovation through vested interest, jockey for position, promote niches for themselves and unnecessarily fragment the industry. While these allegations may contain some truth, it must be remembered that many construction professionals (in the UK for example) do not enjoy any statutory protection of their contribution (unlike their counterparts in many European countries) and that, in the absence of such legislation, membership of the institutions provides the only indication of competence available to the client. [63]

Professional institutions obviously serve a duel purpose. Firstly, they provide associations for like-minded individuals to expand, explore and perfect their own specific area of interest for the advancement of that particular specialist knowledge, to ultimately benefit a dynamic construction industry which requires such skill. Secondly, the professional institutions seek to protect and retain market share for their members, to ensure that the unskilled, albeit often enthusiastic non-specialist, does not inadvertently circumvent the processes of their discipline, to the possible detriment to the building industry.

So, professional institutions have great influence over an individuals accumulation of a specialist knowledge base through explicit accreditation of University courses. Professional institutions influence the application of specialist skill in the design process but professional institutions in the UK must also recognise their responsibilities in facilitating a form of training which allows future professionals to perform effectively in a dynamic and changing industry.

1.4 The Development of Contractual Arrangements

Documented legislation and openly accountable tendering intensified with the expansion of the professional institutions. This occurred largely as a result of a historical fear of corruption and a wish to instil public accountability. The development, of *contractual arrangements* for use in the UK building industry has also had an impact on inter-professional relationships.

Whilst the prevalent 18th century European procurement method, where the Architect supervises the work of individual trades, is still used in some countries (notably Germany) other countries found that this system no longer afforded a suitable expression of building responsibilities. Trade procurement disappeared gradually from most areas of the UK during the 19th century, when public pressure and clients' wishes for a single agreement to govern all construction activities were instrumental in the promotion of a main-contractor procurement method. Main contractors (master masons concerned less with design and more with the actual construction) were prepared to quote a total price, and a fixed term for implementation, prior to starting the construction work. The total price, therefore, included all the work performed by the trades, and the supply of materials. Competitive tendering also spread, accelerating the differentiation of design and construction since in theory the design work had to be complete to the last detail before tenders could be invited.

Design, and its associated responsibilities, became increasingly separated from the actual construction. Designer work also became fragmented. Architects became unwilling and, to a large degree, incapable of providing information such as, bills of quantities (allowing competitive tendering and enabling contractors to price design proposals), impartial economic advice, and specialised design input. Diverse design tasks were taken up by specialists, whose qualification and role came to be controlled and protected by professional institutions.

As projects grew in complexity and the input of specific specialist skills were increasingly institutionalised, it is perhaps understandable that early attempts towards organisational legislation of these specialists resulted in an information hierarchy, with particulars being passed from profession to profession in turn.

Traditional British project procurement and working practice in design and construction became very much a lineal transfer of information. This information transfer system is still used in the vast majority of UK projects[64]. The Royal Institution of Chartered Surveyors' geographical directory for 1993, lists 31,384 single disciplined, private practice members. The 1993 RIBA directory of architectural practices lists a similarly large number of single disciplined architectural organisations. Engineering professional bodies also catalogue thousands of UK single disciplinary specialist consultant practices. New projects for these firms requires inclusion in the main contract to build, or in subsequent consultancy sub-contracts. In general the design proposal is developed, from inception to completion, by a lineal transfer of information from specialist to specialist. Little actual research has been done to assess performance differences between the output of these single-disciplined-practices compared with a smaller number of multi-disciplined organisations.[65] However it is acknowledged that relationships do vary, depending upon the mode of procurement[66].

Speculation on the efficiency of traditional contractual arrangements, compared with those of a multi-disciplinary nature are inevitable. Becker[67] differentiates between on the one hand, a traditional 'relay-race model' of communication in the design process, in which information generated by one group or discipline is handed off to another group in a sequential process, and a 'rugby model' of the product development process on the other. In the 'rugby model' it is stated that *'different disciplines interact in a dynamic constantly fluctuating fashion ...leadership shifts ...and all players are involved from the beginning (to the benefit of the process and product)'*.

Although the present day British construction design team has no legislative restrictions on participation and integration, it has been suggested that *'a cultural development of (traditionally procured design team) relationships affords little opportunity for optimum multi-disciplinary design team participation'* and that in general, the contract for a project allows for individual input without any real chance for enhancing the design process through a Gestaltian consensus of contributors.[68] The design team does not achieve co-operative optimum performance. This position however appears to have a tendency to assume that *all* aims in construction are subsidiary to an assumed need, by the professionals, for co-operation.

It may be logical to suggest that controversies over the achievement of specialist objectives will invariably exist within a multi-disciplinary design team. It may also be argued that it is this controversy which allows a team to satisfy fully all aspects of the overarching aim of the complex project (as a direct result of peer-group vindication of specific professional aims). Professionals may need the controversy of opinion which exists within a multi-disciplinary team to pragmatise the specialist designs, theories and techniques which they bring to the complex project. Indeed if this argument is taken to an extreme, any refinement of contractual and procurement procedure should legislate for an opportunity to conflict with one another as early as possible in the design process. Whilst conflict is examined more fully in later sections, it is appropriate at this stage to comment that the most successful teams tend to exhibit co-operation, whilst the least successful teams exhibit high degrees of conflict.

Cook reinforces the fundamental assertion that building design teams do not perform satisfactorily, and that greater co-operation is required. It would however be ill-advised to assume that the professionals who make-up the design team, favour co-operation above all other professional objectives. Thus, if improvements in the participation of professionals are to be made (in the context of Becker's 'rugby model'), it might be logical to suggest that professionals who are instilled with a greater acceptance of the potential for controversy of opinion, are likely to participate more effectively, than professionals who are brought together merely as a result of a refinement of existing procurement and contractual procedure. Current procedure remains highly dissatisfactory to many commentators[69-71], and its revision is seen as a positive step towards better integration in the design process[71,72]. A key factor is that design team performance is less than optimum and that measures to improve co-operation are required.

Traditional contractual connections are legalised when a main contract to build is made between the client and the builder. Other parties make separate contractual arrangements with either the client or contractor. The relationship, to the main contract, of disciplines involved in the building process varies. Legal relationships between the professions depend on whether or not their services are considered mandatory by bodies such as the Joint Contracts Tribunal (JCT). Choice of procurement and contractual procedure is becoming increasingly diverse. Many variations arise from a need to clarify project relations, and to allow selection of the most appropriate form of contract depending on project requirements. In the UK, the variables which influence the selection of the appropriate form of contract to be entered into by the project participants include the following:- who the designer of the works is to be (Architect, other professional directly engaged by the employer, contractor, or a consortium of each of these); the contract documents available or to be produced; the value range; the type of contract (lump sum; re-measurement, actual cost plus, fixed fee); the fluctuations available (tax, full, formula); the nominated or domestic subcontract requirements, and also, whether a private or public sector form of contract is most suitable.[73]

'*Nowhere in the world have contractual procedures been so elaborated as they are in Britain*'[74] and, although unsubstantiated and emotively argued this apparently reflects a principle defect of the construction industry of '*measuring success by litigation and cost and not by product*'. The implication is that the product of UK building industry is less than optimum. Some 96 different forms of building contractual agreement exist in the UK and it has been suggested that '*this (uncertainty and confusion in contractual arrangements) is a major contributor to professional conflict, to the detriment of the project*'.[75] Colledge[76] also regards conflictual relationships between parties, as stemming from unsatisfactory contractual interaction and agrees with several authoritative construction analysts,[77] who argue that one way towards a reduction in potentially damaging professional conflict within the British design team, would be for the development of a more standardised and systematic preparation of the contract.

Present contractual relations between the client and the design team are also open to comment. It has been suggested for example that '*clients who: increasingly seek a single point of contact with the building team; wish greater security in achieving cost and time targets; want greater involvement for themselves and; are increasingly using alternative procurement paths to facilitate efficiency, are showing their dissatisfaction with the current situation*'.[78]

An anomaly arises if one considers that the letting of *alternative* building contracts, may subsequently require a re-definition of new roles and responsibilities. This anomaly arises since the historical development of legislating specialist input as well as the institutionalisation of specialisms, typified a wish by the institutions to *protect* traditional roles. The propensity of the institutions to adapt, may be challenged even further if, according to some commentators, '*skills necessary to fulfil such (new) roles require an educational foundation which cannot simply be tacked on as an expansion of existing degree curricula*'[79]. Brandon[80] also challenges professional institutions to reassess their accreditation of reactionary vocational education. He lays down a gauntlet which identifies the need for '*a paradigm shift in the professionals of the construction process*', and argues that '*progress, rather than relying upon a refinement of existing techniques, requires a fundamentally new approach to the educational process*'.

The case for a 'paradigm shift' in British construction is further advanced by Piper[81] who reasons that '*changes within the professions occur because of shifts in the type of problem to be solved*'. Indeed mutable procurement methods as well as changes in technology and functionality, present the necessary problem shifts which would satisfy Kuhn's[82] classic stipulation that '*as a result of increasing dissatisfaction with existing paradigms, new or alternative paradigms must come to prominence*'. Although these arguments for a 'paradigm shift' in the education and legislation of the British construction industry are largely speculative, it is clear that a degree of dissatisfaction exists with the present processes and product of UK construction and the effects of traditional procurement procedures.

This background of dissatisfaction and suspicion has a knock-on affect in Higher Educational Institutions. As a result of extensive interviews in academia it has been shown that Higher Educational disciplinary departments feel duty bound to teach their students how to succeed in an '*antagonistic and litigious environment*' and further that this '*creates expectations of conflict which become self-fulfilling in the world of practice and business, and make it difficult to create integrated teams*'[83]. Certainly this would appear to be an inappropriate philosophy if education for the construction industry wishes to address the dissatisfaction with building procurement and contractual arrangements. If improvement in the present system is sought, be it by responding to the extremists call for an 'educational paradigm shift' or the moderates wish for a 'systematic preparation of the contract', it must logically emerge from professionals who desire (or who are encouraged, during their development, to recognise the benefits of seeking) to go further than simply preparing themselves to withstand the 'litigious' symptoms of the problem of an inefficiently integrated communication process.

Although this study links the problems of communication in the building industry with the educational process, it should be recognised that some authors do not subscribe to this point of view and they see improvement in communication as stemming from a more systematic contractual arrangement. Whilst this represents an alternative route towards addressing building design inefficiency, this study considers contractual arrangement as a symptom rather than the cause of the problem. Some 96 different forms of contractual arrangement have been unable to address the dissatisfaction with industry's ability to co-operate towards an effective product. Some of the literature suggests that professional training may be the cause of dissatisfaction with the process and product of the design team.

1.5 The Development of Globalised Hierarchies

The overall structure of contemporary international construction can be said to be determined by factors such:- as: the role of governments; the state of capital markets; taxation; the nature of clients (and the scale, complexity and nature of their requirements); design team; the organisation and responsibilities of the organisation and responsibility of contractors; and the role of building control authorities[84]. Oliver-Taylor[85] argues that these factors are a product of economic circumstance, culture, and history, and that as a result, different structures for the construction industry have evolved in each of the world's countries. The form of some national construction industries is similar but many others exhibit major differences. As national boundaries become less influencial in market participation, the international construction industry must strive to accommodate a diverse range of building organisational systems. Professionals, used to participating in particular national systems, are now finding themselves faced with having to reassess and reassert their skill and knowledge, and adapt to the changing legislative roles, responsibilities and professional relationships of a world market[86].

As nations move increasingly towards participation in neighbouring construction markets, the requirement for a harmonisation of systems, and a way to bring together different national approaches must be addressed.

Whilst comparisons based on size and economic standing of national building industries may not be the best way to highlight international disparities between national construction industries, it does at least allow identification of the current major world players. It is economically prosperous nations which must first recognise the need to address international disparity if they wish to participate effectively within a world market. In the early 1990's, it was reported that '*in the world construction industry, of the 50 major construction groups, 23 were Japanese (although only 1 group had significant turnover outside Japan), 9 were American, 6 were French, 5 were British*', with the remaining 7 being shared one-a-piece by other 'developed' countries[87].

Traditional procurement and contractual arrangements, as well as the institutionalisation of building specialists, common to the building industry in Britain, have been adopted by some of the richest, and conversely, poorest members of the world community. The 49 independent countries making up the Commonwealth of Nations, which evolved out of the former British Empire, retain close professional, academic and commercial ties. However, important factors distinguish the British system of building from organisational procedures in other parts of the world. Differentiating factors are emphasised further by moves towards closer European unification and the forces, both economic and social, of internationalism. Regulations governing public (and private) works and procurement, may ultimately be required to '*Harmonise: to offer equal opportunity to all within the European Community*'[88]. East European moves away from restrictive planned economies, at the same time as North American and Japanese current continental market speculation further emphasise the need to understand how construction operates in other places.

1.5.1. The European Community

Construction industry harmonisation at European Community level is still very much in its infancy. EC officials appear to approve of harmonisation in principle and have commissioned pilot studies to assess its potential[89], but have yet to accept an EC wide system, since delegates generally support the opinion of their own, largely isolationist, national Industries. EC reports dealing with harmonisation have apparently succeeded in bringing about discussion amongst European builders[90] although some respondents in the study voiced caution. It is also argued that the British legal system, dominated largely by the reliance on common law, is an '*obvious obstacle to harmonisation proposals, (and that) reliance on independent standard forms of contract, as opposed to legislative conditions of construction contract which dominate in the rest of Europe, will always tend to differentiate the UK Professional from those charged with similar tasks on the continent*'.[91]

The majority of European nations have extensive Governmental legislation which dominate the qualifications of those who undertake the procurement, design, and construction of the building works. Contractual relationships and responsibilities of European designers are defined by law, and statutory and insurance protection for the building owner against defects is mandatory[92]. British contractual relationships on the other hand are almost entirely at the discretion of the parties concerned, the only legislation being the general law of contract, which has application to transactions in all walks of life[93]. As discussed earlier the British building industry has developed its own practices, outwith 'legal' restriction, which rely on the influence of chartered specialist institutions. This is seen as odd by many continental neighbours.

By European standards the lack of contact which large firms of British architects and consulting engineers have with contracting and commerce is unusual. The previous discussion dealing with the separation, under traditional arrangements, of the organisations responsible for design on the one hand, and construction on the other, appears to be a peculiarly British development. In an 'outsiders-critique' of the British Industry, Huru has also expressed surprise at the small amount of financial commitment made by the British main contractor to the construction project, compared with continental practice and he links this with the tendency for building firms to put their money into property speculation rather than the contracting side of their business.[94]

The foregoing differentiating factors of the organisation and structure of British construction would appear to be a barrier towards industrial harmonisation. However some large contractors and engineering firms have made the 'cross-over' to overseas markets relatively successfully, and also tend to be the most vocal grouping against, what they regard to be, unnecessary EC Directives[95].

Although some similarities can be found between national building industries, it is debatable whether these are enough to produce a '*standardisation of the construction industries contractual practice, harmonisation of liabilities, and a common guarantee period in ... construction*'[96]. Concern has been expressed by those involved in EC discussions, that harmonisation may be sought from either:- attempts towards a 'pick-n-mix' compromise collective, which would satisfy very few, or the complete adoption of one particular system which would inevitably fly in the face of social norms elsewhere.[97]

Despite (or perhaps because of) Governmental legislation for construction overseas, it quickly becomes apparent that no one national building industry can claim to hold the optimum solution. Huru[98] argues that the UK industry, whilst by no means ideal, has much to offer and suggests that '*the strengths of the British industry lie probably in project management especially on the economic and financial side, and in the imaginative flair of the best British Architects*'. This is important, especially in the light of opinion from some distinguished British commentators who advocate that the best solution to dissatisfaction with the UK building industry, is for industry and education to reject current practices, and embrace systems used elsewhere.[99]

Whilst this may be theoretically possible (notwithstanding the need to radically change direction from an evolutionary process which started some 700 years ago) the recommendation for the adoption of another countries system of building, which stems ultimately from a specific national character and distinctive social and industrial evolution, is not to be taken lightly. Just as an assessment of the efficiency of disparate professional relationships in the UK industry cannot be confined to the effects of procurement and contractual agreement, comparison between British and overseas arrangements cannot confine itself to legislation. Socio-economic variables must also be recognised.

Oliver-Taylor[100] in a two stage analysis of the construction industry in the *European Community*, initially identified 4 broad organisational systems. These are summarised as:(i) the *British System* (ii) the *Northern System* which is categorised by a construction industry which is highly regulated, adheres to formalised procedure, and necessitates high standards (iii) the *French system* which is also highly regulated, has formalised procedures, has a more variable attitude to quality, and is greatly influenced by political circumstances, and (iv) the *Mediterranean System* which is volatile, highly bureaucratic, has flexible procedures which express a variable attitude to quality, and is influenced by economic conditions and the political environment.

In the *Northern European System,* in addition to construction legislation and trade organisation, geographical restrictions dominate. In Denmark the tendering procedure and standard form of documentation (*Almindelige Betingelser far Arbejderog Leverancer*) is traditionally cost vetted for every submission by the relevant trade organisation, even although in 1988 Parliament attempted to revise this protectionist practice. Conversely, in the Netherlands post-contract consultations are found to be onerous, since projects, based on general cubic meter cost estimates, often exceed budget, and require a relatively large amount of post-tender negotiation[101].

The highly decentralised political nature of Germany is regarded by Oliver-Taylor[102] as a hindrance to the emergence of a national (potentially exportable) industry. All rights and responsibilities of individuals are described and documented (in a document commonly abbreviated as *HOAI*), all tendering is under the rule of the Federal Government (*VOB*), and just two forms of contract (*BGB-Vertrag* and the *VOL-Vertrag*) specify relationships in the trade (craft-guild) dominated industry. Almost all of the German building design tasks are carried out by either the Architect or Engineer. There is considerable commonality in the education of these two professional groups and both the architectural and engineering courses involve two years of basic study followed by more specialised work leading to the highly regarded qualification Diploma of Engineering (*Dip. Ing.*) It is this certificate and not membership of a professional institution which is recognised as the professional qualification of the individual.

Although basic standards are the same across the Universities, each separate Institution attempts to achieve '*added excellence in specific specialised areas of a building design specialism*'[103]. It would appear that the particular Universities strive to produce architectural and engineering graduates who specialise, or are better equipped to perform a specific role within the overall remit of their profession. This practice may be a direct result of the large number of architects (1000 for every million of the population compared with a UK figure of 400 per million) who chase the relatively small number of paid architectural jobs. Unemployment in the late eighties stood at approximately one third of architectural graduates, with around 15% of those in employment, working in positions other than architecture[104]. It has been argued that although the German construction industry often achieves high quality and technically sound end results, it also has many delays and cost overruns[105] and with reference to German construction and architecture, the comment has been made that '*to an outsider there seems little enthusiasm for innovatory research in building*' and that whilst '*most buildings are soundly constructed and well finished, the resulting public architecture is dull*'.

In the *French System*, the construction industries of Belgium and Luxembourg have specific tender documentation and contractual standard forms. These may benefit from UK style post contractual work. Although the French and UK construction industries appear to have a similar structure, Oliver-Taylor argues that the French system works like construction-management but without a construction manager mainly because there appears to be '*a greater degree of mutual trust shown in professional relationships*'.[106]

Education of the two professions, architecture and engineering, which dominate the industry takes around six years to complete. Interestingly the most prestigious engineering schools, feed high level civil service and industrial managerial positions, whilst it is from the *less* prestigious schools that the construction industry gains its professional engineers[107]. Architectural education, under the control of the *Ministere de l'Equipement* which like engineering exist in schools outside the universities, is presently under review since it is regarded by many to be of poor quality. KMPG -Management's[108] analysis of French architecture finds that it has been discredited of late and has been experiencing high unemployment (20% in the late eighties).

The *Mediterranean System* is argued to be collectively 'chaotic'[109]. In Greece, tender documents are made up of drawings, specifications, descriptions of the work, a bill of quantities and a tender submission, however private contracts are mainly negotiated, do not require to be licensed and documentation of the actual project is limited. The industry is serviced by the profession of *Architect-Engineer* whose five year course of studies receives tuition from a '*heterogeneous collection of tutors each with their own personal skill and interest'*. This diversification of training is seen as beneficial, even though co-ordination and integration of departments and specialisms takes up a large amount of Greek Higher Educational Institute resources. Unfortunately few professionals undergo or gain from this educational diversity, since of the 11,000 practising Architect-Engineers in Greece, 7,000 obtained qualification outside the country, attending British, French and predominately Italian schools. It has been argued that '*internationalism on this scale deserves much blame for the relatively inefficient construction industry and the unimpressive design which exists in Greece today*'[110].

In Italy, as in the UK, there is no standard form of building contract. Clients draw up their own based on regional pro forma, most being firm price contracts. Competition for status and work load between the professions of Architecture and Engineering and the local community *Geometri* (surveyor) is considerable. Although it is only the architect who may legally design, authorise and sign drawings for buildings greater than two stories, it is not uncommon for the work to be performed entirely by the Engineer or the Geometri and merely signed by the Architect for payment. The diploma of Building Engineering allows graduates who have passed state examinations to practice as architects under the title of Engineer. Student numbers for courses in architecture are unrestricted and very large, and the drop out rate is high. Figures from a few years ago showed that 4,000 architects graduated from an intake of 12,000 and that only 3% went on to practice as Architects. The rest went into the civil service, teaching or became draughtsmen.[111]

In Spain too, only the profession of Architecture is officially responsible for all aspects of building, although Engineers legislate infrastructure and the design of industrial plants, bridges, roads, building structures and services. The title of Architect is given to the graduates of two different schools: the *Architecture Superiore* (lasting six years, providing the student with a thorough knowledge of construction and design principals) and the *Architecture Technico* (of three years duration providing knowledge of contractual arrangements, construction and the supervision of labour). There is however much confusion over the status and workload of both types[112].

The legal requirement for a qualified Architect to authorise each and every building often results in Architects maximising fees and that '*only a loosening up of the fee structure, and an imaginative leap by the profession and universities to open up different roles for architects will advance the construction industry in Spain*'[113].

1.5.2 The Commonwealth of Nations

The British system of design and construction discussed in previous sections has influenced greatly several other national construction industries, especially those in the former British Empire. *Commonwealth countries* appear to be experiencing a re-assessment of roles within the construction industry. Some commentators see a need for 'new skills' to meet the changing dynamic nature of the industry, and regard existing (*South African*) educational curricula as being unsuited to fulfil such new roles[114]. *Australian* commentators have also expressed concern over the future direction of vocational education. A Task Force commissioned by the Australian Government believes that the construction industry is demanding increased specialism within the field of engineering[115]. The task force have assessed that '*the half life of specialist engineering knowledge is only of the order of about seven years*', and they fear that professional education is not addressing this development.

The commission argue for an extensive review of the education of the construction professionals. They suggest that less emphasis be placed on the traditional divisions of civil, electrical, and mechanical engineering and that more emphasis should initially be placed on core subjects such as mathematics, physics, design principals, engineering principals and management skills. They argue that the need for more contemporary specialisms must come from the considered opinion of the influential institutes through '*a closer relationship with the needs of industry*'. This Australian Governmental task force of the late eighties continued that '*only by being aware of fundamental principals and having a professional work force suited to necessary specialisms within industry, will the construction industry in Australia evolve efficiently and effectively*'[116].

Attempts towards a 'real and measured change' were realised in The Construction Industry Reform and Development Act of 1992, ratified by the Federal Government of Australia. Under the Act, a body (of fixed life until June 1995, and fixed budget of the equivalent of £5 million with 30% coming from industry) was set up to implement reform through a number of Codes of Practice, including pre-qualification criteria, and Model Projects on which new approaches could be trailed and monitored. The intention is that the change-process becomes self-sustaining and extends beyond the life of the Body of Industry Representatives. Both the Australian government and industry see the need to shake up the existing system, to accommodate technological development and the changes which it is bringing to traditional roles and relationships between specialist professionals.

1.5.3 The USA and Japan

The largest nations in terms of international construction, are the USA and Japan[117]. Whilst their respective successes in both localised and world markets suggest that these two countries have very efficient and effective systems of construction, closer analysis finds that they too must address the consequences of an increasingly technologically complex industry.

Traditionally the *USA*, like much of Europe, has two categories of building professional: Architecture and Engineering. However Construction Management is growing in importance and, as a result of trends towards University courses concentrating on cost-engineering and estimating, specialist disciplines are also becoming more influential in the American building industry. Professional status of such groupings appears to be gaining some support[118]. Indeed as in the UK, much debate is to be found in the construction and academic journals regarding the professional need for either building specialism or generalism, both in industry and vocational undergraduate and postgraduate education[119].

A nation-wide survey[120] conducted amongst prospective employers (contractual and consultant) highlighted two main areas of concern in present US college curricula. Firstly that there is a lack of instruction in specialist areas, and secondly, that there exists a lack of instruction in good communication skills. Another survey[121] commented that within the top 400 contractors, who carry out 1/3 of the total workload, there exists 25 separate construction specialist activities each with its own set of problems and specialities to solve them. The services provided by some US Architects have increased in complexity reflecting the need for:- strict cost control; more demanding regulatory requirements; and, a technically and functionally complex construction. This, together with the need for specialist knowledge, price competition, and, fears of increasing liability, creates an environment where USA firms either seek a specific niche, where competition is less intense, or they improve efficiency[122].

In *Japan*, as in the USA, the traditionally accepted course for construction professionals is a common educational foundation with *ad hoc* training by the employer at a later date. The first two years of the education of the Japanese engineer is taken in common by civil engineering students, architectural engineers, and construction students. The final two years allows specialisation in one of these three disciplines. Architects are educated through separate degree streams but do share courses with architectural engineering students in the final two years. Registration of professionals is governed nationally and is based on the *Kenchiku-Shi* Law (licensed talent in building). Registration is further subdivided into classes which authorise the design (or control) of different types of building.[123] The system of building is broken down by type and size of the building proposed, which determines the combination of *Kenichiku-Shi* that must be employed. Each specialist discipline has the same status and level of qualification, and by law, has its area of responsibility defined.[124]

Although disciplines are equally regarded, salaries, regardless of field are heavily dependent on seniority. Mosk and Nakata[125] argue that although science and engineering students are perceived to study harder than students of other subjects, Japanese tertiary education is more of a screening process where admission to a reputable course is more important than performance at it. Choice of discipline is based to a great extent on the hiring propensities of large firms within the specific industries, since it is the large firms which offer the best chance of job stability, future promotion, status, fringe benefits and salary.

Available evidence suggests that among Japanese, *Kenchiku-Shi* engineer/architects, seniority and age are exceedingly important in promotion and salary levels within large construction companies,[126] whereas British promotional prospects reflect greatly the actual job title and specialism practised. Japanese companies often recruit individuals whose skills are not precisely in line with their needs and that within two to three years of their hiring, up to 40% of Japanese engineer/architects will be following a (company sponsored) technical speciality which substantially differs from what they pursued as college students.[127]

1.6 Traditional Roles in the Building Industry

The *international* building industry is clearly beginning to reassess traditional roles within construction and to re-examine the education of those charged to fill these roles in the future. The state of the building industry in the USA is one where '*specialist knowledge requirements added to price competition and a perilous liability environment has created a* *dilemma; either firms seek a specialised niche where competition is less intense (and train their work force to excel in these areas) or they find ways to become more efficient'*[128]. This could easily be applied to any of the nations described above.

Dissatisfaction towards respective *home* building industries exists amongst the major national players in world construction. The nations in the European Community are heading towards legislative harmonisation (without diminishing individuality), the Australian Government is attempting to pump-prime their industry to be able to adapt better to change, and both the USA and Japan are dependant upon private investment measures to achieve a suitably specialised workforce. In summary there appears to be a growing international trend to fractionalise professional input. This has a knock-on effect for the education of prospective design professionals. Uncertainty has arisen world-wide of how best to prepare future design professionals to succeed in changing legislative economic and technical environments.

It is clear that many of the construction industries problems are of an evolutionary nature and despite the rapid changes in technology and the growing complexity of the industry, the education of the independent professional has not kept pace with the interdisciplinary administration of the teams needed to manage this complexity. The globalisation of the building industry has further compounded the evolutionary process, so much so that now we might be facing a discontinuity of process, a minor revolution (paradigm shift) in our methods, at the heart of which will be the co-operation and coevolution of the profesional management of complex building projects. The evidence is strong suggesting that such professional cooperation needs to be a feature of the education and early development of the various personnel likely to form part of teams in the construction industry.

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CHAPTER 2

A BRIEF RESUME OF THE CURRENT EDUCATION FOR THE INTEGRATION OF THE DESIGN TEAM PROFESSIONALS

CHAPTER 2

A BRIEF RÉSUMÉ OF CURRENT EDUCATION FOR THE INTEGRATION OF THE DESIGN TEAM PROFESSIONALS.

The efficiency and effectiveness of the British construction industry is significantly and adversely influenced by communication difficulties arising from the fragmentation of professional input. Andrews and Derbyshire[129] conducted a series of interviews based on the premise that fragmentation was the most important problem facing the UK construction industry. Of the 11 construction professions, both chartered and non-chartered, who participated, the vast majority concurred with the statement that fragmentation was a major problem. Respondents also presented a consensus view that '*the wish to see better communication and less friction between the professions, involves a belief that a degree of commonality in higher education and training has an important part to play in achieving such improvements*'. This agrees with recommendations from a number of previous reports, which have commented that '*there is acceptance that a greater inter-disciplinary approach to professional education is necessary without losing the expertise of individual professions*' [130]

The education of the professionals responsible for the creation and maintenance of the built environment is accredited and hence heavily influenced by the professional institutions. These include, The Royal Institute of British Architects, The Royal Institution of Chartered Surveyors, The Institution of Civil Engineers, The Institution of Structural Engineers, The Chartered Institution of Building Services Engineers, The Institution of Electrical Engineers, The Institution of Mechanical Engineers, The Institution of Water and

Environmental Management, The Royal Town Planning Institute, The Chartered Institute of Building, and The Association of Consulting Engineers. Academic qualification is not enough to acquire professional status, it is merely a prerequisite for joining a professional institution. Only the attainment of full membership gives professional status. Specific vocational courses providing academic qualification and leading ultimately to recognition by a profession exist in several building disciplines. These courses are independently hosted in separate schools and departments usually contained in the universities of most major towns. In general the course syllabi seldom bring students of different disciplines into contact with one another.

Latham[131] has recently reviewed previous appeals for the integration of education, directed towards the *Professional Institutions*. This latest report documents the Construction Industry Council's recommendations for action by the professional institutions in the following ways: (i) Promote multi-disciplinary education, (ii) Liaise with the Higher Educational Institutions (via the Construction Industry Council) to rationalise entry qualifications and course examinations, (iii) Support the Continuing-Professional-Developments call for multi-disciplinary education, (iv) Identify cross-disciplinary industrial experiences, and (v) Standardise accreditation of the professional courses. To date very little has been done by the professional bodies to address these recommendations and it appears (even with third party CIC intervention) that they are content to retain the educational status quo.

Assessing the fragmentation which exists in vocational education in Britain, Happold[132] cites the work of Wiener and Bowley, in tracing a historical evolution of the UK construction industry educational system as '*a process largely carried out in an attitude of mutual disrespect*'. Contemporary education is also found to be (perhaps unwittingly) continuing this process. Contrary to attempting to instil mutual respect, the Department of Education and the National Council of Building and Civil Engineering[133] proposed, in the late seventies, a model of education which actively differentiated and downgraded several design team skill requirements (with valid historical claims to the title of *professional*) into *technologist* and *technician* categories, as distinct and of a lesser status than the top category of *professional*. 'Pigeon-holing' of this nature can be argued to increase *professional* protectionism and lead to less than optimum design team relationships. For example, it has been suggested that if an individual is taught that, other disciplines are service disciplines, or that education or training is better because of its length or where it took place, then these attitudes will be retained[134]. Attitudes, gained through the processes of education, can have detrimental consequences for the success of the project. Indeed, the detrimental affect on design, of inefficient participation between parties, may be reflected in Marriot's comment that '*when differences, resulting from different patterns of thinking, lead to a reduction in respect for, or lack of trust in each other, the design suffers*'[135].

It has been established that cultural assumptions made by the individual, once established, are virtually impossible to change[136]. Clearly then, if change *is* sought to better the efficiency and effectiveness of an organisation, '*a process reflecting the tenacity which cultural assumptions exhibit*', is required during the formative years of professional education. Yet there is no quick, reliable way to identify cultural assumptions in an organisational environment. It is clear that one can only truly understand a system, once one *tries* to change it[137]. Higher education is charged by the majority of those involved in the construction industry to illicit such integrative changes and improvements. It is reasonable to suggest that the optimum stage at which a complex organisation is open to change is arguably during the development of the member during tertiary education.

Professionals continue the processes of learning and developing their beliefs, feelings and behavioural tendencies throughout their working life, however higher education must accept responsibility for a large part of the process of attitude evolution. '*It is the methods taught to different disciplines which lead to the lack of understanding between differing approaches and conflict within the building design team*'[138]. Franks also comments that '*even if hostile attitudes are not actually inculcated, separate education and training makes communication, and mutuality, difficult if not impossible*' and that this has repercussions in the working environment.[139] Bringing the prospective professionals together at an early stage of their development is suggested as a way to reduce conflicting relationships. For example, it has been argued that an open, agreed approach to changing educational processes, to acknowledge the importance of inter-disciplinary relationships, will result in the strengthening of true specialisms and the teaching of the common aspects of courses at the highest possible levels[140]. At present however no such educational consensus towards an 'open agreed approach' to facilitate inter-disciplinary relationships exists.

Latham[141] has also recently reviewed previous appeals for improving integration in the fragmented construction industry made directly towards the *Higher Educational Establishments*. The report documents Construction-Industry-Council recommendations for action by the educational establishments in the following ways: (i) Publish and promote multi-disciplinary educational initiatives, (ii) Tackle problems associated with different course lengths and lack of synchronicity, and (iii) Look into 'geographical rationalisation' of construction degree courses. The CIC report found that very little has been done by the HEIs to address the above problem, and argue that in fact, the 'free market' culture in higher education now tends '*to mitigate against sharing information about course developments which may be seen to give away any commercial advantage to competitors*'. Whilst the fear of disseminating course details to competitors may be a contributory factor to the lack of promotion of a greater cross-disciplinary system of construction education, it must not cloud the issue that most educational establishments (as well as the professional bodies from whom they receive their accreditation) are still wary of extensive interdisciplinary restructuring.

In a study of the 11 construction professions who participated in an extensive questioning of industry, more than half warned *against* gaining 'commonality' at the expense of losing specialist skills.[142] According to the authors of this study, many of those questioned feel that '*fragmentation is a reflection of a necessary specialism*' and that '*compatibility is a greater problem than commonality, since, properly educated people solve commonality problems on their own*'. In another study outlining employer representative feelings, the author suggests the somewhat conflictual recommendation that commonality in courses should be established *at the same time* as advocating a need to develop more advanced levels of specialism[143]. The distinction between achieving the efficient interaction of future professionals through either a generalistic appeal for greater commonality of knowledge across all construction education disciplines on the one hand, or, on the other hand, by seeking a better system of integrating the existing specialised courses, is an important one.

In a study of educational establishments offering architecture, building, engineering, and surveying courses, 94% of the Higher Educational Institution respondents replied that they '*were aware of the growing trend towards commonality*'. Just over half (56%) consider common teaching to be 'desirable' whilst 9% regard it as 'acceptable'[144]. Clearly vocational educational is far from united in terms of its ambitions to increase commonality between courses. Architectural course leaders are apparently less favourably disposed toward commonality in education than other disciplines[145]. In the main it is believed that the disciplines have different aspirations and with reference to architecture it seems that comments concentrate on the view that '*architecture is design, whilst building is management*', and that '*building for architects is a means to an end, whilst for the builders it is the end*'. Suspicion arises from a majority of specialist design courses that commonality of taught subject areas would herald the demise of innovation. For example, Brawne[146] makes the assertion that there is a '*major difference between those who design and those who do not*'. He argues that the '*theory of design is all-important and must be protected*'. Statements of this nature represent a universal desire to protect good design. However this stance might also be misconstrued as harking back to historical protectionism, doing little to address mistrust amongst the professions.

Administrative and logistical reasons are given as an explanation for the opposition of common education for design team professionals. Two different studies have shown that many educationalists believe: (i) existing disparate vocational courses to be incompatible, (ii) potential numbers to be excessively large for a common educational system, and that (iii) existing organisational Higher Educational Institute structures are regarded to be too inflexible to allow greater commonality of subjects[147]. On the other hand however, Collier et al[148] assessing compatibility and commonalty levels, argue that similar core subjects are central to at least seven existing professional syllabuses. They argue that the following subjects:-building process, construction, design, materials, services, structures, and surveying; and the supporting subjects of:- communications, computing, economics, finance, law, management, maths, and statistics, represent over 60% of the total curriculum studied in 7 distinct built environment vocational courses. This clearly provides a significant basis for development of either a common curriculum for all courses of the built environment or a series of core syllabuses for inclusion within the existing courses. Logistics and geography have an important role in influencing moves towards a common built environment curricula. However most educationalists who cite logistical objections must be aware that problems of venue and course structure run by neighbours are relatively easily reconciled. Underlying fears for the demise of specialist knowledge may represent the root of objections.

Clearly the potential for commonality of information and knowledge contained across vocational building courses does exist. However the ultimate goal of facilitating more efficient and effective interaction of future professionals through a generalistic appeal for greater commonality of knowledge across the construction education disciplines is less certain. For example, '*the various weaknesses of the lecture/tutorial system as a didactic method have long been recognised*'[149]. Core subjects presented in the traditional way, but in a larger venue to a larger selection of disciplines, seem unlikely to break down the barriers of mistrust (documented in almost half a century of literature) in the design team. Even if reference is constantly made, throughout traditional presentation of core subjects, of the collective relevance to each design team member it is doubtful whether better integration of courses would occur. If it did, it is likely to occur only in a limited *ad-hoc* way. It has been suggested for example, that the traditional lecture is an extremely inefficient vehicle for bringing about effective learning, with students in some cases retaining as little as 5% of the material covered.[150]

Higher Educational Institutions, seeking to integrate different disciplines by the introduction of common subjects across schools, cannot be sure that timeous resource assessment and reorganisation will result in the desired improvement in professional relations. An analysis of topics, other than discipline specific subjects, regarded as important to *industry* appear to be less clearly identifiable than the 'core' and 'supporting' subject areas defined above by Collier.[151]

As a result of interviewing 100 members of each of six professional bodies (Architecture, Building, Building Services Engineering, Building Surveying, Quantity Surveying, Structural Engineering) as well as 50 employers of each of these disciplines it was found that both professionals and employers rated *communication*, *problem solving*, and *teamwork* as very important skill requirements for the professional in addition to specialist knowledge.[152] In another study, seeking the opinions of course leaders in British construction education, it was found that respondents gave the three topics of *design*, *communication*, and *problem solving* the highest rating in terms of a 'performance loaded activity' in the vocational courses offered by their Institution(s).[153] Basically specialist knowledge coupled with the opportunity and aptitude to communicate and apply that specialist skill is regarded by both industry and education as a way toward an enhancement of the performance of the design team.

However, the need to look beyond concern about subject coverage as the only important variable of course design, and realise the relevance of choice of teaching method has also been highlighted[154]. It is argued that '*it is important to evaluate the effectiveness of educational programmes if institutions wish to contribute to the health of a professional discipline*'. In a review of recent literature covering interests in different disciplines in the construction industry, the objectives of education have been expanded and elaborated, and they too support earlier studies which call for increased opportunities to 'communicate and apply' specialist skill. For example, vocational and professional educational objectives must seek to help students develop a problem-solving skill, in addition to educational objectives to transfer knowledge. In addition, these skills are '*best gained through group and project work in industry-simulations rather than through more traditional lecture and tutorial combinations*'.[155] Therefore, assuming that such measures are practised, the future professional would be a more effective member of the design team. An educational process which provides inter-disciplinary activity, will also provide the student with an appreciation of the needs of, and the contribution by, other building disciplines and '*this appreciation will further stimulate graduates to pursue procedures which will promote effective integration leading to the achievement of a built product which better meets the clients requirements*'.[156]

Inter-disciplinary project work, which is seen as having a '*principle objective of an interdisciplinary cultural exchange*'[157], is gaining popularity. External bodies[158] have also become interested in running independent integrative initiatives (in which educational institutions encourage undergraduate architecture, engineering and surveying students to take part). Whilst such initiatives are to be commended, there is some concern that they are 'preaching to the converted' and that the majority of students who are under no obligation to participate will carry forward a protectionist outlook instilled by institutions content to react to such *ad hoc* external invitations, rather than seek proactive policies of their own.

Although there are many who favour inter-disciplinary initiatives, the need for the interaction of different disciplines at an educational stage, is not universally supported. Marriott[159] for example suggests that '*university education is too short to have time-consuming exercises to try to rub students from different disciplines up against one another... the time would be much better used to give a more fundamental understanding of their own technology*'. Others can quote examples of unsuccessful experiments in courses with common content, which no longer conduct exercises in integration for specialist courses[160]. One institution which implemented extensive commonality measures in the mid 1980's, has returned to a more traditional departmental structure which retains only a very small measure of inter-disciplinary project work[161]. No mention is made however of the influence of internal politics on the change from a highly integrated common curriculum to a more traditional set-up.[162] Distrust of commonality at all levels within academic managerial hierarchies is clearly implied to exist.

Carolin's case studies[163] illustrate the highly volatile and uncertain nature of contemporary inter-disciplinary education and the wide scope of opinion, displayed by educationalists, towards its need and place within educational structures. Indeed this lack of consensus appears to reinforce the importance of the type of research presented in this thesis which seeks to present an education model which is able to clarify the rationale for integration, and to provide a means of reconciling disparate educationalist opinion of multi-disciplinary initiatives.

Notwithstanding the opposition however, there is recognition in many quarters, of the potential for at least some form of educational process to encourage empathy with the issues faced by other disciplines. However opinions differ greatly regarding the following aspects: the stage of implementation (if at all for undergraduates); the duration; the mix of specialisms; the specific content; the degree of specialist knowledge required; the contribution to vocational course assessment; the method of assessment and tutor input; professional institutional validation; and the ultimate relevance to industry of such initiatives. '*Although it is possible to mix the design principles at an early stage, all disciplines need to be confirmed in their discipline before this can be done successfully*' warns Carolin[164] and then, citing Walker,[165] reiterates that '*collaboration and teamwork among the various disciplines must not submerge separate courses for Architecture, Engineering and Surveying at the early stages of education*' and that the '*vocational motivation of each discipline must be established at the outset*'.

There appears to be no doubt that educationalists are divided over the extent to which specialist integration should occur. In a series of interviews designed to establish the extent of collaborative work between the disciplines, in many of the British educational Institutes, interdisciplinary collaboration was found to be 'varied and widespread' but the authors were unable to specify numbers or amounts since they claim that the range of variables, made quantification difficult[166]. In another survey of 34 Higher Educational Institutions who offered building courses, with a view to the assessment of interdisciplinary work it was found that 15 of the HEIs housed more than one discipline and that, of the 15, 53% provide some form of commonality in courses. The remaining 47% were 'planning' to incorporate some form of integrated work in the near future[167]. Even in the schools currently conducting interdisciplinary initiatives, the extent of most collaborative work remains insubstantial[168].

Whilst it is clear that actual developments in integrative building education, by the majority of British educational establishments are cautious, suggestions and recommendations for its future, from various sources, are by contrast numerous and quite radical. The Construction Industry Training Board (CITB)[169] are attempting, through the introduction of a 'Pre-vocational initiative', to target under-16 year olds at primary and secondary schools, in a promotional multi-disciplinary construction awareness campaign. Through 'curriculum centres' the CITB are seeking to incorporate 'construction and the built environment' into school curriculum timetables, in an effort to '*help young people realise the opportunities in the context of construction*'. Cooper and Stonehouse[170] support this '*wider basis for (primary and) secondary education in combining arts and sciences (with respect to) obtaining a more suitable base for higher education of the built environment*'. The CITB hope to link to a National Vocational Qualifications framework at secondary school stage with NVQ style certificates offered, to allow an easier progression into the construction industry. Enthusiasm for such initiatives must be tempered by the possibility that these

Government led trends towards a convergence of options at such an early age, may result in the construction industry losing those of more diverse interests, who could potentially bring much value to an industry which ultimately thrives on innovation and originality.

In an other recommendation for building education, the Construction Industry Standing Conference (CISC)[171]seek to review the training and qualification process of all participants in the building industry. Chiefly the training of site operatives, technicians and supervisors of the industry (categorised as grades 1-3) are being standardised in line with the National Council for Vocational Qualification. Plans for an NVQ standardisation of 'Professional Skills' in construction (towards grading categories 4 & 5) are also suggested for discussion by the Government Training Agency.

The National Contractors Group[172] propose the furthest reaching reforms to tertiary construction industry education. They argue for the introduction of approximately one dozen 'Centres of the Built Environment' which they see as eventually replacing the present Higher Educational Institute building departments, and substituting the existing courses offered, by a three year common degree with an optional one year specialist supplement to a Masters qualification.

The CIC[173] are also keen to promote a 4 year full-time (and part-time equivalent) undergraduate degree course for all skills, and to make the government and Higher Education Funding Councils aware of the implications of increasing commonality in education. They argue that present funding policies on the development of multi-disciplinary education are divisive and damaging and wish to establish with the Government and the Higher Educational Funding Councils a rational basis for the funding of different vocational courses. However this conflicts with the latest recommendations by

The Steering Group on Architectural Education which argues that the only way to maintain suitable standards of design is through the retention of the government funded qualification of a minimum seven years duration.[174]

Somewhat predictably, the recommendations for structural re-organisation of tertiary education are ill-received by the Higher Educational Institutions. For example, interviews with educationalists show no support for the concept of a common first degree for all construction disciplines[175]. Indeed it has been suggested that '*although a common first degree may be applicable for those who do not yet know which discipline to adopt, the majority should pursue a single-discipline first degree, followed by post graduate education which then may afford opportunities for integration*'[176] Interviewees have also pointed out that different disciplines demand different entry requirements, levels of academic achievement, and subjects studied. The problem of logistics is further emphasised by arguing that, notwithstanding a common 3 year programme, '*even the introduction of core-modules (cited as a possible method to eliminate inefficiency of subject duplication, and as a means to facilitate student transfer between courses*[177]*) into the existing HEIs, will produce very large lecture audiences which will fail in their objective of promoting commonality*'.[178]

Although the 12 Centres of the Built Environment, proposed by the Department of Education & Science are said to be 'under way'[179] (although little is known of progress beyond policy statements), the DoE&S are apparently in conflict with both education and industry[180]. By attempting to implement their proposals, the DoE&S were considered to be '*in conflict with virtually every professional organisation and educational institution responsible for (Architectural) education over governmental centralist tendencies which are seeking to determine the function of each of the professions and their accreditation* *standards*'[181]. Obviously if the motivation for these radical changes to the structure of industry by the Department of Education & Science, and the National Builders Group, is to '*reduce the adversarial conflicts that too often prevail in the building industry*'[182], their approach appears to have generated more conflict that it set out to reduce.

Other alternatives for a more efficiently integrated industry have been voiced by Hutchinson[183] who expresses an Institute position in favour of the adoption of some form of inter-disciplinary education only at the post part II stage of architectural education. Effectively he advocates interaction only at post degree, masters or diploma stage; a level at which professional graduates (other than Architectural students) in construction seldom receive Institutional encouragement to attain. Such support for post degree integration, by the RIBA and also Construction Industry Council representatives[184], must be examined in the light of findings by others, who discovered that only 2 out of the 34 HEIs who took part in his survey, hosted a Masters course which promoted commonality of curriculum or integration of disciplines.[185] Of the two courses offered, the opportunities for integrated common study amounted to substantially less than half of the course. Whilst this information does not undermine the belief that the post-degree stage is suitable for integration, it does show the limited opportunity which the post-graduate stage offers.

Opportunities for post-graduate study notwithstanding, an investigation into the effectiveness of integration at the later, rather than the earlier stage of vocational education, has been executed[186]. The findings suggest that '*generally, (architectural) students become less co-operative in the later years of their academic careers when the pressure to succeed, and an increased emphasis on individual attainment, engenders a competitive, and not an integrative co-operative, attitude*'. This is apparently reinforced by practitioners who maintain that graduate students are not prepared for the co-operative, teamwork approach that is needed in practice. Schools need to increase the use of team projects throughout the duration of undergraduate studies.[187]

Morgan's[188] work dealt with the most appropriate stage to facilitate 'learning through projects'. He found that '*undergraduate students do not have the same difficulties in participating within the theoretical (design) team as is found in experienced professionals*', undergraduates readily accept and defend 'collective responsibility'. This being the case then if one wishes to develop integrative project work at an undergraduate stage, and students are not doubted in their abilities to gain from integrative learning techniques, 'staff confidence is a key factor'.

Obviously if integrative initiatives are to work, staff must be the first to recognise the contribution of other specialist colleagues. At present this does not appear to be the case. In a series of interviews with Science and Technology tutors employed within Schools of Architecture, the major obstacle to the fulfilment of their educational objectives, was '*centred in all cases on the other (Architectural) subject tutors with whom they had to work*'[189]. Principally, design staff made no attempt to generate an interest in science and technology even in terms of its relevance to the wider aspects of the course, and thus Science & Technology Tutors found themselves attempting to 'think (and teach) like architects' to obtain recognition for their subject. There is therefore a '*need for a clearer framework to ensure a common philosophy in (construction) teaching*'[190]. It is clear that the integration of disparate subject-tutors is the first step in the integration of vocational courses. Although 94% of higher educational British heads of school are aware of trends toward commonality, such a first step, of tutors sympathetic to the function of their peers, is still far off. Indeed recent recommendations by the Steering Group on Architectural Education[191], for the creation of titles such as 'Recognised Teacher of Architecture' may only aggravate status-seeking in an already volatile environment if applied sparingly only to design tutors, and would be seen as superfluous, if given a cross-disciplinary catchment[192].

If education is to realise the expectations of industry, and take responsibility for improving future design team relationships, all personnel involved in this process would do well to seek mutual expectations of trust and co-operation, replacing arms length historical protectionism. Whilst it is clear that there is much uncertainty regarding the best course for the future education of professionals, a willingness to accept a call for change is the first step. Lavers[193] summarising contributions from several authors concerned about an increasingly conflictual industry argues that '*surely it is the case that no such proposals will be adopted or even accepted as long as traditional attitudes prevail*' and that the problems of communication in the building industry '*can only seriously be addressed if educational strategists are able to achieve success in the change of mind-set*'. Bishop is cited as '*providing the most noteworthy consensus summary to educationalists, that the key to a more productive future is in the word attitude*'.

It is argued here that the increasingly fragmented construction industry, requires a multi-disciplinary initiative able to address (at an educational stage) the professional mind-set of detrimental attitudes, held toward other design team disciplines.

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CHAPTER 3

ASSESSING THE REQUIREMENTS FOR INTEGRATION IN THE MULTI-DISCIPLINARY TEAM

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3.1 Specialisation and fragmentation in construction: exploring the case for integration mechanisms

Vocational education for building professionals, stemming originally from initiatives by the professional institutions, has now almost exclusively become the responsibility of Schools and Departments within the UK University system[194]. Design and Building courses now complement other academic disciplines in course prospectuses. Universities compete to secure prospective students. University Faculties present broad subject divisions and are themselves further subdivided into many specialist fields. Fragmentation of specialist input in the construction industry is matched by a similar division of interests in the academic arena. If industry is to realise calls for a unification of building professionals, recognition must be made of the fragmentation which exists within the professional foundations of the academic environment.[195]

As the construction industry and the feeder educational process divide into specialist areas it becomes increasingly difficult for individuals to determine the relative worth of efforts of new and different fields, and hence difficult for the participants to make general assessments across other fields. Thus an individual may have a general knowledge of some specialisms, but as technical expertise increasingly fragments industry they are less able to keep informed on all specialist developments. These new fields develop strong subcultures[196]. On the subject of the specialisation of tertiary education, it has also been suggested[197] that academics in a particular discipline develop their own culture, and that '*this culture is made up of the disciplines own styles of inquiry, objects of interest, intellectual orientations, attitudes, heroes, and procedural expectations*'. Academic disciplines also become separated from other disciplines and often from other sub-fields within their own discipline. A reductionist or 'scientific model' may also contribute to the basis for this outlook and whilst 'science' advances literally by building upon previous discoveries, these discoveries exact a cost in the form of increased complexity[198]. Knowledge bases that are more precise and rigorous are then less able to address the overarching issues.

Ruscio[199] likens the overarching issues of the various specialisms to the spokes of a wheel, separate from each other, but brought together by an outer ring. Clearly parallels can be drawn with specialist input in the construction industry. To a large extent the evolution of courses in vocational education which feeds the construction industry, have followed disparate directions assuming that post graduate participation in industry will provide individuals with an effective overarching environment. This does not appear to be happening. Specialist isolation remains an issue in the dissatisfaction of the contemporary building design team. Taught professional specialisms are not self-aggregating (they do not automatically assemble nor combine emphatically) so there is a need to introduce an overarching mechanism directly into the educational process.

Just as previous discussion has focused on the progression towards fragmentation of specialist skill in an increasingly complex building industry, so Ruscio argues that specialisation of the academic professions is (just as) inevitable, since the sheer volume of knowledge and its rapid expansion compel specialists to carve out their own niches of expertise[200]. Academics too, are motivated to achieve higher status within their profession and this is often achieved by advancing their discipline with precise and specialised contributions. Once started, it becomes evident that professional fragmentation in any organisation or environment is difficult to halt.

Complex organisations for example may become a '*synthetic bureaucracy which divides its labour and specialises*'[201]. The organisation accommodates new challenges, but resists others, often causing the rejected challenge to establish a competing bureaucracy. Indeed some commentators regard academic fragmentation as a more damaging environment, (in which to allow the occurrence of specialist obstacles) than industry. In relationships among the disciplines, '*none has the urgency of the virtually insuperable hurdles that have been created by the specialisation of labour in the production of knowledge*' according to Easton[202]. There are shifts in the self-image of areas of knowledge and these typify a broader picture in which there exists a whole series of multifaceted problems which society can only comprehend by the subdivision of a universal solution. Concern arises that the constituent parts of knowledge will be unable to add together to produce a minimal solution, never mind a dictionary definition of a Gestalt whole which is greater than the sum of the parts.

The social process which encourages fragmentation in areas of knowledge which must ultimately contribute to an overarching objective are worth noting, if improvements in integration are sought. Studies have confirmed the importance of sociological factors in the growth of specialisms. Mullins for example systematically modelled the development of specialisms in terms of four stages: paradigm group, network, cluster, and speciality[203]. Each of these stages is defined as having a successively greater social interaction of participants in terms of: communications (serious discussion about the new field), apprenticeship (the training of students in that particular new field) and colleagueship (application of the 'new' field in a multi-disciplinary environment). Disciplines become more committed to their own grouping, interacting less and less with those outside their own specialism.

However disparate specialisms must eventually come together if they are to contribute effectively to an overarching objective. '*Just as it would be hazardous, in an everyday context, to seek a solution that takes into account the wisdom derived from only one source, that ignores understanding derived from other areas of inquiry, it would be equally hazardous to seek a solution based only (or largely) on one discipline, when other areas of understanding and knowledge are available*' comments Easton.[204] Thus attempts to reconcile the 'inevitability of specialisms' must be made.

According to Ruscio[205] for example there may be 4 mechanisms which ultimately re-unite and integrate disparate disciplines which exist in a fragmented environment: (i) Actual problems do not conveniently fall within disciplinary boundaries. To address an overall objective, professionals and specialists must communicate across boundaries and be able to draw from neighbouring disciplines or sub-disciplines. (ii) Methodologies or advances in instrumentation can sometimes integrate. Solving problems in one area can often depend upon a methodological breakthrough in another. (iii) Disciplines reward individuals who are interdisciplinary or who can look at a problem from many different perspectives. The final mechanism to re-unite disciplines occurs where, (iv) The students of a particular discipline (effectively representing the consumers of specialist knowledge) are more inclined to cross vocational boundaries during an educational formative period.

Assessment of these findings allows mechanisms i, ii, and iii to be seen as methods of 'horizontal integration', that is they (occasionally) operate across vocational fields for the benefit of those specialists who are *already* committed to a particular field of interest. Indeed the first three mechanisms are readily available to the disparate professionals working within a fragmented design and build process. However the inefficiency of construction professionals in crossing boundaries in the first of Ruscio's classifications appears to have been instrumental in the dissatisfaction with the effectiveness of the construction industry. The second integrative mechanism, in terms of the building industry, has yet to be realised, since the use of 'expert systems' or new interactive software packages as tools to promote interaction between building professionals is still experimental[206] Whilst the third mechanism (integration through rewarding an ability to look at different perspectives) is open to the subjective opinions of the individual(s) concerned.

Ruscio's fourth mechanism for integration, is perhaps the only way (being more readily applicable to addressing the fragmentation in the construction industry than the other three mechanisms described above) towards a 'vertical integration' of disciplines. This mechanism seeks to provide a link between the producers of vocational education, and the students who will ultimately be in a position to use and integrate such specialist knowledge. It is argued here that facilitators of specialist training must realise opportunities to integrate the future professionals who will be expected to perform in a fragmented environment. To do so it becomes important to see the 'new' disciplines not only as subdivisions of a parent industry but as fields of interest in their own right. Emphasis changes from attempting to instil a central all encompassing objective, to facilitating empathy between, what may at first be seen as, disparate objectives.

It has been argued for example that disciplines, rather than comprising a homogeneous entity are built up of a constantly changing kaleidoscope of smaller components[207] Thus one may legitimately talk not only of specialisms as sub divisions of a broader knowledge field, but of disciplines in their own right. These may comprise a variety of constituent elements, which have a character of their own and which may, in certain key respects, differ noticeably from, or even be perceived to conflict with, a prime overarching objective by other related specialist fields. Specialisms form their own professional cultures[208,209]. These may press against the overall culture of the industry of which they form part, and thus may seem to threaten its identity. Indeed academic disciplines (in related fields) enjoy still greater degrees of independent stability, through measures of institutionalisation, in the form of organised professional groupings, bibliographical categories and dedicated journals.

Becher[210] has also highlighted an interesting feature which emerges from an examination of attempts to characterise the classification of specialisations and sub-disciplinary groupings. He argues that specialisms show an apparently close interweaving of epistemological features and social features and adds therefore that it is natural to invoke both frames of reference simultaneously, referring to 'areas containing groups' and 'groups as inhabiting areas'.

Specialism, be it pertaining to the group, or alternatively the field of inquiry, by its very nature sets itself apart. By doing so it introduces comparison, not only in terms of knowledge generated, but also in terms of subjective importance to the parent industry. The quest for status is a pervasive feature of academic (and professional[211]) life[212]. Institutions vie with one another for reputation; so do disciplines; so do individuals. There is, in most higher education systems, a tacitly recognised 'pecking order' among subjects, in which areas of inquiry tend to rate highly while other fields are held in relatively low esteem. These lowly rated groups are naturally concerned to improve their overall standing amongst colleagues. Highly rated ones seek to maintain or enhance their existing predominance. To a large extent this occurs independently from within the specialism itself. It is somewhat intriguing that disciplines should attempt to enhance their own standing in the academic community without regard to their neighbours[213]. This further emphasises divisions.

Specialist disciplines find it difficult not only to talk to each other but even to carry on a credible discourse with colleagues in subspecialties within their own disciplines, because the development in many areas of inquiry has become too highly differentiated and technical.[214] Whether highly rated or not, groups with differing viewpoints who adopt differing (ideological) perspectives tend to avoid disputes; even those who acknowledge the positive potential for conflict are found to prefer 'mutual distancing'[215] to what has the potential to turn into mutually destructive confrontation. Becher[216] cites research which shows that disagreements sometimes become public, but more commonly he found that specialists simply do not communicate with those who hold a different viewpoint.

The construction industry, apparently believes that the solution to overcoming the obstacles created between disparate disciplines must come from professional education[217]. Education also has an opportunity to be more integrated in teaching terms and that often the highest recognition in academia tends to be accorded, not to those who work along specialised seams, producing small nuggets of knowledge, but to those who develop integrative and overarching ideas. In education '*promiscuity may be seen as a virtue rather than as a vice*'[218]. Clearly this is more difficult in industry. Professional institutions, who although very keen to secure as wide a market share as possible, recognise that disciplinary promiscuity in practice would not only bring much criticism from the other chartered professionals, but may also lead to individuals losing prestige in their existing niche. Education is better placed to allow specialist cross-over.

Recent studies[219] of tertiary education[220] suggest a surprisingly high degree of movement from one specialism to another and even from one discipline to another. Occupational nomadism of this kind may carry career risks for the individual academic concerned, however it can significantly counteract the tendency for specialisms and disciplines to become intellectually isolated from each other. It is the nature of disciplinary groupings to create professional cultures which in some respect complicate and even undermine the source industry from which they derive, however the advantages can be argued to outweigh the drawbacks. The best way forward however is *unlikely* to be through sermons about the evils of narrowly-focused, specialised enquiry, since that would seem to be an endemic feature of academic life, so '*changing the deep-seated values and rewards structures of any enterprise is a major task for any would be reformer; what is required is a development of (approaches) which integrate and stimulate the multiple membership of research networks*'[221].

To generate some overriding sense of academic unity, a measure of collective independence should be retained. The first step argued by Becher is to seek a greater degree of mutual tolerance among rival disciplinary groups. The second step is to extend that tolerance into a deeper understanding of the inherent necessary differences between them. It is argued here that, ultimately, such a process should carry forward into collective contribution in industry.

Specialist activity must not be swamped by unnecessary commonality since *ad hoc* borrowing among disciplines tends to fall short of a theoretical whole. One explicit way of overcoming the handicaps of specialisation is some form of interdisciplinary training although it is difficult for one person to learn even one discipline comprehensively, let alone two or more[222]. To approach the problem of fragmentation by attempting to isolate and instruct only the interdisciplinary areas, is argued to have limited appeal in meeting the ultimate integrative requirements of a multitude of fields of knowledge.

Providing a knowledge of, what is in effect, an assembly of compromise pre-existing bits and pieces may of course provide the individual with only a tiny fraction of the contents of the underlying discipline, and any optimistic hopes for a selective fusion of parts of a few disciplines, tends towards a recognised and self confident field of inquiry in its own right, and does little more than add one further discipline, albeit an important one, to the fragmentation and specialisation of social knowledge[223] A clear example of this is found in initiatives by educational establishments in both the UK and the USA, which are currently seeking to promote the qualification and role of Construction Management. This does nothing to address the problems caused by fragmentation, rather it can be argued, it adds to these problems, simply by the creation of one more specialism.

If it is impractical to attempt to implant all knowledge into one head, then Easton suggests, perhaps by bringing many specialised heads together it is possible to achieve an improved integrative result through teamwork. The barriers encountered by co-operative teams in academic research, testify to the fact that the effort to integrate the disciplines for applied purposes may come too late in the educational process, and so integration should be developed earlier[224].

This project recognises however that a contradiction arises in combining the disciplines too early, since the process of obtaining understanding often dictates that individuals must quickly move to specialisation, and that combining with others at this stage would merely reduce specialist knowledge. Whilst generalists exist, there is little place for them in industry or academia: there are few departments which exist in educational establishments, there are limited recognised career paths, and little professional institutional support or encouragement for such mutli-disciplinary students. '*Although there may be an audience, it is not as numerous, dedicated or esteemed as established professional constituencies*'[225] suggests Fleishman.

So, the mechanism to integrate the different specialists of the building design team must concentrate on allowing them to cross vocational boundaries at their formative educational stage. However integration of disciplines must not swamp the specialisms with unnecessary common knowledge bases, rather it must seek to empathise. Thus far this process has resulted in a succession of documented difficulties which appear to support the idea that individuals, educated under different traditions about what constitutes the most appropriate way to achieve professional objectives, find difficulty interacting in a common project.

3.2 Trait differences between design and non-design professional disciplines

So far it would appear that difficulties arising from professional interaction, reflect different educational traditions. Adherence to tradition gains significance in the light of reports in the architectural press, that many architectural academics '*tacitly believe that the differences between the professions are insurmountable*' and that '*a happy mix of disciplines is impossible*'[226]. Indeed the RIBA president elect, Hutchison, answering an accusation, at the Building Industry Councils Head of Courses meeting, that architects tend to '*place themselves outside and above the rest of the construction industry*' replied '*We are different*' and backed the view that, there is a major difference between those who design and those who do not[227]. The very fact that the question was asked at all, reinforces the notion that divisions do exist within the construction industry. Indeed the RIBA presidential answer may be said to simply reinforce the relevance of research presented in this thesis, which identifies and highlights perceived *disparities*, so that they can be used by education, rather than remain dormant within a multi-disciplinary design team which has yet to achieve optimum potential.

The notion[228] that design is based on a kind of romantic subjectivity[229] which the other disciplines within the design team do not adhere to, (and that education merely facilitates the process) provides a foundation for those who argue that '*the only real solution is to put (the disparate professionals) together so that they will irritate each other so much that out of this will come progress*'[230]. However any attempt to understand the trait differences which exist within the *building design team*, is constrained by literature which deals (almost exclusively[231]) only with the profession of Architecture.

In a more universal vein, previous research concerning the differences which exist between individuals embarking on, and working in, different occupations has produced much data[232] which indicates that variances do exist in the personality and individual traits of those working in particular occupations. However the extent to which these traits are *learnt* by an individual immersed in the traditions of vocational education is less clear.

Studies by Lawson[233] to ascertain how design and non-design disciplines perceive and tackle problems, consciously targeted two groupings of students:- final year Architects and final year Science students on the one hand, and first year Architects and sixth-year school-leavers on the other. The first grouping of final year tertiary students were found to employ two distinctly different strategies for tackling problems, dependent upon their being either an Architect or a Scientist. Final year Architects were found to adopt what Lawson terms a 'solution-focused' approach towards tackling problems whilst the final year Scientists employed a 'problem-focused' approach. Both final year groupings were found to adhere to problem-solving traits which Lawson argued as being peculiar to either Architecture or Science. However, a similar analysis of first year Architects and six-year School Leavers showed *no* consistent problem solving strategy in either of their sub-groups. Although first year Architectural students and six-year School Leavers were found to perform uniformly worse at the task in hand when compared with the final year students, they did *not* adopt the distinctive problem-solving strategies displayed by students who were at the end of their tertiary architectural or scientific training. This suggests that specialist trait differences may be influenced by vocational education.

Whilst it may be argued that respective educational systems used for science and design simply reinforce an interest in what Lawson calls the 'abstract' or the 'concrete', the study also suggests that graduates *develop* strategies and traits which reflect the educational methods and philosophies which they have undergone. Educational curricula for the construction professionals, does appear to have an ability to influence trait and personality variables.

Another study which examines the early stages of Architectural education, also suggests that there is little evidence to support the notion that individuals who initially perform well in design (education) exhibit inherently particular and distinctive traits and personalities. Schmidt[234] studied a battery of 14 personality and performance measures[235], and applied each of these tests to over 100 first year Architectural students in an attempt to assess the links between personality and performance. Whilst he did find a link between 'anxiety, motivation and analytic ability', and 'creativity' he found no significant relationship between (academic) *success* (at this initial educational stage of architecture) and the personality variables of the students. Both Lawson and Schmidt agree that an individual may be drawn to a particular course which initially allows an opportunity to develop an interest in the 'abstract'. To be *successful* in that field however, the individual must go beyond trait variables which contribute to this initial interest. To be (academically) *successful* an individual may have to adopt, and adhere to, the educational tradition and process, of their chosen profession.

A comprehensive assessment of the influence which a vocational educational process exerts on the evolution of traits and personalities is difficult to establish from the existing literature since it is often found to be overlooked in work which sets out principally to identify what the differences are. Attempts to analyse the development of the somewhat intangible processes and make-up of the design professional, as opposed to the non-design professional, can be swamped by research which deals with minutiae, which then detracts from the main objectives[236].

However much research seeking to assess the qualities of design, through an examination of the disposition of the designer and a differentiation of designer versus non-designer, is worthy of attention. Using an 'art versus science' route to attempt to differentiate learning styles[237], it has been claimed that Architects favour a 'right side of the brain' style of learning and thinking, whilst Scientists (medics) favour a 'left side of the brain' style of learning and thinking[238]. It has also been argued that similar significant differences exist between the cognitive process of designers and non-designers[239]. These findings suggest that architectural students generally, are more 'field independent', and as a consequence they show greater social independence, a stronger sense of having a separate identity, and less likelihood of being persuaded by others than those classified as 'non-architects'.

'Creative ability' is apparently an important factor characterising successful practising architects[240]. In constructing a 'profile of the creative architect', creative architects show high levels of personal dominance, ego strength, self acceptance, and '*an independence of decision which favoured acts of perception over judgement*'. The group 'of highly creative American architects' also excelled in tests requiring flexibility and insightfulness, high aesthetic and theoretical values, and perceptual and intuitive preferences[241]. Interestingly MacKinnon theorised, architectural creativity is a result of creative responses in both the 'arts' and 'sciences' and that the '*creative architect has twin abilities in that their creative work overlaps or synthesises these two broad categories of the creative endeavour*'[242]. Whilst this may well be a valid description of the process of design, the argument that architects are able to overlap, in what other research indicates to be two distinct categories, does little more than cloud attempts to determine why the designer is considered to be different. Attempts to explain the mystique of the design process and the mysticism of the designer in terms of psychological differentiation, rather than give a clearer idea of why their position is important, become increasingly confusing and somewhat gauche.

Further analysis of creative productivity has been carried out by Bergum and Cooper[243] whose assessment of creativity also broached both art and design[244] where they linked arts and science *disciplines* (rather than artistic and scientific endeavour) together in the determination of creative productivity. They suggest that the trends in their data '*tend to support a view that artistic, scientific and technologically oriented disciplines provide the bulk of creatively productive individuals*' and that students strong on individualism and independence would be found in greater proportions in the schools of Architecture, Engineering, and Science, than in the schools of Business, Education and Agriculture. In addition, they found that Architecture students liked complex problems and were most confident about their creative abilities. They tended to be less socially active and less verbal than most other disciplines. Engineering students were found to display the strongest tendency toward individual contributions and also found to be less verbal than most. Obviously this might be expected to have an effect on performance within a contemporary design team.

Bergum's earlier research[245] suggests that 'less successful' professionals deviate from the modal, most frequently expressed, public view of their groups characteristics and traits. From the above evidence it would appear that sociability, orientation toward teamwork, and willingness to communicate with peer groups, in fact, represents a deviation from the modal view of successful (architectural and engineering) designers. Interestingly, in an industry which is experiencing an ever growing need for specialisation to combat an increasingly complex process, the designer who *is* willing to communicate with peer disciplines, does not adhere to personal dominance and is open to suggestion from others, given the rationale above, may be expected to be a less successful and less creative individual than fellow professionals. Obviously the importance of design must be retained, however the ability to communicate the potential for good design in a multi-disciplinary team must be seen to be equally important.

Research, seeking to predict the creativity and potential for the success of architects, conducted on professionals at the initial stages of their development, shows much less evidence to support propositions that variables of 'individualism' facilitate success. Attempts to discriminate between academically successful architectural students and those students who fail exams and ultimately fail to be awarded a degree, began in the late 1940's, when McClure[246] questioned why architectural schools had a high percentage of student drop out[247]. Whilst the majority of work seeking to aid selection processes and admissions to professional Schools of Architecture focused chiefly on aspects of secondary educational examination results, another reason for trying to interpret personality and trait differences, has been to attempt to provide additional criteria to aid the admissions procedure to design courses.

Evaluations of the use of personality and trait characteristics, as an aid to the selection of potentially successful students, vary. Warnings of the use of academic success predictors[248] suggest that the tests employed were of limited use and of *no* value in the prediction of degree attainment. Recall that Schmidt too found *no* significant relationship between academic success and the personality variables of student architects. Others, at odds with the research above and warning against recommendations based on the early display of traits, take a conflicting view and suggest that prospective '*undergraduate students whose self perceptions differ from those characteristics for their prospective disciplines should be advised to switch career choices*'

Bergum and Cooper[249], appear to be advocating that individuals who are less socially active with a strong sense of having a separate identity, are less verbal, have little likelihood of being influenced by others, and have an independence of decision which favours acts of perception over judgement, and show high levels of personal dominance and ego strength, are the ideal candidates to be submitted to professional schools of design and ultimately progress towards an effective integration and efficient communication of their skill in the multi-disciplinary design team. Although this summation may appear glib in the extreme, it nevertheless indicates a point of caution for educationalists by presenting the anomaly that, whilst designers may well need aspects of individuality, the technically complex industry in which they participate, more and more relies on co-operative team work.

Notwithstanding the above, there is some research which suggests that the predictive efficiency of equations, which seek to discriminate between who succeeds and who fails in architecture schools (which are slightly better than guess, with a 53% chance of being correct) can be increased by 30% if an index of 'problem solving ability'[250] is considered in the analysis[251]. This would appear to support the evidence which found that first year Architectural students do not naturally possess the distinctive problem-solving strategy displayed by those students about to complete their tertiary Architectural training.

Clearly if students learn to adopt implicit problem solving strategies imbued by Architectural education, they will achieve academic success. Architectural graduates then, *develop* strategies and traits which reflect the educational methods and philosophies which they have undergone. It is unlikely that they instinctively display specific professional attributes, they learn them, and in this respect are no different from the other vocational disciplines in the design team.

Building design and the construction process is a technologically complex operation. The architectural design professional, who may be regarded as having a major, but by no means exclusive, role in this process, have learning attributes which appear to contrast with those attributes necessary to allow co-operative participation The efficiency of the process, and the effectiveness of the product will be less than optimum, if traits of independence and competition dominate in relationships which the building designer may have with other design team disciplines[252].

However much of the research attempts to '*side step the highly romanticised truism, held by the architectural profession, that it takes something special to be a creative architect (by describing) that special something in terms of psychological differentiation*'[253]. This 'side step' has produced descriptions of professional attributes in terms of 'strength of character' and 'individuality' which are found to be equally confusing and no less romanticised. The creative professional whose creativity is argued to be linked to attributes of independence and competitiveness, in dealing with the process and product of design, presents an anomaly in today's technologically complex building process. Can a particularly creative professional contribute effectively to the integrative process of the building design team, or does their creativity diminish if competitive and independent attributes are instilled with a more co-operative stance? Whilst large high-profile organisations cannot necessarily be said to automatically reflect similar levels of innovative performance, the success of reputable multi-disciplinary firms (such as Ove-Arup, Building-Design-Partnership, Oscar-Faber, Bell-Ingram, Davis-Langdon-and-Everest, Rider-Hunt International and Chestertons) clearly indicate that co-operative building design professionals do have the potential to produce work worthy of respect.

So, if differences (suggested above to be imbued by tradition and the educational process of design) lead to a more successful and efficient design team and a more effective product, few would say that this is necessarily a bad thing. However, over 40 years of documented dissatisfaction with the output and process of the design team find that professional differences influence detrimentally the building design process. This links inefficiency to inter-professional relationships and argues that professional education is a key variable in addressing dissatisfaction. It is argued that traits described above, learned implicitly from educational traditions, are detrimental to professional relationships and ultimately the product of the building process.

3.3 Participation and the processes of innovation

If professional traits, gained largely from vocational educational traditions, may be detrimental to multi-disciplinary relationships, then the factors which influence the individuals participation in a group or organisation will be important. Here, participation is discussed in terms of the extent to which it allows knowledgeable individuals to contribute to a decision, address conflicting points of view, or gain new sources of expertise and experience.

The disposition of the building design team may vary but it is basically a grouping of individuals, each with a different skill, who combine to create and maintain the built environment. Design team members interact; their relationships with one another figure greatly in the process and production of specific briefs. Participation, in the fulfilment of a specific brief by the individuals who make-up the design team, can affect performance, the innovative process, and the efficiency of a specific product. In a more universal sense, participation levels, in the achievement of a common objective in a technologically complex process, can determine, to a large extent, the efficiency of industry. Indeed some researchers suggest that the individual specialist interaction occurring in the team can be said to represent industry in microcosm. '*The development of individuals, through group endeavour, to achieve smooth co-operative activity*' can be used to examine the workings and efficiency of any complex organisation according to Bion[254]. It has also been agreed that observation of small group interaction is a means of understanding issues in the wider, more complex organisational environment and that interpersonal relationships occur as a result of the enactment of activities and that an assessment of group mentality can be used as a gauge for the wider efficiency levels of organisational communication[255].

In the link between group mentality and participation, it has been suggested that if effective participation is sought to improve efficiency levels of organisational communication, the 'motivational' and 'cognitive' mechanisms, which are inseparable from group mentality, require assessment[256]. The motivation mechanism includes factors such as trust, ego involvement, increased identification with the organisation, increased overall goal acceptance, and greater control of working tasks. Whilst cognitive mechanisms include:- a better understanding of the overall rationale underlying the decision making process, and the better utilisation of all available information. In research concentrating on cognitive mechanisms as a basis for improving the participative process, it was found that individuals instilled with an ability to marry their own objectives to the rationale underlying the decision making process of the group, lead to improvements in the utilisation of the skills and knowledge of the collective members[257]. Such improvements in the utilisation of skills and knowledge will only occur as long as participants have sufficient task knowledge to make a useful contribution. Participation should be used to allow knowledgeable individuals to contribute to a decision, to address conflicting approaches of view, or to gain new sources of expertise and experience[258] The need for empathy between specialists, is a major factor in organisational participation

Once confidence in a specialist area is attained however, individuals must then seek to combine these skills in the participative team. Motivational mechanisms, such as trust and ego involvement in conjunction with cognitive mechanisms to allow individuals to understand better the overarching rationale of the decision making process, require to be addressed if an improvement in the efficiency level of organisational communication is sought.

Participation properly implemented by those involved, is effective in *improving* performance, productivity and employee satisfaction and in any valid method for analysing the effects of participation (and participative management), three types of contingencies must be examined: psychological, organisational, and environmental[259]. Applicability of these contingencies extends towards most complex organisations. To allow a greater understanding of the process of participation of the *building design team*, it is argued that assessment must seek to acknowledge the values, expectations and attitudes of building design team members (categorised by Shaskin as psychological contingencies), the degree to which members are interdependent at different stages of the project (Shaskin's organisational contingencies) and, the changes in technology, contractual procedure and competition of the building industry (environmental contingencies).

The participative (psychological) contingency[260] is emphasised by the existence of perceived hierarchical structures which exist within an organisational climate. If one member of the design team is seen as autocratic (possibly the architect as the traditional leader) then it is unlikely that participative efforts will succeed[261]. However, by '*slowly but meaningfully changing the individuals expectations, the organisational climate will also change and become more suited to a group participation method*'[262]. In the relatively constant environment provided by the majority of industrial and business organisations, such an initiative might easily be acted upon 'in-house'. However in constantly changing building design teams, fed by somewhat reactionary professional consultancies, a process which requires a slow but meaningful change in individual expectations is difficult to achieve. This would appear to suggest a need to target the formative period of a building professionals development to achieve organisational change suited to greater participation.

Notwithstanding the importance of improvements to the performance and the productivity of integrating professionals by an increased awareness of participation, interpersonal contact in the context of work activities may also be a basic human work need[263]. Indeed Shashkin[264] cites various studies which argue that interpersonal contact and participation in the working environment is a fundamental human necessity. Freud is cited as suggesting that interpersonal contact is extremely significant in working environments, since it is '*through work that one makes basic contact with the physical and social world around us*'. Indeed, the interpersonal need for social contact in the workplace can be traced back to the work of Karl Marx on 'Autonomy and Control' and Elton Mayo on 'Social Isolation and Meaninglessness'.

A link between participation, interpersonal contact as a basic human need, and the performance of the participants, is also highlighted in a study of NASA engineers and managers which revealed that those who had increased opportunity to participate in the overall decision making process were found to have low psychological strain, a higher use of skills, increased feelings of responsibility, better work relations, more positive attitudes toward work, and higher output, than those employees not afforded the choice of participation[265]. It might logically be suggested that low levels of participation in other technologically complex design industries, might also exhibit the obstacles to process and product described among NASA engineers. Interestingly, Cook[266] suggests that a cultural development of traditionally procured building design team relationships affords little opportunity for multi-disciplinary participation. The traditional UK building design team is more of a hierarchical information transfer system which exhibits relatively little prospect for participation in the overall rationale underlying the decision making process.

As mentioned previously, Becher[267] differentiates between on the one hand, a 'relay race' model of communication in the design process, in which information generated by one group or discipline is handed off to another group in a sequential process and a 'rugby' model of the product development process on the other. In the rugby model, different disciplines interact in a dynamic constantly fluctuating fashion. Leadership shifts as the nature of the project evolves. The hallmark is that all 'players' are involved from the beginning. Traditional project procurement[268] and working practice is very much a 'relay race' of information transfer. Whilst no legislative restrictions exist which limit participation to this lineal information transfer, the development of relationships between the professions are largely confined by tradition, making this restrictive, 'cultural container' of social interaction difficult to avoid[269]. This traditional system is used by the vast majority of UK professional firms[270], and by implication it might be argued that low levels of participation can result in an undesirable and detrimental affect on the efficiency of the process and the effectiveness of the output of industry.[271]

The argument for a participative process to exist within the organisation, centres on the premise that interpersonal specialist contact enhances the performance of the participants and consequently improves the output. However it is also acknowledged that a number of designers adhere to an alternative assumption[272]. The alternative assumption is that a design, if it is to be *innovative*, results from a single-minded, egotistic belief in what constitutes an aesthetic and functionally successful proposal[273]. Clearly discussion of participation must address *innovation,* both in terms of a finalised building design, as well as the processes of the building design team.

If a design is to be called innovative, it must go beyond the early stages of inception and the creative art of invention. A building which is aesthetically and functionally successful can be argued to extend the creative art of invention. It is further argued that it is only the first or early employment of an idea which allows invention to become an innovative design. Whilst the designer is charged with the initial creative art of invention, it is the *building design team* which should, theoretically, be responsible for an innovative design. '*Innovation is a social process of organisational adoption in contrast to independent* *discovery*' according to Carroll[274]. Innovation too is '*the initiation, adoption and implementation of new ideas or activities within an organisational setting*' and the *process* of innovation depends little on the individual but it is dependant upon the communication processes of the organisation.[275]

Becker & Whisler[276] also focus on innovation as an organisational or social process which follows 'invention'. The process of innovation has been summarised as, idea generation, coalition building, idea realisation, and idea transfer[277] This corresponds with earlier work which classifies the process of innovation as, initiation (an idea or proposal which when adopted will lead to enactment within the organisation), adoption (where organisational decision makers provide a mandate and resources for progress), and, implementation[278].

It has also been suggested that innovation within an organisational environment may be regarded as an influencing factor in the overall communication process.[279] The implementation of the social task of innovation is critically reliant on an overall collective knowledge of cultural background, dictating the individuals place within an organisation. Innovation is dominated by informal codes and as such a cultural background, which in turn directly affects interpersonal communication[280].

This parallels, to a large extent, the dissatisfaction with the communicative processes in the building industry. The evolution of formal and informal hierarchies in construction have frustrated the idea of the design team as an innovative entity, so much so that contemporary communication between design team members can be said to reflect simply an unsatisfactory lineal pecking order of contribution to the initial brief.

If the building design team is to attain its theoretical status as an organisational innovator[281], the innovation process of building design must be addressed, by breaking it down into its constituent parts. Several studies have suggested that the variables which have greatest influence over the innovation process of an organisation are: (i) *contextual variables* (ii) *structural variables* and (iii) *individual member variables.*[282] The factors which make up the *contextual* issues influencing innovation in the organisation, are associated with business environment, inter-organisational interdependency, economic climate, Governmental policy, and the formation and termination of the innovative team by organisational senior management.

Whilst change in any one of the *Contextual* variables above may be enough to hinder the innovative processes within the organisation in general, the building design team is perhaps less susceptible to the contextual issues, since in the construction industry contextual variables (which include: environmental uncertainty, design team project duration, and inter-organisational interdependencies) are continually in a state of flux. The construction industry experiences economic peaks and troughs periodically. Government policy and markets at home and abroad are never certain. The formation and termination of disparate traditional design team organisations are a constant feature, and the professional consultancies which fed these design teams invariably compete for larger slices of the market. The construction industry can be said to differ from more theoretical innovatory processes in that, it continually endures these contextual changes. Whilst an ability to perform in the light of constant contextual fluctuation does not necessarily show that the industry has suitably addressed the contextual challenges to the innovationary process, it does imply that they hold little surprise for the building design team, and as a result influence little, innovation in building design.

The second variable of the innovative process, the *Structural* variable, includes *differentiation*, *participation*, *formalisation*, and *stratification and* an absence of a single professional ideology (*Differentiation* of occupational types) will promote a cross-fertilisation of ideas[283]. During the *participation* stage a greater number of sources of information and a freer information flow in the decentralised network will generate a '*greater ego-involvement and commitment to facilitate the implementation stage of innovation*'[284]. In the multi-disciplinary design team however, an evolutionary process of lineal information transfer and professional relationships might be argued to restrict professionals from realising the theoretical variables of differentiation and participation. Indeed the *formalisation* of the building design team might be argued to restrict co-operative participation. This is worth noting since it has also been argued that '*predetermined modes of behaviour which have become rigidified cause a restrictive culture within a grouping which is detrimental to relaxed information exchanges*'[285].

Kanter's *Structural* variable of the process of innovation also includes *stratification* (status mobility). Thompson[286] citing Maslow's work on 'motivation & personality' and Mayo's work on 'the meaning of anxiety' states that '*stratification leads to personal insecurity*' and that '*status striving behaviour is incompatible with creative thinking*.' There is however concern over perceived hierarchies and it has been shown that similar formal or informal aspects of control, significantly influence the extent to which people clearly perceive, and enact their roles in a communicative relationship.[287]

The effect of perceived group hierarchies has also been examined[288] and it was found that organisational equals, either perceived by the individual or represented in the structural hierarchy of the group, are more likely to discuss problems or proposed changes to improve output, than are individuals who see themselves as differing in status. This variable once more links innovation with aspects of building design team participation discussed earlier. Chiefly without professional equity, participative efforts and innovative design can be expected to occur only in an indeterminate fashion.

The third variable of the innovative process, the *Individual* variable includes the *attitudes* which organisation members hold[289]. Pierce and Delbecq[290] also address the role of attitude in innovation and argue that attitudes play a critical role in predicting innovation. '*Innovative behaviour differs, depending on whether or not the members of the organisation perceive (themselves and their colleagues in) the organisation to be successful or unsuccessful*' according to Cyert & March[291]. Attitudes relating to self and peers has also been found to be important in the innovative process of an organisation.[292] Professionals of (a perceived) equal stratification, who were satisfied with their relationships with others, were more likely to search for ways to improve interaction, output and product.

Research also suggests that there is a positive relationship between education, and attitude toward change and innovation[293] and there is an acknowledgement that the potential of change, precedes the wish for an organisation or team to seek innovative solutions. Values held by organisational decision makers, favourable to an appreciation of the requirement for change and evolution of (individual member relationships within) the organisation, will be positively related to innovation[294].

So, there appears to be a link between group mentality and participation. The factors which contribute to group mentality influence organisational communication and that effective participation improves organisational performance and facilitates innovation. A key point appears to be that individuals in the building design team are more open to changes to improve participation during their formative period than in

the project-specific design team organisational structures of practice. Clearly, links can be said to exist between attitude and behaviour that seeks innovative and participative solutions. Apparent also, is the relationship between education and attitude.

3.3.1 Participation, the physical working environment and information technology

Before leaving the process of participation within an organisational environment, two variables of communication within the organisation are worth noting, the effects of the (i) *physical working environment*; and the opportunities presented by (ii) *advances in information technology*. Both factors are relevant to an examination of the participative working relationships of organisational members. Whilst this thesis is aware of the somewhat peripheral nature of these factors to the discussion at hand, it is felt that they require inclusion at this stage to provide further background knowledge. Indeed the exclusion of such influential research would almost certainly detract from universality of the discussion.

The first of these two potential influences on the communicative process of the organisation, *human/environment relations in the workplace*, can be regarded as having developed from early studies, chiefly in factories, towards current examinations of white collar office environments. Interest today focuses increasingly on facilitating the management of the integration of resources, people and their particular skills.

A summary of research by Becker[295] allows a brief chronological description of the development of interest in the field of human/environment relations in the work place as follows,

- *1910-40* (Reflected efficiency and individual performance concerns) Workers hired to do a specific task were viewed as being largely motivated by financial incentives. This period typified the view that work was a sequence of specific tasks linked by a formal organisational structure, and was not a social process.[296,297,298]
- *1940-1950* (Task performance and social relations stage) Recognition of the importance of incentives other than financial were made, and the formal organisational structure became increasingly viewed as a critical factor affecting task performance[299].
- *1950-60* (Group dynamics, communication, and conflict studies) Research at this time was concerned with the reduction of interpersonal conflict, and increased knowledge of democratic and co-operative group processes[300301]. Interest in the field shifted from resource managers to architects and planners[302].
- *1960-70* (Focus on the non paying client) Environmental psychologists and design professionals became interested in how the built environment affected human behaviour.[303,304]
- *1970-90* (Communication, worker comfort, and satisfaction concerns). Developments in Bureaulandschaft (loosely translated as open-plan) planning, carry forward the issues of communication, user involvement, employee satisfaction and comfort. [305,306]

Clearly much work has been done in the field of human/environment relations though many inconsistencies still exist.[307] Whilst differences in the physical environment in (international) offices are generally found to reflect differences in (national) characteristic, cross-cultural studies in the field of how the physical environment influences the process and performance of the workplace do not appear to have a common theme. Indeed on the one hand, in studies between Los Angeles and Tokyo[308], it was established that there was less privacy and personalisation in Japanese offices than in American offices, on the other hand, a report carried out by DEGW[309] looked at the different space requirements among multinational firms, in New York, London and Tokyo branches and found them to be remarkably similar despite enormous cultural variation.

Workforce characteristics can be said to reflect the evolution of cultural norms within which the individual acts in relation to their working environment. Therefore if an organisation wishes to influence the individuals approach to their work by making changes in the physical environment, the organisation must initially consider the cultural background of the work force[310]. Although an organisation may attempt to influence work, by the design of a physical variable (or the reorganisation of a structural variable), the success of such initiatives appears to depend on the extent to which the professional perceives the 'new' environment as compatible with the attitudes, and opinions learnt in their formative development. Becker describes a case study in which an organisation sought to move completely into a new office complex, which incorporated the most up-to-date research regarding office design planning, to facilitate the most efficient flow of communication and the most effective integration of individual skills. The organisation sought advice on how to minimise disruption and concluded that only by instilling in the workforce the potential for change could such a move prove profitable. He describes how one year before occupancy an acculturation process was developed and implemented that not only explained the concepts behind the building, but also helped to develop the attitudes and behavioural patterns of the work force, to support these 'new' physical design concepts.

The process of acculturisation carried out by this particular organisation to prepare its work force for a changing physical and technological environment can be paralleled with building professionals in an industry which, although physically transient (in terms of a specific design team location) is no less technologically dynamic. It might logically be suggested that the construction industry requires tertiary education to facilitate suitable 'acculturation' of the building specialist to allow effective integration and efficient communication with the other professionals in a design team environment

The relationship between communication and the design of the environment, and professional performance, has also been examined and a positive relationship between the quality of engineering design solutions and the amount and nature of communication among engineering groups during design development has been found[311]. Perhaps of greater interest however, is the finding that the engineers in this particular case study shared the information necessary to remain current in their field by word of mouth in offices, corridors, cafeterias, car-parks and the like, irrespective of restrictions and obstacles in their physical and social environments[312]. This study did not however attempt to examine the value of new design and office planning initiatives in the quest for improvements in professional communication, nor did it seek to trivialise such work. Rather the study suggests that an important aspect in 'informative' and 'inspirational' communication[313] is a willingness of one individual to openly share information with another. Of importance to this thesis is the indication that effective communication relies less on the physical environment, and more on a professionals sociability toward the colleagues and peers with whom the process of engineering design must be shared.

In many respects the advances made in *information technology* as a tool to aid organisational communication, mirror knowledge generated in the field of human/environment relations in the workplace in that, the inconsistencies which arise in the various assessments of the value of *IT* suggest that it has yet to fulfil its potential. The proliferation of tools for technology-assisted collaborative work has sparked much research on how groups use communication technology for information processing and decision making[314]. 17 types of technologies have been identified that could support group work, ranging from co-ordinated writing software to sophisticated Group-Decision-Support-System (GDSS) technologies[315]. However studies[316] which link technology with group process and communication appear to show little or no significant differences in equality of participation and decision consensus between groups using these Group-Decision-Support-Systems, and those who remain 'unsupported' by decision enabling computer packages. No differences have been found between GDSS and non-supported groups on perceived equity-of-participation.[317]

Other concerns regarding the effect of information technology on group progress have found that reliance on technology limits the use of social cues in meetings and that this is especially problematic for those groups forging new relationships.[318 319 320] The limitation on social cues poses an obvious problem for groups like the traditionally procured building design team which is continually required to forge new project specific relationships. Indeed the use of technology as an aid to organisational communication in terms of group outcomes has resulted in substantially slower group decision speeds, with little change in group decision quality, and member satisfaction.[321] In addition there is an indication that using GDSS makes the decision making process less understandable and the communicative process less thorough. It has also been reported that a negative relationship exists between quality of solution and consensus, and that project issues perceived as being more trivial receive too much attention, resulting in important objectives not being pursued with sufficient emphasis.[322]

Caution is required of those who seek to generalise the use and potential benefits of information technology and attempt to define technology objectively conceals the social nature of technologies, and that until applied by a user in a specific context, a GDSS or any other technology is simply dead matter.[323] Technological influences on the processes of communication are argued to arise not from the technology itself but ultimately from the choices that group members make about what features of the technology to use and in what fashion. Such choices are intimately linked to group dynamics.

The importance of group dynamics has also been stressed in any attempt to utilise new technology.[324] Communication, which must relate to the development of a technologically assisted approach to communication and which includes initiation characterised by getting connected with collaborators, the execution including the planning and processing of information and the establishment of interpersonal trust, and, the public presentation focusing on a development of what to present are regarded as important.[325] This approach to organisational communication highlights the fact that, despite advances in computer software, '*the establishment and maintenance of a personal relationship is the glue that holds together a piece of a collaborative effort*' and that current technologies have been largely unsuccessful because they focus primarily on task completion without supporting personal relationships.

To understand technological effects, research should focus not on the packages of hardware and software (such as expert systems, computer conferencing or electronic mail) but on the specific task and social variables that are inherent in specialist interaction (such as interactivity, synchronous versus asynchronous environments, and complexity of integration[326]). The role of *social relations* is important in collaboration, and neglect of these relations may lead to the failure of existing information technology systems to support adequately this dimension of (scientific) interaction.[327,328] Much of the evidence points towards the need for technological support systems to *supplement* the structure and process of communication rather than attempt to substitute it.[329]

So, the fragmentation and specialisation of role and responsibility, emphasises the importance (notwithstanding technological advances) **of the social process of communication within the multi-disciplinary team. Communication and participation within the multi-disciplinary team require correspondingly high levels of integration to achieve organisational innovative solutions. The social processes of communication, and in particular the 'individual variables' of the innovative process of an organisational team (described above), appear to provide the key to effective integration.**

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CHAPTER 4

TOWARDS AN EDUCATIONAL INITIATIVE TO ADDRESS BUILDING DESIGN TEAM CONFLICT

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4.1 A commentary on traditional and modern outlooks in educational integration: potential for vocational education of the multi-disciplinary team

From the evidence already provided, changing the mind-set[330] of specialists and specialist education, towards a greater acknowledgement of the integration of interests, should diffuse or at the very least reduce the conflict within the design team. Concerns arising from a concentration on technical mastery, to the possible detriment of communicative and innovative skills, in education have long been the subject of debate[331]. Throughout history, attempts to seek the most general causes and principles, of the ideas and human perceptions of knowledge transfer, provide an influential treatise which forms the philosophical foundations of contemporary education. The commentary below, of the *traditional* and *modern* philosophies of education, seeks to emphasise important factors for future integrative professional training.

Many of the *traditional*[332] philosophies of education highlight important variables, directly relevant to any contemporary initiative seeking to integrate better the disparate specialists of the building design team. Proposals for an educational process able to prepare students for fragmented working and social environments are certainly not new. It has been suggested for example that tenets of an educational integration of technical expertise, were first presented by Socrates around 400 BC and that the teachings of Socrates regarded specialist facts, not as true self-knowledge but as being merely a starting point for the real quest to tackle more universal goals, common to all[333]. Indeed adherence to '*good and communal dialogue, impartial questioning, openness, and a refusal to insist on ones own opinions*'[334] intoned by Socrates some two and a half thousand years ago, is still pertinent in today's multi-disciplinary industrial and educational environments. However, whilst Socrates demands *continual* self-assessment through discussion with peer groups, Plato[335] teaches prudence and practical wisdom.[336] Plato found that students, once trained, are more likely to spend their time in administration than in endless Socratic discussion. Platonic wisdom comes from teachings which demand that '*education must help participation in an efficient decision making process, not because students have some modern report on all the facts, but because they have learned to see in each situation the matters that need measure*'.[337]

Kolb further argues that the prevailing pre-occupancy with the expert may also be attributed to ancient Greece and in particularly to a group known as the Sophists[338]. He suggests that these early teachers offered a '*new education to fit men for their role in the new democratic and commercial world; ...they acquainted students with current developments and gave them a knack for rhetorical persuasion*'. Both Plato and the Sophists insisted on a reflectively critical attitude toward tradition according to Kolb. However, whilst Plato saw this to be testing tradition against the changing needs revealed in the Socratic quest for knowledge, the Sophists on the other hand taught the use of tradition to enable the individual to attain their own personal goals. Indeed Plato's manuscript 'Meno'[339] appears to advocate a warning against specialist education of the kind provided by the Sophists. Plato, reflecting on the reluctance of experts to accept alternative information asks '*how is it possible for a person who has been taught what is right to act contrary to the principles he has learned?*'. This question is still relevant to all vocational departments preparing a student body for postgraduate industrial application of specialist teaching. Educators of specialist professions, teaching within traditional boundaries, must also seek to allow the student to appreciate that which exists outwith their own vocational remit.

Self interest, and skills in articulate persuasion, must exist concurrently with the concept that individuals invariably require to work as a team. Any decision making process which has disparate experts setting forth an acknowledged set of facts, provides a framework within which private interests and chosen values often compete to influence policy. This competition of private interests appears to be a significant obstacle to the successful integration of specialisms[340]. Teachings of Aristotle[341] directly oppose a decision making process in which the specialists last word settles the debate. An Aristotelian process - argues Kolb[342] requires a '*man of practical wisdom who is good at making prudent decisions*'. Aristotle's universe however also 'needs a prime-mover'[343].

Aristotle argues that the controlling hand in the decision making process does not require specialist knowledge; the controlling hand should be a person of practical decisions with the ability to lead.[344] Construction specialisms under the direction of a project manager appear to provide an example of such an Aristotelian decision making team. In such a system it is implied that debates can be ended by the authority or by the influence and charisma of a person of practical decisions. Indeed, several leadership training theories attempt to provide those already in a position of power, with techniques to improve their authority.

A comparison of Plato and Aristotle suggests that an individual should not be expected to attain or attempt to dictate the implementation of the knowledge bases of other disciplines, and that '*no one individual can be expected to oversee and dissect every* *specialist contributor in the search for an unbiased solution'*[345]. *'Each specialist should follow a platonic understanding of how to approach the forms that are the sources of a harmonious goal expression'*and *'although charismatic or bombastic leadership can stop people from talking for a while, it takes an expert to settle a debate and to present a rationale which is beyond doubt'*[346]. The emphasis according to Kolb must return to a Platonic development of all opinion in order to determine external truth and ideas, so that team members (experts with often disparate objectives) can acknowledge for themselves the potential of the contribution, other than from their own discipline, in the pursuit of innovative solutions. Therefore, in the building design team, if individual skills are placed under the leadership of, albeit a prudent and practical, dictator-of-policy, then it may be logically assumed that conflicting interests would remain.

Largely, these classical writings can be seen as providing the foundations of any educational initiative which seeks to acknowledge the growth in the provision of specialist knowledge, encourage specialist integration and empathy, and, allow assessment of the individuals place in the decision making process. Following the Renaissance of literature under the influence of classical models, the treatise of the *traditional* philosophies of education is again seen to expand. An awareness of the detrimental affects of *excessive* provision of (vocational) knowledge can be found in subsequent work. John Locke returns to teachings which encourage students to pursue an almost Socratic search for self realisation through experience[347] and he suggests that *'some thoughts should be instilled into the students, only to set them upon seeking and describing learning for themselves'*. [348]

Jean Jacques Rousseau, in his text 'Emile',[349] also highlights the need for a fundamental knowledge base which acknowledges the importance of motivating students to learn for themselves (as opposed to being instructed) that they and their peers exist in their own right[350]. Rousseau also suggests that specialist self-esteem, although a useful instrument in the interaction with others, also carries dangers if relied upon too heavily in working and social environments. He argues that '*an illusion of pride is in no way preferable to the illusion of prejudice*'. Imanuel Kant[351] too suggested caution to educators who may impart (vocational) bias in their curricula arguing that no advantage is to be gained in an overabundance of sectoral instruction, for later on, the student will have to face opposition from all sides and constantly receive rebuke.[352] This is an argument against isolationism and an emphasise on the importance of experimentation in education suggesting that '*the best way to understand, is to do*'[353].

The classical literature so far describes an educational appeal for learning through experience(s). Indeed calls for some form of integrative project work in contemporary education can logically be argued to have as its foundation in these early traditional educational philosophies. It has been suggested that Jean Jaques Rosseau places the responsibility for (specialist) integration at the feet of the educational establishments[354]. Rosseau's comment that '*there is no remedy for vanity but experience; if the student is not allowed to feel it, (s/)he will never learn its worth*' being used as evidence. Although Immanuel Kant[355] suggests that '*through their own efforts one generation may educate the next*', he also endorses the need for '*education to instil (as well as exist within) a strong cultural background*'[356].

Some *Modern*[357] philosophies of education can be found to build upon the traditional approaches to the provision of knowledge described above, whilst others present markedly different outlooks. Contemporary educational initiatives seeking to integrate better the disparate specialists of the building design team must have their foundation in both, the traditional outlook and also in the *modern*[358] assessments of the causes and principles of the ideas of knowledge transfer presented below.

'*The most significant question which can be asked, about any situation or experience proposed to induce learning, is what quality of problem it involves*', suggests John Dewey[359]. Educational establishments seeking to address the dissatisfaction with the building design team similarly must assess the quality of the problem. The technically complex design process clearly makes use of specialist professions. An example of seeking to assess 'the problem' of interaction in the design process may come from the proposition that dissatisfaction stems from the fact that the multitude of specialist knowledge-bases seldom overlap. The question which arises in this particular scenario, is whether specialist knowledge *needs* to overlap. If this is *not* the case, then commonality of curricula across the professions requires less emphasis. Any integrative initiative which seeks to improve building professional interaction must firstly seek the quality of the problem it involves, only *then* can it hope to address that problem.

Higher education, in general, focuses on the individuals ability to pass exams; written or practical. In setting tasks and in evaluating performance and achievements, institutions tend to concentrate on the assessment of one persons effort. This process may lend itself to the introduction of subject commonality between disciplines but would appear restrictive to any alternative attempt towards integrative processes between disparate disciplines. John Dewey[360] has argued that the best type of teaching '*bears in mind a habitual attitude of finding points of contact and mutual bearings*' and also maintained that '*every recitation, in every subject, may give opportunity for establishing cross connection between subject matter and the wider experience of life*'. The continuation of specialist interests, as well as attempts to provide students with an opportunity to pro-act with, and react to, peer discipline perspectives, may require a re-examination of the traditional methods of academic assessment. It would appear illogical to attempt to introduce initiatives which seek to find points of contact and mutual bearing for education of design team disciplines without seeking matched techniques of assessment and success evaluation.

If assessment procedures are unable to identify whether an integrative initiative has qualitatively addressed the relevant problem, then such an initiative decreases in value to the educational process. Alfred North Whitehead[361] has argued that '*a certain ruthless definitness is essential in education*'. In addition however he also adheres to the notion that any educational process must seek to instil definite expert knowledge, within a suitably enlightened cultural background, and that it is this dual objective which must be well structured and tangible. '*Culture is activity of thought coupled with receptiveness to ... human feeling*' and that '*a merely well-informed man is the most useless bore on Gods earth. ...what we (educationalists) should aim at producing is men who posses both, culture and expert knowledge in some special direction*'[362].

Sidney Hook[363] has also argued for an educational process to establish firmly its objectives. He states that the '*bane of much college teaching is improvisation*'. Again, the notion that if specific educational outcomes are to be achieved, initiatives must be clear of purpose is emphasised. Hook calls not for the generalisation of knowledge: '*whilst all needs are individual, although many of them are at the same time common, not everything need be known by all*' but for an educational process which is able to bring specialist knowledge together. He argues that '*Education for growth goes hand in hand with education for democracy; justification of one is tantamount to justification of the other*', and he further argues that education should encourage '*the existence of democratic* *communities in which individuals of conflicting faiths and beliefs co-operate in democratic support*'[364]. Parallels may be drawn with the changing nature of the building design process as innovative design requires the co-operation of several differing professional viewpoints.

The structure and content of any educational initiative is of great importance in the achievement of objectives seeking to address specific problems. Also of importance to the success of educational initiatives are the tutors charged with its implementation. Sydney Hook comments that to '*possess a thorough knowledge of a subject matter is no guarantee that one possesses the ability to communicate that subject matter to a student*'[365]. Indeed if the transfer of specialist knowledge is required to complement a process of facilitating integrative co-operation, concern arises that the highly specialised background of such tutors may restrict the successful outcome of the educational process. Without any defined policy or underlying educational objective, the knowledge transfer process between lecturer and student may lose direction and be misconstrued.

Contemporary opinion concurs and further develops the above argument. Whilst Cahn[366] comments that '*Instructors are the kingpin of the educational process; they make or break programmes and overall departmental objective*', Donald Schon[367], has suggested that advanced students can learn as much from each other as from the instructor. If the instructor becomes more of a '*facilitator and catalyst for learning, rather than the sole source of ex-cathedra enlightenment*', students are able to learn how to *implement* new information and use such to adapt to change.[368] Tutors then, require to have clear objectives and a degree of confidence to enable students to learn for themselves through experience and by doing. Indeed De Charmes[369] found that a training programme developed by *tutors* which aimed at promoting intrinsic motivation and internal locus of control in pupils achieved 'gains' in pupil achievement and autonomy which were still present seven years after the event This came as a result of thoroughly involving the tutors in the design of learning experiences for their pupils. A replicate of this study which attempted to impose the programme, designed by the original group of teachers, onto a new group however *failed* to achieve the same results. Commenting on the work done by De Charmes, it has been argued that the crucial element seemed to be that '*the original teachers shared ownership of the project*'[370]. Successful tutor input to educational initiatives then, appears possible through addressing tutor motivations by involving them in a systematic sequence of steps from identification of need, to processes of evaluating the effectiveness of course design and presentation.

However the fundamental principle for the achievement of a specific objective of professional integration, still needs to address the problems created by a disparity of interests. '*It is the business of an intelligent theory of education to ascertain the causes for the conflicts that exist and then, instead of taking one side or the other, to indicate a plan of options, proceeding from a level deeper and more inclusive than is represented by the practices and ideas of the contending parties*'[371]. Dewey suggests that '*such an educational policy should not attempt to bring about a compromise between opposed schools of thought, nor, make an eclectic combination of all relevant points*'.[372]

Dewey also suggests that an educational theory which attempts to recognise conflictual opinion requires the '*introduction of a new order of conceptions leading to new modes of practice*'. Clearly the endorsement of new integrative measures at the expense of traditionally sectoral techniques, which goes beyond simply introducing commonality of curricula, may create disruptions. Educationalists however, must always recognise the need for change and not lack the commitment to implement measures which will meet this need for change and Dewey adds, educationalists must '*thoroughly appreciate the requirements of the new, otherwise departure from the old style will solve nothing*'[373]. Contemporary construction education need only look to joint industrial and Governmental[374] calls for change to strengthen its resolve.

Jorgen Habermas[375] states that '*the attainment of individuality and selfhood can only be achieved through the co-operation with others, through actions and structures that recognise others as full persons who are at the same time recognising the individual concerned as a full person*'. Complete mutuality is attained when there are '*no inequalities built into the cultural structures by which persons attain selfhood; then social structures and acts come about through the mutual approval of each member. In such a state nothing is different from what it appears to be, there is no hidden content or secret interest*'[376].

So, it is argued that education must investigate the factors which influence the occurrence of conflict and difficulty in communication between the building design professionals, and then allow tutors to implement a structured plan of action to address these conflicts at their formative stage.

4.2 Schools of communication thought and their applicability to the building design team

The discussion so far which begins to link the differences in the traditions of specialist education, and the existence of difficulties in professional integration, highlights several factors which have the capacity to influence the structure and process of communication within the building design team. Generally however the achievement of an efficient and effective communication process must stem from an acknowledgement of the *need* to communicate, by the individuals who make up the team. If there is no recognition of the potential which greater integration of disciplines would bring to the process of innovative design, initiatives to improve communication within the design team are foundationless. Whilst it may be argued that improvements in communication cannot occur without a change in the mind-set of design team professionals, it is equally valid to argue that social change of this nature cannot occur *without* communication. This dilemma reflects the complexity of any initiative, based in the broad field of communication, which seeks to facilitate greater specialist integration.

Communication is essential for social change and this can only arise from the creation of ideas, the diffusion, or the process of the communication of ideas, and acknowledging the consequences and changes which occur as a result of an innovative idea[377]. Effective communication occurs when source and receiver are homophilous, unless the source and the receiver have a high empathy. (That is where persons who are similar in certain attributes such as beliefs, values, education, and social status, or who are able to project themselves into anothers role are best able to communicate effectively with one another). Rogers and Shoemaker also suggest that '*special problems of inefficient communication come about because source and receiver are heterophilous in diffusion*'. Design team relations can be argued to fall into this category and it has been argued that effective communication is a two way activity which continues to and fro until both parties believe they understand each other[378]. Such understanding is unlikely to come about unless an atmosphere of mutual trust and confidence is developed.

Various schools of thought have attempted to break down the processes of communication, with a view to ultimately making the process more efficient. One of the most widely respected is Shannon and Weaver's[379] 1949 classic mathematical theory of communication shown below:

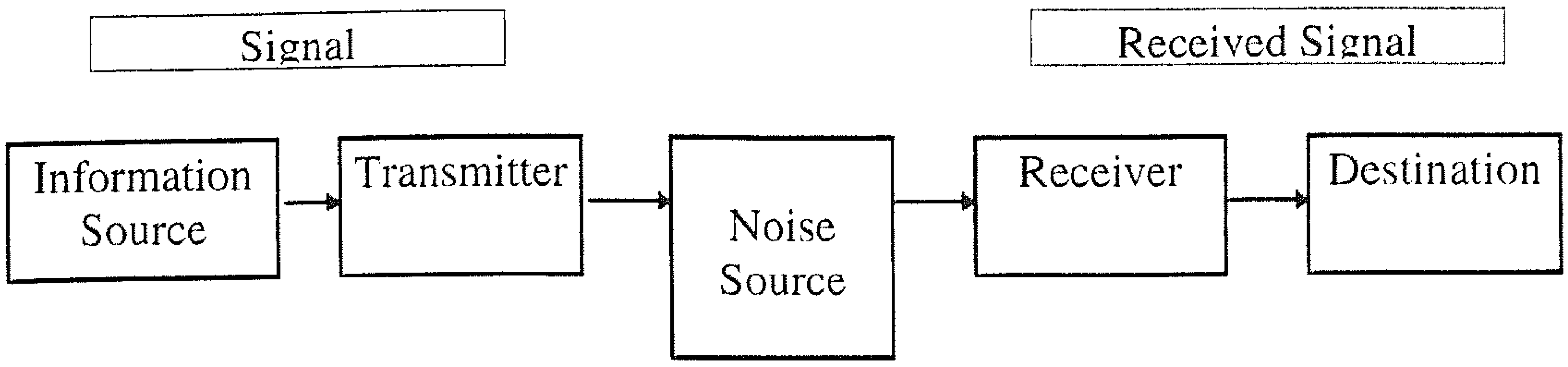

Figure 4.1
Shannon and Weavers classic mathematical theory of communication

The mathematical theory of communication is regarded by many as the fundamental development in communication studies. Although it leaves out additional variables such as feedback, context, and alternative signals, it is still recognised as a major contribution to the theory of communication[380]. Indeed subsequent research into the field of communication can be argued to emphasise, simply in greater depth, the elements outlined by Shannon and Weaver's model.

In a review of several schools of thought relating to 'managerial' (peer group and superior/subordinate) communication, it is apparent that different theories have in common the broad elements identified in the model above[381]. In reviewing the *classical school of communication,* classical writers focused on increasing the probability that a message would be attended to, comprehended, and accepted. It was also recognised that receivers had formed attitudes and values which would determine in great part (either consciously or unconsciously) their level of attention to, comprehension of, and acceptance, of messages. The classical school of communication also argues that perceptions of others guide an individuals communications toward them and will tend to reinforce expectations for future interaction. The *two-way communication* school of thought develops the ideas of the classical school, but concentrates on the requirement for participant empathy, and appears to be appropriate in an organisational situation where two (or more) people interchange information and need mutual and accurate understanding. In a similar vein, improving atmosphere and trust are the main tenets of the *interpersonal school of communication* in which a human relations approach to communication attempts to provide a climate of supportiveness, empathy, participation, and trust.

The *group process* school of thought regards communication problems as having considerable influence on an entire group. Since organisations consist of groups of people, and because most tasks are so complex that they cannot be handled by one individual, dealing effectively with the communication problems in groups becomes of paramount importance. The group process school of thought is based on the concept that it is possible to achieve more in a group than by any combination of individuals working independently. Achieving such synergy involves recognition of a common group task, establishing more open channels of communication, and developing an atmosphere in which group members have no fear of sanctions for their, possibly unpopular, remarks. This is particularly applicable to design team interaction, where groups can lose effectiveness in certain situations if the development of certain group norms bolster morale at the expense of critical thinking.[382]

The *leadership* school of thought in the achievement of effective communication comprises an individual's interpersonal traits and style of initiating structure to address the project at hand. A development of this is the *organisational systems* school of communication, which suggests that people use different types of information in different ways, resulting in a process where the decision maker(s) select certain types of information and determine its ultimate use. However discussion in previous sections above, found that traits held by the traditional leader of the design team, were often potentially detrimental to an atmosphere of integrative activity. This leadership/organisational approach appears to be inappropriate in seeking to advance the efficiency of communication in the technologically dynamic process of innovative design.

The *information systems* school and *information technology system* seeks to make the communication process more effective. However the evidence presented earlier reveals that advanced technologies do *not* increase the rationality of decisions. Modern and mechanised information systems have not been able to improve the processes of integrative innovation, and largely, the traditional information gathering and dissemination mechanisms such as personal contact and relationships, whilst being open to criticism, still prevail.

Many of these different schools of thought contain elements which are directly applicable to the building design team. However no one system stands alone as a preferred approach to improving the communication within the construction design team. Indeed Cunningham and Lischeron[383] themselves, attempt to present an amalgam of the different schools of thought as the best way forward towards effective communication. They stress that by doing so, they are *not* attempting to mix the assumptions and philosophies of different schools. Rather they see communication as a concurrent process which incorporates devising the purpose, constructing the message, transferring information, developing relationships, and designing information and organisational channels.

Carrying forward the role of communication in the organisation, from the theories which underlie the organisation and transfer of information, to an enactment of that information, it has been argued that there is a central role for communication in the relationship between meaning and action.[384] In so arguing the relationship between, how groups make collective sense of their experience, and how they come to take organised action was closely examined. Both the *shared meaning perspective*[385,386] and the *retrospective sense making perspective*[387,388] implicitly acknowledge the central role of communication in the relationship between meaning and action. Although there is also a necessity for at least some agreement among the parties about their interdependence, and about the means of enacting their relationship.[389]

The construction design team, although having specialist group members whose interpretations of joint experience and previous projects may be quite divergent, inevitably still manage to take organised action. There must be some form of communication by which the professionals voluntarily forge agreements to interlock their behaviours, despite apparent differences in their interpretations of those behaviours. Indeed developments in the *systems theory of communication*[390] attempt to explain the existence of multiple routes toward a single end. Such routes are said to be 'equifinal' and they allow disparate individuals to adopt an organised approach towards a single overarching objective.[391] Thus equifinal meanings are argued to occur when organisational members hold different reasons for undertaking a decision or action, and have different interpretations of the actions potential outcome. So, organised action does not require the meanings, held individually by organisational members, to be coincident; equifinal meanings are sufficient.[392] Organisations, at their most basic, require only a recognition of mutual interdependence and some shared understanding of the code for interaction.

It is argued here that specialist design team members have two alternative sets of organising tools at their disposal, shared meanings, and shared communication

mechanisms. If achieving shared meanings in the established building design team organisation is neither possible nor practical, specialist members can still benefit from a reliance on shared communication mechanisms. These shared communication mechanisms create Beer's concept of equifinal meanings, which are consistent with specialist input.

Current dissatisfaction in the construction industry however appears to stem from a somewhat reactionary acceptance that the organisation of the design team can only hope to achieve minimal shared meanings between disparate disciplines. Acceptance of shared meaning limits carries a caveat. For example it is argued that equifinal meanings developed in the process of communicating about organised action are at best precarious and, at worst may not even be able to survive what is referred to as 'post action sense making'.[393] If the building design team seeks to deliver innovative solutions, and its members are to act in a co-ordinated fashion, professionals must begin to seek a greater degree of shared meanings and shared interpretations of their joint experience in the innovative design process. Communicative mechanisms must complement any innovative action by the design team which wishes to achieve more than can be expected from, merely a recognition of mutual independence and, limited shared understanding of the code for interaction. **It is argued here that communicative mechanisms for the multi-disciplinary building design team must have a solid foundation of shared meanings if they are to be effective.**

Further interpretation of the concepts identified above of the differing schools of thought in the field of communication, as well as the mechanisms of communication can be gained through an examination of these elements alongside their contiguities. In an extensive review of research into communication in the organisation, it has been argued that research in the field of organisational communication can be examined under four main headings, *Theoretical issues*, *Contextual issues* (internal and external environments), *Structure* (patterns of organisational requirements), and *Process* (communication of behaviour in organisations). Interestingly these divisions correspond to similar divisions made in the analysis of *innovation within the organisation*, previously discussed. This similarity of field division allows the linkages between communication within the organisation and innovation within the organisation to be more clearly investigated.

In a summary of traditional theories of communication within organisations it has been argued that links may be made between these traditional theories and a Mechanistic perspective (of communication channels and message transmission), a Psychological perspective (looking at how the individual responds to information environments), an Interpretative/Symbolic perspective (in which shared meanings are created among communicators through a role taking process), and, a Systems interaction perspectives (where patterns and systems interact).[394]

Contextual issues representing the internal and external environments of studies in communication, serve as the backdrop of organisational life and act as the framework that embeds behaviour and structure.[395] The advent of Systems Theory[396] described above, has apparently moved 'context' into the mainstream of organisational behaviour and communication research. Adopting a subjective view of organisational culture, based on shared meanings and norms, rather than an objective view defined by such factors as tools, and languages, it has been argued that ignorance of the cultural differences that may exist within organisations (in terms of: different non-verbal communication systems, appropriate social rituals between disparate specialists, and reliance on stereotypes) leads to communication problems within the organisation.[397]

In addition, it has been proposed[398] that formal and informal networks affect the *Structure* (patterns of relationships) of the organisational communicative process. It is believed that networks/structures are embedded into any organisation and that these informal and formal networks influence communication. The 'network' position of the members of the group are argued to influence attitudes, which in turn are said to influence communication within the organisation. The recurrent process of forming, maintaining, and dissolving formal and informal communication linkages, is influenced by three main factors according to Mongue and Eisberg[399] and they are the environment (local character, industrial culture), the organisation itself (economic climate, technological direction), and, the individual (internal hierarchies, role in organisation, and professional training).

In relation to the innovative process of design, the construction industry has to continually address 'environmental' uncertainties such as economic peaks and troughs, changing Government policy, and uncertain markets at home and abroad. As well as 'organisational' uncertainties involving, the constant formation and termination of uniquely project-oriented design team organisations, and, consultancies which fed these design teams who invariably compete for larger slices of an increasingly technologically complex market. These uncertainties are a constant feature of the contemporary construction industry, and as such are argued here as unlikely to influence a communication process which addresses such constant uncertainties on a daily basis.

The most important influence on the organisational communicative process of the building design team is likely to come from the third of the three factors discussed, that of the 'individual'. Individual influences and the changes arising from variables such as, new internal hierarchies and the relationships between the new roles in the dynamic design team organisation, are argued to be of much importance in professional training initiatives which seek to adapt to and address changes in tradionally heterogeneous roles.

Danowski[400] found that, very often the group members who are required to communicate most, were least homogeneous in attitudes on how to realise the project and he argues that how this 'heterogeneous' communication is conducted will bear much influence on the quality of interaction and ultimately the success of a project. In a similar argument Jablin[401] emphasises, '*the death of research which attempts to analyse actual oral, written or drawn messages*' in the consideration of the communication structure of relationships.

It is argued that any analysis of relationships must concentrate on the structure of the 'individual' influences of perceived hierarchies, changing roles and professional training. This analysis of individual influences is linked to Jablin et al's fourth variable of communication in the organisation, that of *Process*. Here it is argued that the key to understanding the *process* of communication and behaviour in organisations, is to recognise their developmental nature.[402] Thus communication and behaviour in an organisation are argued to evolve and develop, as member relations evolve and develop.

A link has been established between the development of relationships between disparate specialists in an organisation, and the processes of communication, and it has been suggested that communication, between individuals who adopt heterogeneous attitudes towards the realisation of a project, may be largely confrontational.[403] Whilst this need not necessarily be detrimental to the outcome of the project, it has also been argued that '*if* *communication in a conflict process, is to be effective, it must seek to assess the three main variables of, Issues, Perceptions of conflict, and Enactment of behaviour*'.

So, effective communication occurs where source and receiver have a high level of empathy. Several different schools of thought have emphasised this principal concept. Current dissatisfaction with the processes of the building design team suggest low levels of empathy. This in turn links with cultural dissonance, which influences detrimentally both communication and innovation in building. Both the *environment* and the *organisation* (two of the three factors of formal and informal communication) of a project-specific building design team are constantly in a state of flux. As such the communication in the dynamic building industry must continually accommodate changes to environment and organisation. The *individuals* influence on communication, on the other hand, is very important, and the individuals role in the process of heterogeneous communication is considered to be developmental.

An analysis of the development of confrontation which occurs in heterogeneous communication therefore needs some elaboration.

4.3 Conflict and controversy of opinion among the members of the multi-disciplinary team

The construction process, involving a multitude of activities, some occurring serially, others in parallel, can be argued to provide ample opportunity for conflict to arise. The conventional method held to prevent dispute is the implementation of management procedures, contract management, and the inclusion into the contract documents of indemnity insurances and dispute procedures. The conventional resolution of conflict and dispute in construction is the appointment, by the parties involved, of a third party to 'manage' the dispute and initiate the often timeous and expensive process of arbitration and contract litigation. These procedures occur after the event, and are often only taken when conflict has gone far beyond the point of professional inconvenience and decision discrepancy [404] The popular psychologist Edward DeBono suggests that '*on the whole, it is in the nature of society to encourage and spur on conflict right up to the point at which it becomes personally inconvenient. By then it can be too late to switch off*'[405]

The antecedent conditions of conflict must not just exist, they must be perceived by the parties to exist thereby resulting in a transformation from 'latent conflict' to that of 'overt conflict', and the resultant perceptions of a conflict of interest are then generally accompanied by negative feelings of hostility.[406] It may be said that the antecedents of latent conflict are perceived to exist by many building professionals and academics.[407] Indeed, there is a '*widely held view that there are deep rooted differences in attitudes, outlook, and ways of working between construction professionals which make it difficult to bring them together and that permeate the education system*'.[408] These antecedents of latent conflict, having been perceived to exist, manifest themselves more overtly in the integrative processes of the design team thereby necessitating the design team to engage in a timeous integration of professional value systems rather than an integration of skills.

It has been argued that it is '*change: the alteration, by modification, omission or addition, to a project document, design process, or method previously approved or accepted which must take place, in response to and as the outcome of, conflict*'[409]. As a result of data collected from client groups in an attempt to find a relationship between stage of conflict (briefing, design, or construction) and resultant change,[410] it was found that almost two thirds of the recorded conflicts occurred at the design stage.

Although the authors of this study were unable to draw specific conclusions from this data to support their proposition that conflict may benefit a project if managed creatively, they still went on to argue, that the 'creative management' of conflict must be pursued, maintaining that a development of strategies to aid project management is a prime objective of industry.[411] The independent observer on the other hand might logically suggest that the introduction of another specialist (the project manager), albeit one who seeks to oversee and manage the contribution of the others, may simply add one more discipline to an already highly competitive design team, potentially increasing the occurrence of conflict at the design stage, and consequently resulting in a need to re-assess the incidence of conflict found in original studies.

Acting on information gained from an initial briefing with the client, professionals seeking to adopt and implement project inception give rise to two thirds of the occurrence of conflict in a project. Somewhat ironically, this is widely held to be the stage of greatest integration of the professionals of the design team. Whilst Gardiner and Simmons[412] were unable to draw specific conclusions from their data, they did indicate that a '*latent conflict between the parties (originating before the design stage) at inception, was likely to have serious implications of cost and time*'. An analysis of their data-set acknowledges that the high incidence of conflict within the design team must be addressed. Given that this study was unable to present specific recommendations for a project to benefit from discord by creative management, the interested observer might again argue that an alternative means of addressing the high incidence of conflict is required.

Based on the evidence already presented, the latent conflict found to exist within the design team, might be suggested to run *too* deeply for creative management by a third party. It can be argued that adherence to a solution which seeks to promote a specialist third party to oversee professional contribution, appears to advocate treating the symptoms of conflict, instead of seeking a cure for a problem which has been found to have serious implications of cost and time. That problem must be traced to its root, which, based on work by Gardiner and Simmons, appears not to be found at the practice stage. If the practising professional cannot be 'creatively managed' to overcome detrimental design-team conflict, then the professional development stage (*professional education*) must be the logical place to attack the source of the problem.

It may be argued that it is the professionals themselves, who must be made aware of the inherent latent conflicts which exist within the design team. Professions require to acknowledge, and be able to respond to the processes of change and innovation, to ultimately improve the integration of disciplines and the communicative processes of the industry. The introduction of project managers to orchestrate conflict and lead the design team, may simply add to the latent conflicts between the professionals, many of whom believe their own specialism to be best suited to perform the function of team leader.[413]

Project teams, composed of individuals with different expertise and viewpoints, are increasingly being held responsible for completing organisational tasks. Specialist fragmentation of the construction industry typifies '*the need for decision makers, with often opposing views of how to respond to a rapidly changing environment, to reach agreement over the best way to complete their common task*'[414]. Disparate professionals require to reach agreement, regardless of third party intervention. This being the case, it is logical to assume that a capacity for conflict is *always* present in the multi-disciplinary building design team. However it becomes apparent that a distinction exists between '*conflict which is regarded as too far beyond the point of professional inconvenience and decision discrepancy*',[415] and, professional confrontation which is less detrimental to the project at hand.

An attempt to address this anomaly can be found by comparing and analysing Deutsch's definition of *Conflict* as '*that which exists whenever incompatible activities (or ideologies) occur*',[416] and the alternative view of confrontation (able to exhibit a degree of benefit to a project), defined by Tjosvold[417] as *Controversy*. Tjosvold suggests that controversy (not conflict) '*arises when differences of opinion temporarily prevent, delay, or interfere with the decision making process*'. It may be a somewhat moot point to suggest that the latter definition carries less negative connotations than the former. However, if as has already been discussed, improvements are sought in the integrative and communicative process of the disparate design team through a change of mind-set, every opportunity to reduce the potential of latent barriers must be taken. In this vein, 'conflict', and its implication of a definite barrier of incompatible activity, may be diffused by regarding confrontation between disparate professionals, as design team 'controversy'; that is merely the temporary cessation of activities, with a view to improvement.

Tjosvold argues that productive confrontation does have a part to play in an organisation. He documents research which indicates the potential and value of controversy in project teams.[418] He suggests that it is often a valuable decision making tool and has many positive functions. Controversy is said to stimulate interest and curiosity and can be the source of personal and social change presumably toward a bettering of the existing system (which might even be argued to be in need of bettering, simply by the occurrence, or more specifically the recurrence of conflict). Findings indicate however, that controversy must be well managed before it can ever be productive. In this regard, the work undertaken by Gardiner and Simmons, which attempts to link the potential for creative management, with conflict which arises in the construction process, mirrors Tjosvold's findings. Whilst both studies argue that project team controversy must be well-managed if it is to be beneficial, recommendations on how to achieve this are much less readily available. Managerial intervention by a knowledgeable third party may well find a degree of benefit in the conflicts recognised to exist between design team professionals, however such intervention is unlikely to eliminate all detrimental conflict. Indeed it is repeated that the introduction of an additional specialist may simply add to levels of conflict between project members.

If inter-group conflict, argued to affect detrimentally the decision making process of the construction design team, is to be addressed, greater understanding of the variables of conflict are required. The evolution of 'cultural roles and values' which influence social interaction between building team disciplines requires assessment, before steps can be taken to address conflict and the adverse perceptions of professional hierarchies.[419] Conflict can exist in interpersonal, inter group and/or international environments, and may be examined through a social psychological approach. Of direct relevance to the multi-disciplinary building design team are Duetsch's[420] key notions that:-

(i) Decision making within the group can entail a struggle among different interests and values for control over action, and that, such social interaction takes place within a social environment which has developed various cultural rules and values.

(ii) Each participant in a social interaction responds to the other in terms of their perceptions and cognitions of the other, these may or may not correspond to the others actualities.

Notwithstanding the propositions above, it has been proposed that it is sufficient for conflict to occur through the discrimination and reduced interaction which comes from simply belonging to a group. This assertion corresponds with work by Sherif[421] who finds that it is the existence of the group rather than the attributes of the individual, which forms the basis of conflict. Whilst it would appear that membership of a group may be enough to induce conflict, Male's[422]studies of the building professionals position within the team, suggest that this assumption must not cloud other variables.

In this latter investigation of conflict between professional and organisational norms, conflict between an organisational and professional commitment was *not* inherent and its actual existence was low. As a consequence, there is little evidence to suggest that conflict occurs as a result of the increased bureaucracy imposed by membership of a larger multi-disciplinary organisation. This being the case, the occurrence of conflict may be argued as being more open to influence from, what Duetsch describes as, '*the perceptions and cognitions of the professions interacting within established cultural rules and values*', than simply being part of a team. This has important connotations for the Higher Educational Institutions, since it is the educational stage of the building specialists' development, which is argued to be chiefly responsible for the evolution of the rules and values which make-up particular professional culture(s).[423] It is logical therefore to suggest that, it is more the building professions and their value systems (developed largely through traditional vocational education), and less an adherence to generalist group organisation, which influences the occurrence of conflictual exchange in the building design team.

Disparate design team professional value systems, and professional input occurring within a lineal process of information transfer, can be argued to limit the opportunities for consensus agreement of task objectives. This is worth noting since the ability of the group to match their specialist input to an overarching objective also appears to influence the occurrence of conflict. Conflict for example occurs between group members seeking to realise mutually incompatible goals; whereas in the group whose members engage in tasks which need interdependent behaviour, co-operation ensues[424]. It has been demonstrated that hostility can be reduced, simply by group members being made aware of the presence of vital goals and tasks which cannot be achieved alone. Indeed the construction industry is increasingly charging the Higher Educational Institutions to instil professionals with the realisation of their collective, rather than individual, responsibilities. Blake and Mouton[425] state, somewhat sweepingly, that *'the provision of common goals eliminates conflict.'*

Clearly, the existence of conflict within a building design team working towards common project completion, requires an expansion of this rather sweeping simplistic statement. Thus a more contemporary linkage between objectives and conflict may be restated by a recognition that where members of a group are made aware of a common objective, inter-group conflict is much less likely to occur. A similar argument has been presented by Tjosvold commenting that *'people in co-operation may disagree on how to reach their common goal, but believing goals to be positively linked allows members to realise the potential of controversies of opinion'.*[426] Controversy, in the context of organisational innovation, should be expected and neither party should be embarrassed that they have opposing positions. Controversy, when recognised as a co-operative requirement to achieve a commonality of purpose, may indeed be a natural process within the construction industry. However professionals must be made aware of its potential, and again it must be restated that the construction industry charges education with this responsibility.

Several studies have indicated that co-operative goals help people in different roles discuss their opposing views constructively and productively. In addition to expressing their views more openly individuals with co-operative goals ask questions more easily, demonstrate that they are working for mutual benefit, and integrate their ideas to create new solutions[427]. On the other hand, competitive goals lead individuals to avoid discussing their views, trying to dominate, and being unable to integrate ideas and reach agreement. Tjosvold & McNeely further suggest that having common objectives is the predominant reason for co-operative goals, but they are less clear about the conditions that lead organisational members to believe that their goals are co-operative, competitive or independent.

Analysis of co-operation and competition lies in the nature of the way the goals of the participants in each of the situations are linked. A perfectly co-operative group occurs when participants can only attain their goal(s) if the others with whom they are working can attain theirs. Members are in what Deutsch[428] describes as, a 'promotive interdependent situation' (where all goal linkages have a positive correlation between the attainments of the linked participants). However Duetsch also argues that the minimal conditions which must be met before a collection of individuals will turn into a co-operative system require (i) that the individuals must be aware of one another's existence, and, (ii) they must share the same main objective and choose to co-operate with others. Clearly these conditions already exist (to varying degrees within existing procurment procedures and conditions of contract) in the innovative building design team.

Duetsch also stipulates that the co-operative system requires, (iii) interaction which must be reciprocated in such a way as to confirm for each member his expectation of a mutually desired co-operative relationship, and that, (iv) individuals must be aware of themselves as a distinguishable entity.[429] These final two conditions are rather less clearly established in the fragmented design team. Again emphasis is made of the need to address (through development at the educational stage) the perceptions and cognitions of each participant towards their peers, in attempts to reduce conflict in the design process.

Research also highlights the differences which exist between co-operative and competitive groups.[430] Chiefly, co-operative groups show more effective inter-member communication, more friendliness, more co-ordination of effort, greater feeling of agreement, and greater similarity in overarching ideas. Deutsch concludes that the processes of: *Communication*, *Perception* of the group, and *Attitude* toward one another, are *positively linked* under a co-operative organisation; and spiralingly competitive under a competitive system. He continues that co-operation is induced by (and induces) a perceived similarity in overarching beliefs and attitudes. *'Positive attitudes result from perceptions of (overarching) similarity' and that these are 'determinants of open and effective communication'*[431] according to Deutsch. Mutual trust is also seen as a contributory factor in the communication processes of the group and *'the correctability of the individual's perceptions of a situation will be greater when that individual begins with a perception of mutual trust, rather than a perception of mutual suspicion'*. Again parallels may be drawn with the construction industry, where suspicion has historical precedent and dissatisfaction with the workings of the building design team is well documented.

There also appears to be a relationship between conflict, co-operation and communication where communication becomes a way of merging conflict with individual goals[432] To this end, established Instruments[433] designed to measure interpersonal conflicts in organisations, centring on the role of communication implicit in the measurements have been reviewed.[434] These Instruments were designed to allow respondents to learn how, and when, to use a situation-specific communication-technique, ultimately to diffuse conflict. However such techniques appear very much as a senior management tool to allow the manipulation of relationships with subordinates, and can be argued to highlight the dangers of not fully addressing a problem which is argued to be, less about gaining the upper hand over colleagues, and more about seeking to benefit from disparate specialist input. Again, in a similar fashion to research which seeks to aid third party (project managerial) intervention, this appears very much as a reactive way to treat the symptoms, rather than attempting to seek a cure for detrimental conflict; which is more likely to come from proactively addressing design team perceptions and cognitions (through an educational approach able to instil empathy at the outset of professional development).

The general argument that the processes of communication, perception of the group, and attitude toward one another, are positively linked under a co-operative organisation, is also supported by the suggestion that the construction specialist's '*image of the professions, varies according to their acceptance or rejection of conventional stereotypes*' and that '*these images are likely to affect their role, perception and performance*' within the design team.[435]

Due to rapid technological and social change, building professionals are undergoing considerable changes, leading to a re-evaluation of conventional stereotypes and new role perception.[436] Based on this and other[437,438] research it is argued that professional attitudes can be studied using the individual's opinion of conventional and more recent professional stereotypes and that these opinions affect ego involvement. Vari-Szilagyi finds that 'work-task' oriented building professionals, whose interest lies chiefly in the realisation of the initial design, are more open to the potential for information gained from new (co-operative) role norms and (co-operative) responsibilities, than those who are striving to belong to a given professional stratum or group, simply because of the high social prestige it allows. Clearly, it may be argued that perceptions of peer group empathy (attitudes which affect ego involvement and trust) influence co-operative input to the innovative design process.

It has also been argued that, as individuals are engaged in new situations, their expectations and role requirements change, and that as a result, '*historical consciousness is always being renewed*'.[439] Seeking to assess the evolution of latent conflict within the building design team, it has been found that distinctions in cognitive style, held to differentiate building professions, need *not* form the basis of latent conflicts.

This latter study[440] however is at odds with earlier work[441] that learning divisions relate to a 'dual knowledge thesis'[442] which supports a view that different areas of expertise deal with different kinds of reasoning. If adherence is made to the dual knowledge thesis then typically design is seen as a '*divergent*, intuitive activity', whilst the application of, say, economics is termed a '*convergent* application of theories'. The dual knowledge thesis results in positions of antagonism manifested as divisions within the design process, about the respective roles of science and art.

Whilst Coyne and Snodgrass challenge this view they do acknowledge that this distinction is the logical starting point for many who believe that '*there are deep rooted* *differences in attitudes, outlook, and ways of working between construction professionals which make it difficult to bring them together and that permeate the education system*'.[443] In contrast, they argue that the dual knowledge thesis does *not* necessarily form the foundation for latent conflicts within the construction design team.[444] Instead they suggest that today's increasingly complex construction industry demands that a *hermeneutical*, interpretative philosophy[445] be applied to all aspects of the process of innovative design.

Here understanding is accomplished through interpretation, and that this in turn is derived from past experience and so both *convergent* and *divergent* activities are merely actions stemming from the same learning process[446]. Kolb's[447] idea of learning as '*an attempt to understand*' and that '*understanding is the appropriation of experience*' is referred to by Coyne and Snodgrass who then argue that '*the hermeneutical nature of understanding is shared by both the divergent activity of designing and the convergent activity of solving a mathematical or litigious problem*'.[448] For example, '*creating a work of art, and applying a rule to predict the motion of a structural beam are both hermeneutical, even though the media, subject matter and corpus of experience will be different between the areas of expertise, as will aptitudes*'.

Coyne and Snodgrass argue that an *interpretative* mode of thinking is the only way of thinking, whether solving a mathematical problem or creating a work of art. In this way, what were once regarded to be conflictual thought processes, differing from profession to profession can instead be argued to converge and stem from an overall process of interpretation, thus allowing controversy of opinion to exist, not as positions of antagonism and an overt display of detrimental conflict, but rather as an integration of specialist interest.

So, it is argued that the development of conflict (suggested by Pondy) **as stemming from a latent perception, which can quickly become an overt feeling of hostility, must be addressed before the design process can develop efficiently. If all human thought and action has a hermeneutical interpretative characteristic, then dual knowledge distinctions no longer present a foundation for latent conflict. Changing the mind-set**[449] **of the professions, and their educational processes, towards an acknowledgement of a hermeneutic integration of interests, may diffuse a major antecedent of latent conflict within the design team. Logically, an acceptance** (facilitated by education) **by the design team members of themselves as specialists within an 'indistinguishable entity'**[450]**, must greatly reduce detrimental conflict, and improve co-operation within the group.**

4.4. A commentary on group culture in terms of the building design team and tertiary education.

Previous discussion suggests that one may legitimately talk not only of specialisms as sub-divisions of a broader knowledge field, but as being disciplines in their own right. Specialisms can also be said to consist of a variety of constituent elements, having a character of their own, and indeed forming their own culture.[451] It has been argued that it is the nature of specialist groupings to create cultures which in some respects complicate, and even seem to undermine, the overarching field from which they derive. It was also argued that generating some overriding sense of unity to retain a measure of collective independence becomes increasingly important. This is important especially in light of findings from reports such as the latest Construction Industry Council/Department of Employment report[452] which argues that '*it will take some time to change the mind-set of the (building design team) professionals and put behind them old obstacles of mutual* *mistrust and cultural difference'.* Happold[453], arguing that *'truly, there are different cultures within the construction industry'* highlights the notion that problems of professional disparity are perceived to stem from differences in the established values and norms of specific groupings (group culture).[454]

Groups can form in three main ways:- as a result of an environmental accident, as a coming together of individuals for an advertised event, or, as is more often the case in building design teams, as a conscious decision to bring a group of people together for a purpose.[455] Schien,[456] in his attempts to invoke cultural change in small experimental scenarios, found groups to rely greatly on 'cultural norms'. Initially in his test sample, aggregates of people were found to experience the unease of silence, and eventually the beginnings of a rudimentary pecking order. These feelings may link a biological need for some form of organisational order, and the realisation of a dependence on cultural rules, such that *'culture eventually covers over, with a veneer of civilisation, the underlying roots of human nature'*, and that *'cultural norms regarding the handling of conflict, help deal with feelings that might run out of control, endangering us and others'.*[457] As a result, it is argued that such cultural norms once established are not easily changed. Members of a group become aware that in an interpersonal situation one cannot *not* communicate and to do so one must adhere to *existing* cultural assumptions about interaction and integration.

The large amount of documented dissatisfaction with the interaction and integration of the traditional, project specific, building design team, reflects poorly on the overall effectiveness of the construction industry. If improvements are sought in the performance of the UK construction industry, both at home and internationally, it would appear logical to address the processes of the design team grouping. It has been suggested that a generalisation of small group experiences, to that of the wider efficiency levels of organisational communication, is obtainable through an investigation of culture, which is seen as an assessment of the system of shared meanings between the members of a group.[458] In addition, it is claimed that '*culture provides a framework of possibilities for understanding which transcends each individual member of a group but at the same time maintains the meaning system and is developed by the individuals continually using it*'. Culture is seen as both a structure and a process of group activity, whether large or small. Cultural themes are in evidence in all aspects of the social system '*much as the total generic material to produce each individual is present in all their cells*'.[459]

The building professions comprise collections of like-minded people, each with their own codes of conduct, sets of values, and distinctive intellectual tasks. As the work, and points of view, of professional disciplines become more specialised, individuals have fewer things in common in their backgrounds and daily problems. They have less impulse to interact with one another and less ability to do so. Construction disciplines and academic vocational departments may indeed therefore be termed cultural phenomena.[460] It has been suggested that to begin to understand group culture '*one must let go of the idea of community, and unified culture, and instead focus on the disciplinary subcultures which tend to split the interdisciplinary group*'.[461] Furthermore, '*it is vital to look more closely at the individual disciplines and their relationship with one another, if an improvement in mutual appreciation, respect, and cohesion, is to be obtained*'.[462] It can be argued that the building design team appears, less as a community exhibiting a unified culture, and more as a multi-disciplinary grouping which requires to address the interaction of 'sub' cultures.

Schien[463] has suggested that misunderstandings at a face to face level should always be treated as a cultural[464] issue rather than an issue of individual personality. This is worth noting in the light of research which seeks to highlight *inherent* differences between the design team professionals.[465] The notion that professional misunderstanding is a cultural issue, links with earlier discussions examining the extent to which professional differences occur, not so much as a result of innate personality traits, but rather through exposure to specialist educational traditions.

If an overarching, integrative, cultural environment (which seeks to facilitate a pattern of basic assumptions which cope with problems of external adaptation as well as internal integration) can be instilled during the formative years of professional development, the 'creative tension'[466] which is said to arise as a result of professional controversies of opinion, could play a more effective role in the production processes of innovative design. Without such measures, disciplinary sub-cultures, which are allowed to develop independent of the needs of a design team grouping, are in danger of exacerbating division through a process of increasing the individuals perception of latent conflict through traditionally disparate specialist education.

Without some degree of cultural commonality the group cannot exist. Culture and the group are two sides of the same coin and without the cultural element the group simply becomes an aggregate of people.[467] Three theoretical explanations for the formation of a group culture have been described as follows:- Leadership theory, learning theory, and sociodynamic theory. *Leadership theory* provides insight into how founders, owners, and 'leaders' create and embed their own assumptions into groups and organisations. *Learning theory* and especially models dealing with cognitive learning help explain why some situations are culturally stabilised whilst others are in controversy. Thirdly, *Group* *dynamics / sociodynamic theory,* (or open systems theory) provide important insights into how group members interact with each other.

Leadership within the organisation and consequently, the wish to create and embed ones own cultural assumptions, consciously or subconsciously, can be said to occur only when the authority of the leader is legitimate. Schein suggests that legitimacy can only exist when there is a *consensus* among the members of an organisation, on the basis on which rule is derived and, on the system by which a person is put into a position of authority.[468] These two factors appear to be lacking in the building design team. In an extensive survey of building professionals,[469] the professions of Architecture, Quantity Surveying, Civil and Structural Engineering, as well as Contractors, and even knowledgeable Client Bodies, each regarded the leadership qualities of the traditionally procured design team leader[470] as no better than their own abilities to lead the team. Indeed Architects, Quantity Surveyors, Contractors, and even some Clients, each regard themselves as best suited to the job of team leader. Although this survey made no attempt to determine the perceived legitimacy of the 'new' specialism of project manager, the findings are obviously relevant in any attempt to assess contractually procured leadership and the legitimacy of authority in the design team.

Whilst the basis of legitimate authority can be examined from both a sociological and also a psychological point of view, both approaches are similar in their assessment of the requirement for leadership.[471] In 1947 the German sociologist Max Weber[472] summarised leadership as arising from, (i) A rational legal ability and a recognition of past experience and management skills. (ii) Charisma and the force of personality; (iii) Pure rational authority arising from specialist knowledge; and (iv) Tradition. The psychologist Cartwright[473] also postulated a basis for legitimate power as existing through: (i) Position power; (ii) Potency of the leader and his referent power to elicit information; and (iii) Expert power.

The sociological legitimate power base of 'tradition' is implied by Schien to have no psychological counterpart. This is worth noting since this aspect of power is a major basis for the contractually procured leadership hierarchy of the construction design team.[474] Psychological commitment is suggested by Schien as, '*one of the major variables on which hinges a measure of the efficiency and effectiveness of the open complex organisation*'. By implication, the traditionally procured design team, which relies greatly on tradition to achieve its hierarchical leadership structure, would appear to lack an associated psychological commitment by group-members to serve the traditional design team leader (the Architect) thereby influencing the efficiency and effectiveness of the unit. It is equally questionable, whether the employment of the 'new' profession of project management (notwithstanding the considerable abilities which such a professional must hold[475]) will be able to compensate productively for attitudes held by the design team members, that they themselves are the best suited profession and discipline for the job of leading the group[476].

Several leadership training theories[477], based on a static diagnosis of leadership qualities to improve the technique of those already in a position of power, attempt to change the cultural values from which group assumptions are made.[478] However, once again if 'subordinates' do not fully except the legitimacy of the leader, attempts to improve existing leadership styles are flawed from the outset. Indeed Schien[479] questions whether a basically autocratic person who *learns* how to behave participatively, without changing his underlying attitudes, can encourage subordinates to respond positively to such behaviour, or whether subordinates sense the incongruence and react even more negatively than they might to the 'honest' autocrat.

Leaders however may be unable to behave participatively by their very nature.[480] This clearly presents an anomaly for the multi-disciplinary design team which hopes to integrate its skills, at the same time as its specialist members simultaneously display attitudes holding themselves as best suited to lead the group. **In recognition of this anomaly it is argued here that a need arises for a participative group culture[481] able to exhibit values and norms which embrace interactive-empathy,[482,483] rather than a group culture that requires acceptance of the conciliatory solutions that result from dominant leadership.**

In addition to the leadership theory for the formation of group culture, Schien's other theoretical explanations for the formation of a group culture may be restated as, *Sociodynamic theory* (providing insights on how group members interact with each other) and *Learning theory* (cognitive learning to explain why some situations are culturally stabilised whilst others are in controversy).[484] These alternative approaches to the formation group culture also require examination but allow greater analysis of the major links between the formation of group culture and (its relevance to) building design team education. This examination is conducted in future sections. In a general sense however, Porritt[485] defines the perception of culture by the individual, as stemming from a process of socialisation which can be said to include both sociodynamic and learning theory.

Porritt argues that the perception of culture by the individual occurs as a result of '*the comprehension and consistent induction of an individual into the objective world of a society*'. Porritt also suggests that cultural cognition occurs: (i) in an *ethnocentric* way when a person judges another culture to be inferior; (ii) in the form of *cultural relativism* when the individual is able to accept the beliefs and practices of another subset of a community; and (iii) as *acculturation* when new patterns of behaviour are adopted as a result of leaving an existing group to achieve integration with a new group.

Socialisation has links with the perception of culture by the individual. The process of socialisation has been specifically related to professional groups.[486] *Traditionalists* are seen as resistant to change, wanting things to stay the same; *utilisers* seek financial gain, unaware of professional issues; and *professionalisers* are motivated individuals who look ahead and plan for changes. Building upon work by Porritt, and Haberstein and Clunist, it is argued that different professional development(s), which instil in the individual Porritt's theoretical *cultural relativist* outlook and go some way towards facilitating specialist *professionalisers*, are consistent with the needs of the multi-disciplinary design team in an increasingly technologically complex building industry. It is further argued that the optimum stage to encourage cognition of cultural and group development is tertiary education.

Appeals for a participative design team culture, exhibiting values and norms which embrace interactive-empathy, can be said to arise as a direct result of the dissatisfaction with today's building design team and its inability to realise fully the potential of multi-disciplinary relationships. It is argued that cultural change (explored in subsequent sections as being modifiable to a large degree by controlled group exercise) requires to be addressed by tertiary vocational education.

So it would appear that cultural assumptions made by the individual, once established, are virtually impossible to change.[487] If change *is* sought to better the

efficiency and effectiveness of an organisation, a process reflecting the tenacity which cultural assumptions exhibit, is required during the formative years of professional development. Schien has pointed out that there is no quick, reliable way to identify cultural assumptions in an organisational environment. The optimum stage at which a complex organisation is open to change, is during member development by tertiary education. Higher education is charged by the construction industry to illicit change which will bring about improvement in inter-disciplinary communication process and product.

4.5 Group work and team building with respect to the building design team

The building process takes place in a technically dynamic industry. Complex projects demand a diverse number of skills. Traditional professional roles and relationships are changing.[488] The ability of building professionals to acknowledge the requirement for efficient interaction in diverse project teams is increasingly important.

Specialist professionals are required to be part of and learn to perform effectively within, the overarching group. The previous section describes Schien's[489] theoretical explanations for the formation of a group culture as *leadership theory* (outlined in the discussion above), *learning theory* (cognitive learning to explain why some situations are culturally stabilised whilst others are in controversy), and *sociodynamic theory* (providing insights into group member interaction).

Douglas[490] has argued that contemporary behaviour patterns have been largely group-formed and should be modifiable to some degree by controlled group exercise. He further argues that '*groups can be used to effect changes in the attitudes and behaviour of* *individuals*' and states that group dynamics (the way in which groups function) are part of this process. The tasks or goals groups set themselves, and the ways in which groups integrate and react to factors of influence in achieving such goals, are important reflections of group effectiveness. Douglas tabulated some of the links between the '*variables influencing interaction*' and the major 'theoretical orientations' in the study of group dynamics and these are shown in TABLE 4.1.

Variables which influence interaction	*Analysis of variables*	*Theoretical orientation*
qualities of the group	group attractiveness	field theory(1)
group goals	interaction of goals	interaction theory(2)
qualities of the task	role dynamics	systems theory(3)
social binding	sociometric choice	sociometric theory(4)
qualities of members	social norms	psychoanalytic theory(5)
qualities of members (2)	human behaviour	general psychological theory(6)
external relationships	statistical procedure	empiricist statistical theory(7)

Table 4.1
Douglas' links between the variables influencing interaction and the major theoretical orientations in group dynamics

1. Field theory: argues that behaviour is a product of a field of (life/social space) interdependent determinants. Structural properties of this field are represented by a set theory by means of psychological and social forces. This approach is accredited to Lewin in the early 50's and is detailed by Cartwright and Deutsch later in the same decade.
2. Interaction theory: conceives of a group as a system of interacting individuals; with an attempt made to construct high order concepts around the basis of activity, interaction and sentiment. This system especially developed by Bales, Homans and Whyte in the early 50's
3. Systems theory: adopts the view that the group is a system: systems of interlocking positions and roles was a theory stimulated by Newcomb again in 1950; the group as a system of communication follows leads from communication engineering; and the group as an 'open system' can be found in the writings of Miller and Stodgill from the late 50's. These systems concentrate on input and output and like the field theory emphasise equilibrium.
4. Sociometric orientation: is concerned primarily with the interpersonal choices that bind people together, it was originated by Moreno in the 30's and elaborated by Jennings in the early 40's.
5. Psychoanalytic theory: focuses upon the motivational and defensive processes within the individual and was first extended to group work by Freud in the 20's. Its major reference to group dynamics are an analysis of the concepts of identification, regression, and defence mechanisms.
6. General psychology orientation: argues that conceptions of human behaviour developed in general psychology are found in work on group dynamics. Major concepts of: motivation, learning, perception, and more especially cognitive theory, are influential in the field of group dynamics. Important contributions after WWII have been made by Kretch & Crutchfield, Asch, Festinger, Heider
7. Empiricistic statistical orientation: argues that group dynamics are discovered from statistical procedures rather than a prior theorist construction. Uses procedures developed in the field of personality testing. Illustrations of this approach may be found in the writings of Mayer, Cattell, and Hemphill in the middle of the this century.

Industry apparently gives high regard to interpersonal skills of employees being able to work as a team and that developing a collection of individuals into an effective working group can be helped by facilitating training initiatives which understand the problems that groups commonly face together[491]. The introduction of a 'formal models orientation' to group process contrasts with the above table of 'variables influencing interaction', by attempting to construct formal models of group dynamics which deal rigorously with specific (although often somewhat limited) aspects of groups. Many models have been proposed for this purpose[492,493] most of which are similar to Tuckmans[494,495] Five Stage Model of Group Process and Stage Development, which may be summarised as Forming, Storming, Normimg, Performing, (and Adjourning).

Work carried out by Woodcock[496,497] also explores similar, forming through to adjourning, theoretical stages in team development. This approach to team development is described in four stages. Stage one, *the underdeveloped team*: most common; pyramidal organisation; unusual ideas unwelcome; team members do their allotted work; no real teamwork. Stage two, *the experimenting team*: willingness to face the unknown; feelings come out into open; team members begin to understand each other; but still lacks unified methodical manner. Stage three, *the consolidating team*: team has more confidence; trust develops; decisions taken by clarifying the purpose of the task before the team using knowledge as a basis for improving future operations, and finally Stage four, *the mature team*: different approaches adopted to meet different needs; individuals do not seek to defend their position or status; leadership decided by the situation that emerges - not by protocol; individual commitment; everyone striving toward same objective.

Whilst the theoretically fully integrated team is argued to attain all four stages, dissatisfaction within the construction industry appears to suggest that the building design team has yet to satisfy Woodcock's final stage of development. Higher vocational education, charged by industry to bring disparate professionals together, must facilitate prospective design team members to attain the full potential of their multi-disciplinary project team(s).

The reason groups are set up, or redefined, is that there is an assumption, often not made wholly clear, that such a group possess attributes which will facilitate the attainment of an overarching objective.[498] If this is not the case then the exercise is at best cosmetic and at worst completely pointless. In addition groups are often created around a common problem, however the differences (skills) which each member is able to bring to the common problem may start with a negative connotation for the other group members. Thus the problem of the group addressing a common problem with a diversity of skills, is to allow that diversity to become an available asset in terms of increased choice, rather than discomfort for the other group members.

It has also been argued that this diversity-of-skills presents a fundamental barrier which the majority of 'team literature' fails to address and that '*some of the phenomenal growth in the use of teams in organisational settings, derive from the need to bring different specialisms together*'[499]. An underlying objective in multi-disciplinary teams is to bring the combined brain power and differing perspectives of specialists to bear on a complex problem. '*When it works it is magnificent; but those very specialisms provide problems for teams because the members attitudes*[500,501] *to their own and other specialisms often prevent the team from performing to its full potential*'.[502]

A difference of opinion between members may be argued to lead to greater understanding within the team. However to be constructively employed, controversy needs to supplement co-operation. The multi-disciplinary team member needs to acknowledge that specialist goal realisation through competitive or independent action holds less potential than through group co-operation.[503,504] Waterman[505] points to research which shows that the best results are secured *not* through competition, but through co-operation and teamwork and he argues that extensive research carried out at Columbia University, and Texas University '*proves conclusively that the best results are secured not through competition, but through co-operation and teamwork*'. His findings indicate that achievement and competitiveness are *inversely* related. In similar fashion, it has been argued that in order to use controversy, and the problem solving approaches which must arise from it, successfully, the team needs to be able to create an atmosphere in which communication is constructive, open and co-operative. Thus before 'conflict' and any necessary resultant problem solving measures can be utilised positively, inter-group co-operation and communication must *already* exist.

A co-operative atmosphere must be instilled, otherwise detrimental specialist attitudes, will prevent the team from performing to its full potential.[506] A dilemma appears to exist in which co-operative intentions must, in many ways, precede conflict. It may be said that inter-professional conflict (or rather controversy of opinion) must have a co-operative foundation. The chartered and non-chartered building design team professions increasingly see tertiary education as the principal means to address this anomaly.[507,508] Educational establishments are charged with design team improvements in integration, co-operation and, by implication, achievement through addressing aspects of group dynamics and the cognitive processes of group culture.

There is a body of opinion[509] which believes that differences in dealing with people are largely a matter of values and attitudes and that these *can* be modified by 'training'.[510] Therefore a rationale for improving the ways in which individuals deal with others is, as argued by Morgan, by addressing the potential for attitude change. The first step towards this rationale is an acceptance that skills which are learnable are important contributors to differences in the facility to deal with people.

What a person does when dealing with others (exercising interactive skills), is determined by what their attitudes will allow them to do.[511] The way to improve interactive skills is to change attitudes.[512] Methods developed for training in interactive skills, based on this theory, require to fulfil two things (i) it has to be demonstrated quite clearly that attitudes can be changed; (ii) attitude change is reflected in behaviour change. However, the evidence for the latter is less compelling than the former and in '*many cases where changes of attitude have been achieved, behavioural effects, other than verbalising 'changed' attitudes, are seldom satisfactorily demonstrated, and, in cases where they have, related behavioural change has often only been of a fairly gross change of shopping-habits-kind which involves no skill*'.[513] Clearly behavioural effects must be addressed in any educational initiative which seeks to instil an atmosphere of co-operation in the building design team.

It is clearly difficult to identify the specific attitudes that need to be modified in order to improve a particular interactive skill, and that in general (managerial) situations-specific attitudes can be highly individualistic.[514] However, others[515] have highlighted the fact that attitudes, in terms of the multi-disciplinary building design team, are professional attitudes[516,517] held by a particular discipline and they emphasise that it is profession-domain attitudes which provide problems for design teams. It is '*these attitudes, to their own and other specialisms, which can prevent the team from performing to its full potential*'.[518]

Morgan however, has warned that often it is not enough that an individual should *want* to behave in an interactive way, but they also have to know how to, and to have practised doing it. Thus any educational approach seeking to instil an overarching co-operative culture, as well as seeking to develop interactive skills should also recognise the importance of behaviour change. thereby allowing individuals an opportunity to try out and practice new behavioural skills. Morgan cites other studies which suggest that behavioural changes can induce attitude change[519]. It seems that the practice of new behaviours, accompanied by success in achieving the objectives of interactive situations, causes attitudes to be modified. Such findings illustration the close link between attitudes and behaviour which multi-disciplinary integrative educational initiatives must acknowledge.

The use of small-group training methods as a managerial interactivity tool to understand group process and develop the interactive skills required to work effectively in and with groups, is not new. Recognition of the 'small group' as the most effective medium for seeking to bring about attitude and behavioural changes can be traced back to Kurt Lewins work at the Massachusetts Institute of Technology in the mid to late 1940's.[520] This early work developed four widely known small-group methods of interactive skills training[521] (unstructured methods of learning by analysis of the members own experiences in the group, where the trainer steers the group towards the objectives of learning). The four techniques developed were T-Group training[522] Instrumented laboratory training,[523] Managerial Grid training,[524] and Coverdale training.[525]

In any method which aims to improve interactive skills of a 'company/group', it has been argued that before any training can start a decision has to be made about which behaviours and attitudes are relevant, and therefore need to be developed.[526] The method of interactive training (for established 'managerial' participants) should also contain an opportunity to address behaviours/(attitudes) held and the interactive training situations must be as real as possible.[527] Participants must then receive feedback on how well they are doing, since success is more likely if participants discover for themselves the inappropriateness of 'established' behaviours. As a result participants will then be more strongly motivated to seek more appropriate behaviours and continue to use them when they leave the training situation.

Based on extensive research,[528] the initiatives which seek to address interactive skill(s) have been summarise in a 'specific theory of interactive skills' which may be broken down into 5 stages as follows:

- Effective interaction depends almost entirely on the specific situation in which the interaction takes place, *therefore*
- the usefulness of particular behaviours to an individual will depend on the context or situation in which they are used, *therefore*
- individuals from different areas have very different training needs and objectives, *therefore*
- there are unlikely to be 'right' and 'wrong' behaviours in a general sense, *therefore*
- because the appropriateness of a behaviour is dependent on the situation, such behaviours can only be developed by specific tasks geared to the situation and the individuals need.

In other words the multi-disciplinary educational initiative must acknowledge the diversity of areas and taylor projects to suit specific groupings, at the same time as allowing an overarching continuity of the project-situation.

The features outlined in some of the management-training-tools mentioned above, which seek to improve behavioural analysis and ultimately the interaction of small groups, allow an overview of the fundamental principals of group-work initiatives attempting to address behaviour and attitude. However, *several factors* clearly affect the creation, life, and outcome of the group and these need to be recognised and taken into account when planning the group.[529,530] Douglas has summarised 3 obstacles to effective group work and efficient resource distribution. These are stated as follows:

- *Personal Characteristics* of members and tutors (beliefs, habits, attitudes, experience, skill, status and relationship, needs),
- *General Constraints* (environment organisation, accessibility, material resources, time and size considerations), and,
- Member and tutor *Perceptions* (anxiety, threat of change and disagreement potential).

Much work has been done which attempts to examine these specific variables of group work with a view to training methods able to facilitate the creation of an optimally effective and efficient team.

In studies of management-teams over almost 15 years, several attempts have been made to measure the successfulness of teams in terms of the grouping of member attributes.[531] Results from experimental training teams composed of people who score very highly in mental ability tests, showed that they performed *worse* generally than teams made up of low psychometric test ratings.[532] A number of possible explanations were proposed. For example it was felt that, academic upbringing which instils winning against colleagues all the time, more negative 'critical thinking appraisal', (criticising others to the best of ones ability), and, the more negative constructs held by individuals who score highly in mental ability tests, impedes the success of a collective of similarly disposed individuals.

According to Belbin[533] 'clever people prefer anarchic autonomy, and if they find themselves competing for some aspects of the leadership role without being able to discharge that role, they are more likely to disrupt rather than contribute to the effective functioning of the group'.

Whilst these findings indicate that teams composed almost entirely of high psychometric test ratings are rare in industry, groupings of similar personalities often occur in vocational industrial environments. Individuals with particular personalities tend to be drawn towards particular professions and logically, if they succeed in their occupations, then teams which come from single-disciplinary industrial environments will have much in common. Occupational similarities recur since it is argued that in recruitment, people try to recruit 'themselves', thus an elective homogeneity occurs. In Belbin's experimental team-sessions these 'personality-pure' teams containing similar personalities are found to lack the natural balance found in more diverse groups, although they are usually argued to find a style of operation which suits all members without trouble. However, whilst this 'chosen style' can work well if the environment is stable, technically complex environments require teams able to adapt. Same-personality teams were found to be unsuited to technically diverse fields.[534]

The building design team can be argued to exist within a technically complex and diverse environment, however it must also be creative. Group-creativity however may be a misnomer since the closer a task comes to being creative, in its truest sense, the less effectively it can be performed by the group.[535] Douglas also argues that the executive processes, which must arise from the creative act in order to give it existence are well within the competence of group operation. An examination of the role of creativity in an industrial setting revealed a general *lack* of ability to utilise the ideas produced from contrived groups moulded by their organisation, to make them 'creative'.[536] Indeed most industrial breakthroughs when followed back to their source, were more likely to result from an initial idea which had been developed within a simple social process. Hoffman[537] also found that *formal* group structures tend to reduce creative production.

Belbin[538] sought to take this notion further and examine experimentally the creative individual's place in the team. He used two approaches to identify the creative individual, by peer group nomination, and by a creativity-disposition-tool (Cattels creativity disposition tool). The former method identified 'creative' individuals who were found to be heavily involved with people and good users of resources. The latter method identified creativity within those who were, inadvertently, also regarded, by both facilitators and participants, as 'loners'. Belbin found that if 'creative loners' are allocated a position in the team which is out of role '*their asset value is substantially reduced*'. Whereas the 'resource user' (the individual identified by peers as creative) rather than being an ideas person, has alternative skills such as knowing when to initiate, when to ask the right questions, and, how to spot the occasion to benefit from a colleagues idea. According to Belbin, industry has in fact confused both the concept of the creative individual, and also their role within the project team.

Peer group nomination is also of importance in the examination of experimental team leaders. Belbin (whose training programme specified that groups *had* to elect leaders) found that successful-task teams elected 'chairmen' who were not, on average, more mentally able nor creative than the less successful team's chairmen.[539] Elected chairpeople with 'low' mental ability were able to compensate through other (measurable) personality/character attributes. Unsuccessful mentally-superior chairpeople overshadowed any possible leadership aspects of personality. Two types of leader were subsequently identified, one suited to team role distribution in coping with multi-dimensional problems (less relevant to a multi-disciplinary building design team which is generally aware of its professional responsibilities), and, the other leader who is able to aid group members, who possess a specific skill, to overcome internal or external barriers to team performance (more akin to the building design team).

Whilst the inclusion of a hierarchical team leader in the building design team may simply contribute detrimentally to latent conflict these latter experiments raise an interesting issue. For example, the latter group who required facilitation in overcoming specialist barriers, were found to respond more to participation in an intensive training programme, than in an extended multiple-week course in management education and team working. This suggests that the successful educational initiative, which seeks to bring disparate building specialists together, should look to adopting an intensive programme of short duration.

Recognition of generalist participative team roles, complementing specialist knowledge input, aids team performance and unsuccessful task-teams occur where teams do not acknowledge team role in addition to specialist task requirement.[540] Teams in which members gravitate to the area which they feel they know most about, rather than to an area in which the team could benefit from their input, also tend to do badly. Kelvin[541] found, in his group work experiments, that participants frequently display a tendency (most noticeably in interaction, adaptability, and creativity) towards disparate factions which is very difficult to overcome. Unless the group can be influenced by '*a pleasant human environment in a team*' then the tendency to seek a separate faction will continue to result in irregular team performance standards.

There are, of course, dangers of not being able to recognise the need for a team role as well as technical expertise in the optimum team. *'Each member in the team usually has a role, which is a broad description of what that team is expected to do'*.[542] Caution has also been expressed however about 'brave-new-worldesque' role allocation through personal, peer or personality test, nomination.[543] The great danger about roles, from the members point of view, is that they can become rigid and actually prevent achievement. If members of a group become trapped by their role(s) the team suffers; as do individual team members, because their development and initiative can become stunted. Belbin[544] advocates the exposition of potentially damaging reliances on member perceptions of what they feel themselves to be good at. The more conscious the members of a team are of where personal and peer internal strengths and weaknesses lie, the easier it is to adjust to use their internal resources to good rather than poor effect. The lower this awareness, the greater the danger of making strategic mistakes that spring from self-delusion.[545]

However, teams with less than an ideal distribution of talents can compensate for shortcomings by recognising a latent weakness and then deciding to do something about it.[546] Task-winning teams occur where a wide spread of mental ability scores are observed to pull together, rather than where teams are intellectually more homogeneous. Brown[547] also emphasises the need for balance in group composition. Homogeneity and heterogeneity are equally required, to allow stability and vitality respectively. Successful (experimental training) groups are found to have such diversity of talent and personality in the make up of the team. Kelvin[548] has also argued that the selection of members with (compatible goals and needs and) sufficiently diverse abilities and skills, results in less effort being required for interaction and organisation, so that energy is productively concentrated on tasks.

Notwithstanding the merits of diversity, the mixed team identified as successful in 10 years of experimentation does *not* seem to figure amongst winning teams in industry. According to Belbin[549] there is human resistance to searching for a mixed team since often company policy tends to create groups in its own image. Indeed, it has been argued that professionals in industry, who group together to pursue certain aims by combining their specific skills tend on the whole to accomplish what they set out to do and rarely experience failure.[550] As a result they never learn how to learn from failure, and subsequently do not require to adapt. In terms of the construction industry then, whilst the building design team seldom fails to get the brief built, it may equally be argued that the efficiency and effectiveness of the process seldom receives attention.

Small training groups appear to be the most effective medium for bringing about change in attitude and behaviour. Small groups of individuals also invariably find themselves charged with eliciting change in industrial or organisational environments. Hoffman[551] found that the larger the group the more inhibiting the size becomes for members who have strong introverted tendencies. The question of how many individuals make up the optimum team led Belbin,[552] based on ten years of experimentation, to argue that it is difficult for more than 7 people to integrate in a theoretically ideal way. He found that 7 or more team members performed less successfully than 6, and argued 6 team members to be the most suitable number to tackle complex problems. However a 4 person team, although less well equipped than 6, achieves a level of intimacy, involvement and excitement that 6 cannot match. Relations between 4 member teams are not necessarily any more integrated, but they are more pronounced and become more intense. A large team with many group members may exhibit 'a negative influence' on the project learning outcomes of educational team building initiatives[553] and the optimally sized team will have just enough people for the efficient execution of perceived project tasks.[554]

Whilst specific task performance by each member is important in team performance, a feature of positive team member contribution, obtainable by peer assessment, is found to occur where an individual gets the group 'out of trouble'. So, for an individual to receive commendation it appears necessary for the group to get into some sort of difficulty, from which it is rescued by a member with the abilities and personal qualities commensurate with the task.[555] Other favourable features of a team member, obtained through peer assessment techniques were found to be self restraint, flexibility, and maintaining team goals. Maintaining team goals is very important and team success depends on having members who set team goals above those of personal self interest.

After 4 years of research into high-performance (innovative) engineering team performance, results suggest that effective team building is a critical determinant for project success[556] and that effective decision making depends on how members perceive team spirit, as well as their ability to trust the information that is becoming available. This has obvious connotations for the building design team. If team members, in the formative stage of professional development, are made aware that peer group contribution can be trusted, and instilled from the outset with a positive reaction to team spirit, levels of project success will increase.

The interest given to team building and team design by researchers, highlights a notion that human compatibility is more difficult to address than obtaining technical suitability for the team. Belbin drawing on almost a decade of research presents 5 interlocking principles in obtaining successful team design as follows:-

- Members of a team can contribute in a technically functional role and also by performing characteristic team-roles in which one team member interacts with others in facilitating the progress of the team;

- Teams need an optimum balance in both functional roles and team roles. The ideal blend depends on the goals and tasks the team faces;
- Team effectiveness will be promoted by the extent to which members recognise and adjust themselves to their own relative strengths (and weaknesses) in abilities to engage in specific team participative roles; and finally that
- Teams deploy technical resources effectively only when they are able to address requisite team participative roles to ensure efficient teamwork.

Belbin argues that obtaining reliable data about people is the starting point for (generalistic) effective team-building. The subsequent sequencing of team induction based on this information can seldom be disregarded, even if technical skill is traditionally deemed more important to a particular objective. In more specific environments, such as the building design team, it is logical to suggest that data obtained (and acted upon in the training environment of professional development) about the disparate professions carries similar importance in the ultimate determination of team effectiveness.

Furthermore, allowing greater participation in team composition by the participants themselves, is often well received[557]. Results showed that selection processes by members tended to follow introductory lectures/seminars on team composition, and that the resultant groupings produced correspondingly successful teams. However selection processes had to be modified after it was noticed that the elitist nature of public selection produced internal tensions. Alternative team selection, where nominated syndicates selected anonymous code numbers based on what the syndicate member needed to fulfil a particular team-role and task characteristic, were deemed fairer. An initial assessment of the problems which must be overcome, and a knowledge of the professionals who are able to address such problems, allows teams to be more conscious of their relative strengths and weaknesses, and produces a greater probability of effectiveness.

The discussion thus far has identified member variables which influence the process of interaction between individuals within the team. Any initiative which seeks to examine group working must also concern itself with the content of the training vehicle within which individuals are to learn. The development of tasks set are of interest to an educational process which seeks to instil efficient integration. After first making an assessment of managerial communicative skills, and then providing follow up training programs based on these original assessments, it was found that managers participating in communication-skills-training in areas previously identified as requiring attention, gained significantly higher performance ratings in interpersonal skills, problem-solving ability, and productivity over three long term assessments.[558]

These findings show that if educators firstly identify areas of perceived conflict, subsequent task development and training programmes are much more likely to address and eradicate such conflicts. It is argued that if the building industry seeks to improve multi-disciplinary communication and interaction, it must be able to identify perceived conflict, and through educational initiatives, address specific inter-disciplinary conflictual attitudes directly.

'*Students need to go beyond the brochure image of their own discipline and set out to develop a critical perspective which acknowledges that all multi-disciplinary organisations work well for someone*', according to Berkman et al.[559] Curriculum projects which, rather than specify task application, '*probe system related questions about the students own skill, as well as the potential of their colleagues skills*' should be developed. Often educational project-work techniques, which bring students together are apt to '*give too much emphasis to finding a correct task answer, rather than on perfecting answer-finding methods*'.[560]

This somewhat ambiguous call, for answer-finding objectives which are, better able to address (known) disciplinary divisions, is clarified in an interdisciplinary initiative for social work specialists[561]. Here a curriculum was developed which tried to integrate professional disciplines, by bringing (disparate) students together informally in aspects which are initially of mutual interest. Students chose an area of the industry which carried greatest interest for them. This brought them into contact with other specialists who had also identified this field to be of interest. The resultant integrated project then required them to discuss fully *all* problems which might arise in this area. It is argued that this approach allows, a clear framework for analysing all possible difficulties, the development of intervention strategies for integrative skill input to address these problems, and ultimately it allows members to recognise the potential of others to overcome problem areas which are unrealisable without specialist knowledge.

Robinson,[562] combining analytical and creative techniques into what he regards as the main thrust of a multi-disciplinary problem solving process, suggests an approach which is similar to the above. Here it is argued that participants must learn for themselves the ability to seek out external specialist knowledge from other areas to resolve specialist difficulties. Professional motivation for integration is obtainable by showing integration as having potential for personal gain, and that it is this which will most readily invokes a system of networking across the disciplines.[563] Randolph and Posner[564], appeal somewhat more altruistically, for members of a team to learn how other people perceive their goals and actions, to ultimately determine a common perspective for the disparate team. Each specialist then, whether for the good of the project or for the good of themselves, is instilled with an awareness of the potential of others which may, through deliberation at the early stage of development, improve integration in future environments.

Schon[565] found that individual professionals learn through a process of reflection rather than through content-led taught courses alone. His studies found that this (reflective) activity can be encouraged and facilitated. However although active learning through project work and tutorials is more likely to meet important (multi-disciplinary) objectives than the traditional lecture method, such objectives should not be taken as static or obvious since the relative importance of educational objectives are themselves dynamic.[566] Course design and structure must extend *beyond* subject coverage. Staff must take account of how pedagogic techniques are perceived by participating students before assessment can be made of their effectiveness.[567]

Group facilitators need to be well addressed to the group(s) they encourage and organise. Douglas[568] argues that tutors require 3 abilities, an ability to observe, an ability to make appropriate intervention, and, an ability to assess the groups situation. Research shows that the values which are held by any group tutor constitutes a major influence on what happens in that group and often, the values held by the tutor or enabler of a group are in conflict with the objectives of the group programme. To avoid this, the values which underlie the tutors actions should be made more explicit before the tutor is ready to lead the group work initiative. There also appears to be a relationship between the professional training received, and professionally held distinctive values compared with the general population[569] Thus if a group tutor is from a vocational professional background then this may logically influence the outcomes of the group.

So tutors require to have clear objectives to aid students to learn for themselves through experience, and by doing. De Charmes[570] found that a training programme developed by *tutors* which aimed at promoting intrinsic motivation and internal locus of control in pupils (by thoroughly involving the tutors in the design of learning experiences for their pupils) produced 'gains' in pupil achievement and autonomy, which were still present seven years after the event. A replicate of this study, which attempted to impose the programme designed by the original group of teachers onto a new group, however failed to achieve the same results. Jones and Frederickson[571], commenting on the work done by De Charmes, argue that the crucial element seemed to be that the original teachers shared ownership of the project.

However successful tutor input to educational initiatives appears possible through addressing tutor motivations by involving them in a systematic sequence of steps from identification of need and the identification of conflictual aspects to be addressed through group-work, to the processes of evaluating the effectiveness of course design and presentation.

According to Douglas,[572] all group work follows a simple pattern, which requires 5 steps: (i) recognition of need and an analysis of it, (ii) re-definition of the individuals as groups, (iii) creation of a system which will offer logical organisation of facilities, (iv) termination of the group, and, (v)an assessment of outcomes. So it would appear that educational initiatives seeking multi-disciplinary integration must firstly seek to identify the specific factors of conflict, and include such factors in the training programme. Educational schemes must then seek to facilitate students to learn (for themselves) the importance of multi-disciplinary action, and allow (suitably motivated) tutors to be actively involved at initiation and feedback stages.

So, before any training can start a decision has to be made about which behaviours and attitudes are relevant, and therefore need to be developed.[573] If educators firstly identify areas of perceived conflict, subsequent task development and training programmes are much more likely to address and eradicate such conflicts.[574] Behaviours can only be developed by specific tasks geared to individual needs.[575] Training situations must also be as real as possible and seek to develop the potential of skill diversity as an asset to the group, by improving the capacity for project completion.[576]

Although 'the executive processes which arise from a creative act in order to give it existence', are well within the competence of group operation,[577] success is more likely if participants discover (for themselves) the inappropriateness of relying on what may be termed member 'established behaviours'.[578] Teams in which members gravitate to the area which they feel they know most about, rather than to an area in which the team could benefit from their input, tend to do badly.[579]

In terms of group composition 'clever' teams, made up of high psychometric test scorers, perform *worse* than mixed ability groups. Similarly 'same-personality' groupings are found to be unsuited to technically diverse fields. Interestingly research also implies that *successful* educational initiatives, which seek to bring disparate specialists together in preparation for performance in an industry which is technically diverse, adopt short intensive programme durations, rather than extended multiple-week courses in areas such as management education and team working.[580]

A large team with many group members exhibit 'a negative influence' on the project learning outcomes of educational team building initiatives.[581] In addition it is found that the larger the group the more inhibiting the size becomes for members who have strong introverted tendencies.[582] It is also difficult for more than 7 people to integrate in a theoretically ideal way, with 6 team members argued to be the most suitable number to tackle complex problems, although a grouping of 4 achieves a level of involvement that is said to be 'pronounced, exciting and intense'.[583]

Allowing participation in team composition by the participants themselves aids success.[584] If students are allowed to choose an area of the industry which carries greatest interest for them, this brings them into contact with other specialisms who have also identified this field to be of interest. Theoretically the resultant integrated project then requires them to discuss fully *all* problems which may arise in this area, and allows members to recognise the potential of others to overcome problem areas which are unrealisable without specialist knowledge.[585] In a similar vein, a feature of positive team member contribution, obtainable by peer assessment, is found to occur where an individual gets the group 'out of trouble'.[586] Professional motivation for integration is obtainable by showing integration as having potential for personal gain, which invokes a system of networking across the disciplines.[587] [588]

The values which are held by group tutors are found to constitute a major influence on what happens in that group.[589] Successful tutor input to educational initiatives is found to be best achieved through addressing tutor motivations, by involving contact tutors directly in a systematic sequence of steps from the identification of need, to the processes of evaluating the effectiveness of course design and presentation.[590]

4.6 Educational initiative to instil professional empathy: a model

Using the information from previous research a model has been constructed and is presented below to describe an educational initiative able to address the problems of communication and integration that exist within an increasingly technologically complex multi-disciplinary building industry. This model is presented graphically using a method drawn from the systems methodological approach for the representation of research that presents, examines and seeks to solve a particular problem.[591]

The starting point of the model presents the premise that *the complex building industry must strive to maintain an effective and innovative output*. This starting point is then linked to industry's *need for specialist professionals suited to the dynamic requirements of the processes of building design*. To produce suitably qualified practitioners, education must seek to do two things: *educate the individual to perform within a specific specialist field*, and *educate the individual to participate effectively and efficiently in a multi-disciplinary building design team*. These twin requirements, are then succeeded by three separate, yet intimately linked, explicit definitions of how educational establishments must develop an educational strategy to prepare vocational students for a multi-disciplinary industry.

The three defining constituent parts of the educational strategy propose that tertiary education must, (i) *provide specialist knowledge with due regard given to other specialist requirements of the complex building industry*, (ii) *provide a multi-disciplinary approach able to take account of existing levels of building industry experience*, and, (iii) *provide a multi-disciplinary approach able to accommodate idiosyncrasies peculiar to particular stages of disparate vocational courses*. These are shown schematically in Figure 4.2.

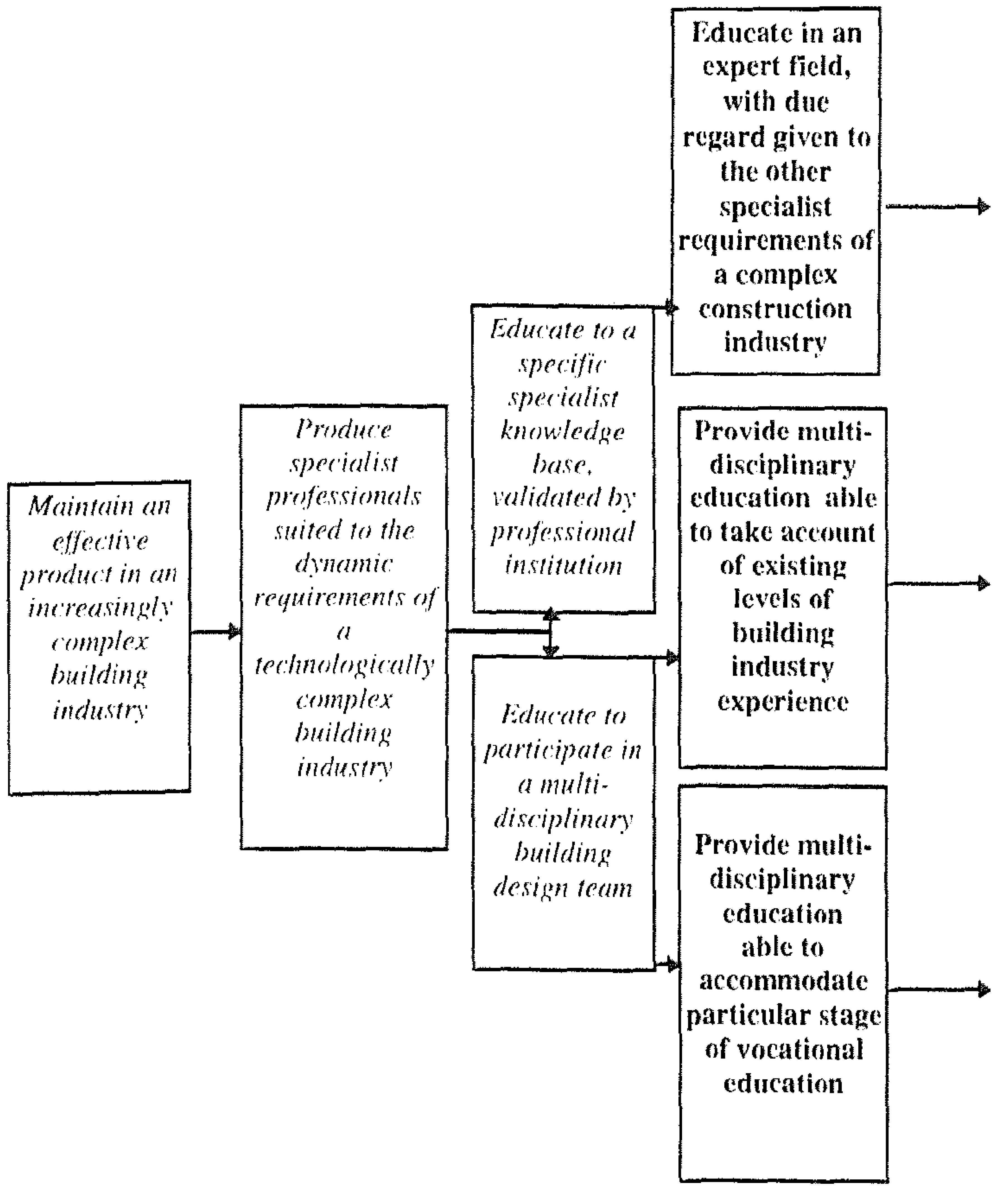

Figure 4.2
3 Objectives for the professional education of building design team specialists

The model then postulates that from these explicit objectives, three separate, yet intimately linked, conceptual activities can be developed. These activities expand the three definitions of professional education, by stating the minimum necessary activities that must be done (by research) in order to progress towards the identification of a formal process able to (allow educators to) improve inter-disciplinary education.

These three activities form the basis for the empirical research discribed in PART 2 of this thesis. The model proposes that once this data is available then progress can be made towards an *identification of educational initiative(s) able to encourage and instil professional empathy*. Thereafter the model follows classical lines. An *educational strategy* would be developed which would have to account for contextual variables of the proposed *programme*, and the structural variables of the available *resources*. Once these variables are in place, *implementation* of the educational strategy should take place. The *review* stage allows alterations to be made. The model is then able to feed back, into a technologically complex industry, professionals able to integrate effectively their particular specialist field of interest, to allow optimum performance in the multi-disciplinary building design team.

The complete graphical representation for initiatives in inter-disciplinary educational is shown in FIGURE 4.3

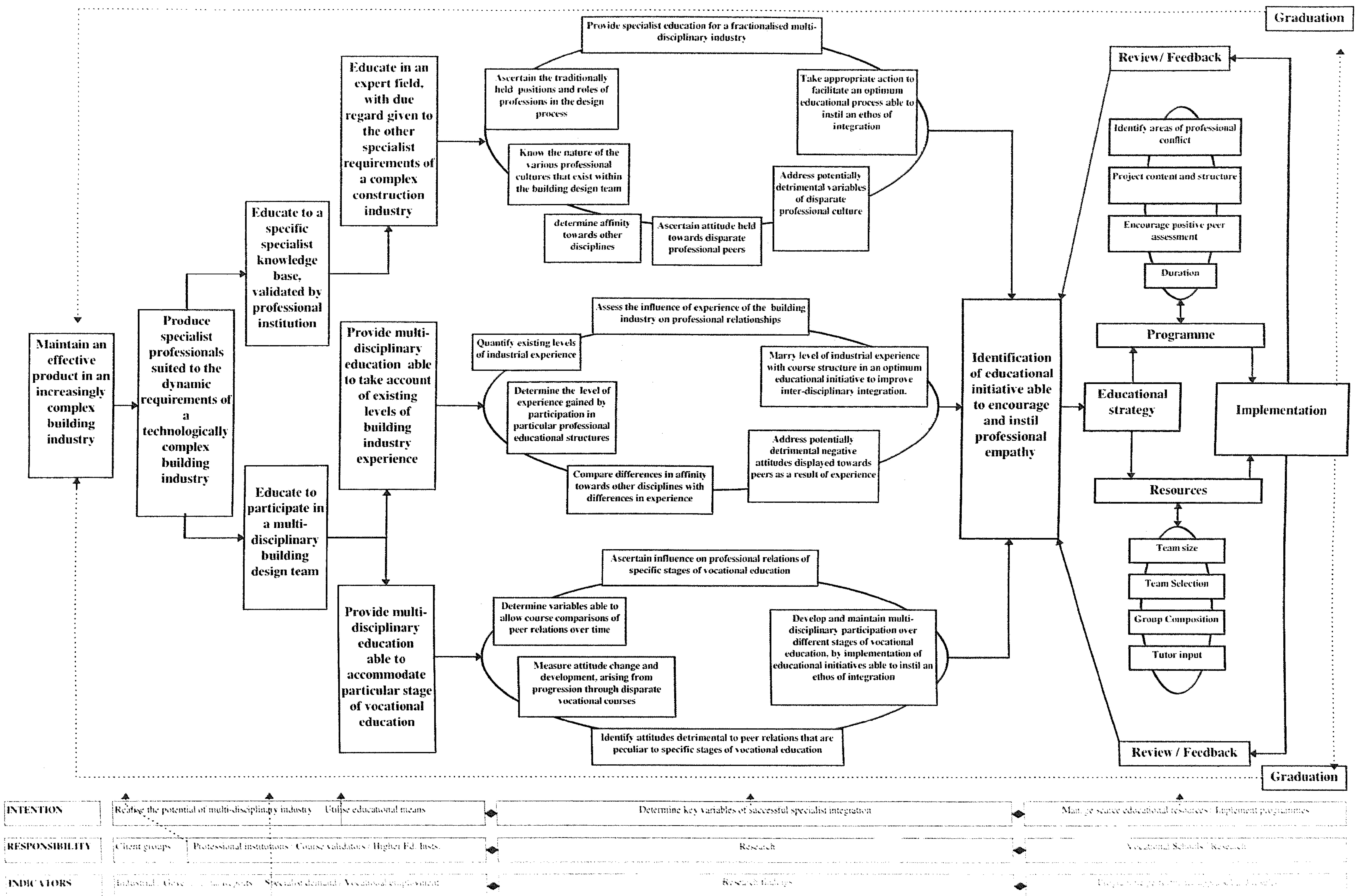
Maintain an effective product in an increasingly complex building industry
Produce specialist professionals suited to the dynamic requirements of a technologically complex building industry
Educate to a specific specialist knowledge base, validated by professional institution
Educate to participate in a multi-disciplinary building design team
Educate in an expert field, with due regard given to the other specialist requirements of a complex construction industry
Provide multi-disciplinary education able to take account of existing levels of building industry experience
Provide multi-disciplinary education able to accommodate particular stage of vocational education
Provide specialist education for a fractionalised multi-disciplinary industry
Ascertain the traditionally held positions and roles of professions in the design process
Know the nature of the various professional cultures that exist within the building design team
determine affinity towards other disciplines
Ascertain attitude held towards disparate professional peers
Address potentially detrimental variables of disparate professional culture
Take appropriate action to facilitate an optimum educational process able to instil an ethos of integration
Assess the influence of experience of the building industry on professional relationships
Quantify existing levels of industrial experience
Determine the level of experience gained by participation in particular professional educational structures
Compare differences in affinity towards other disciplines with differences in experience
Address potentially detrimental negative attitudes displayed towards peers as a result of experience
Marry level of industrial experience with course structure in an optimum educational initiative to improve inter-disciplinary integration.
Ascertain influence on professional relations of specific stages of vocational education
Determine variables able to allow course comparisons of peer relations over time
Measure attitude change and development, arising from progression through disparate vocational courses
Identify attitudes detrimental to peer relations that are peculiar to specific stages of vocational education
Develop and maintain multi-disciplinary participation over different stages of vocational education, by implementation of educational initiatives able to instil an ethos of integration
Identification of educational initiative able to encourage and instil professional empathy
Educational strategy
Programme
Identify areas of professional conflict
Project content and structure
Encourage positive peer assessment
Duration
Resources
Team size
Team Selection
Group Composition
Tutor input
Implementation
Review/ Feedback
Review / Feedback
Graduation
Graduation
INTENTION
Realise the potential of multi-disciplinary industry
Utilise educational means
Determine key variables of successful specialist integration
Implement programmes
RESPONSIBILITY
Client groups
Professional institutions
Course validators
Higher Ed. Insts.
Research
Vocational Schools
Research
INDICATORS

Fig. 4.3

To summarise, the model consists of 3 parts. The first part (in boxes) draws conclusions from existing research and states these as a set of 7 premises. The second part consists of 3 key activities expressed as conceptual ideas (Elipses). These form the basis of the empirical research conducted for this thesis. Finally the third part (again in boxes) is an expression of classical management decision making. The key to this model is of course the linking of the first and third parts, both of which can be created from existing data but linked by an original interface. The rationale for this interface is as follows.

4.6.1 Three requirements for tertiary vocational education

The three intimately linked objectives for tertiary education, described in the model are derived from the arguments presented in the earlier chapters, are as follows:

(i) Educate in a particular specialist area of the construction industry, with due regard given to the other specialist requirements of the complex industry.

(ii) Educate to participate in a multi-disciplinary team, with due regard given to students' existing levels of industrial experience of the building design process.

(iii) Educate to participate in a multi-disciplinary team, with due regard given to the idiosyncrasies peculiar to particular stages of disparate vocational courses.

These are emphasised in the reproduction of FIGURE 4.4.

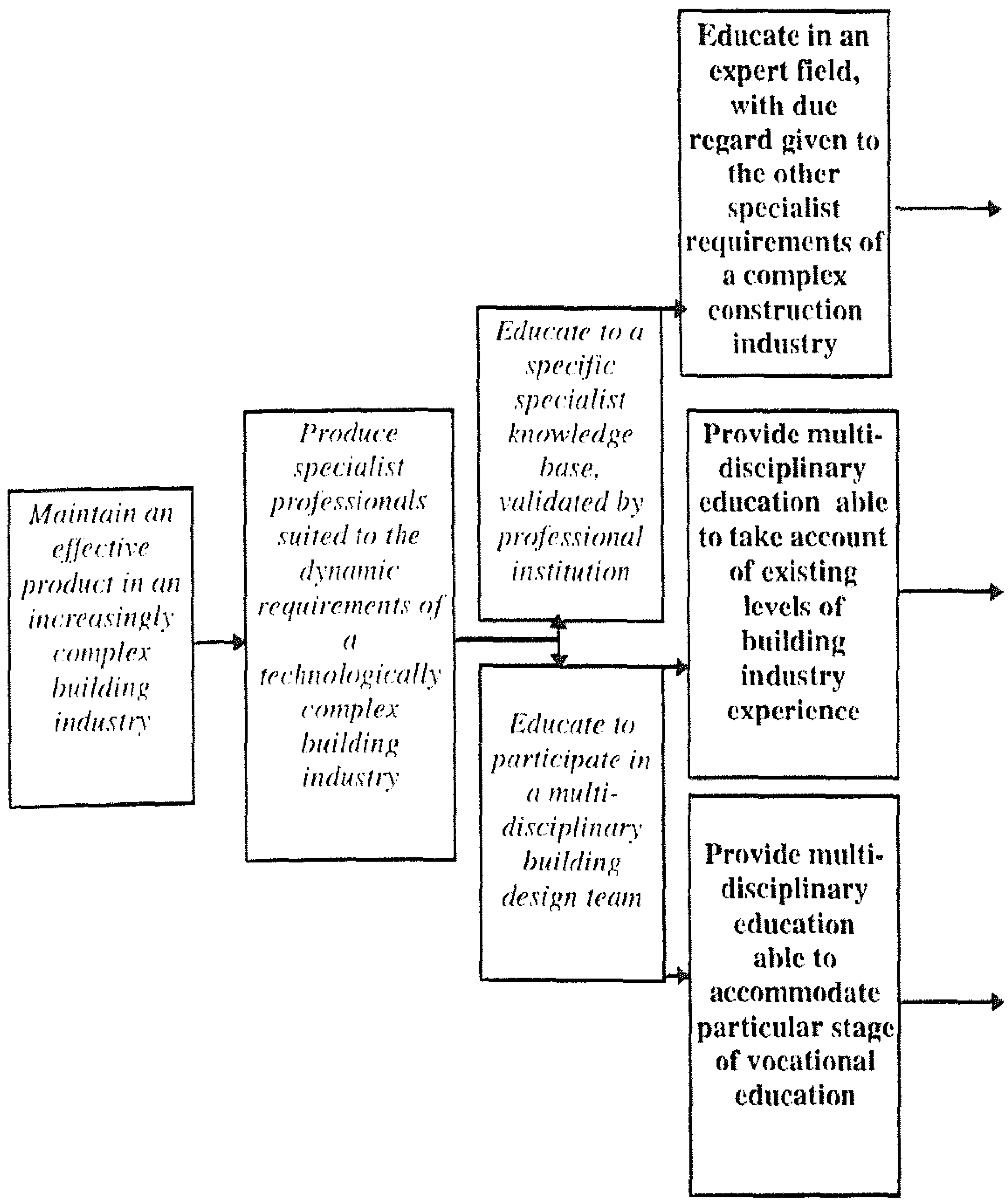

Figure 4.4
3 Objectives for the professional education of building design team specialists

Each of these objectives are now examined in greater detail and finally expressed as conceptual activities.

Acknowledgement of specialist input.

In the UK construction industry specialist input has a key role. At present specialist vocational courses are provided by Higher Educational Institutions. These are validated by various professional bodies to meet the market demands of a fractionalised building design process. HEIs are charged to highlight, within existing vocational courses, the increasingly complex nature of the dynamic construction industry by acquainting students with the existence of other disciplines. To do this effectively Schools should first determine the existing level(s) of affinity held towards building design team colleagues.

The activity bubble stemming directly from the need to educate in an expert field, with due regard given to the other specialist requirements of a complex construction industry, is shown below:

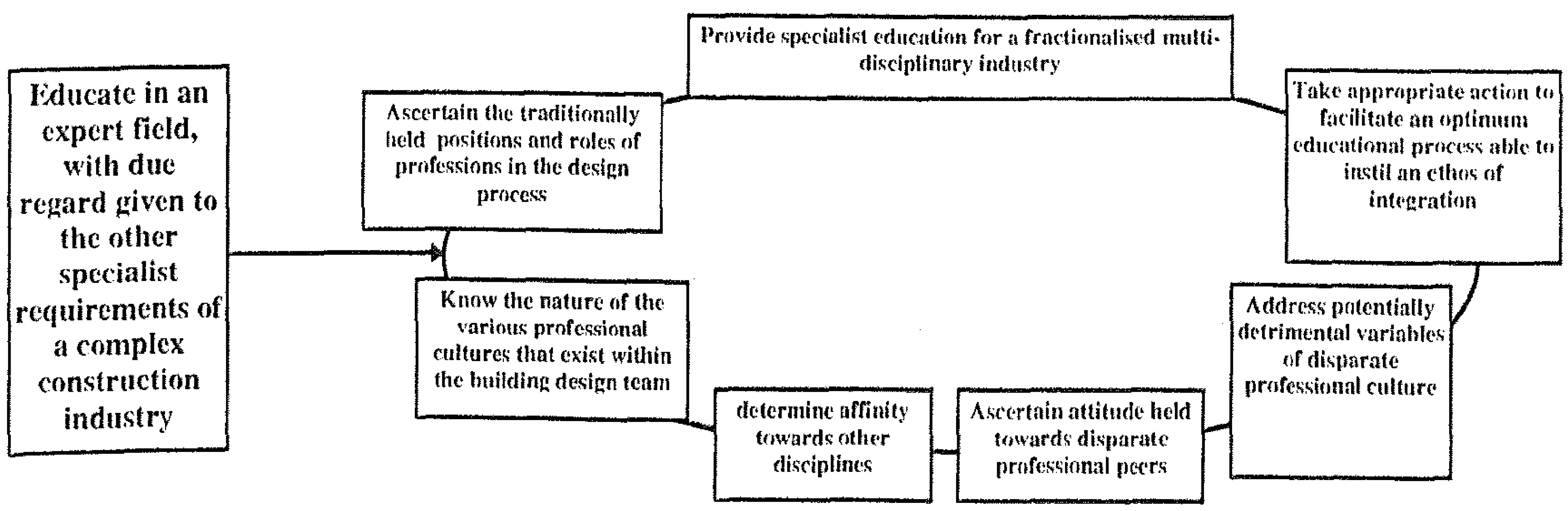

Figure 4.5
Activity bubble stemming directly from the need to educate in an expert field

Taking account of industrial experience

The second of the three conditions which allow vocational courses to progress towards an identification of educational initiatives able to instil professional empathy, is the need to provide multi-disciplinary education that takes account of existing levels of industrial experience.

In particular educational establishments must recognise the developmental nature of professional attitude in 'practice' to accommodate part-time and mature students.

The activity bubble which seeks to address the need to provide multi-disciplinary education that takes account of existing levels of industrial experience is as follows.

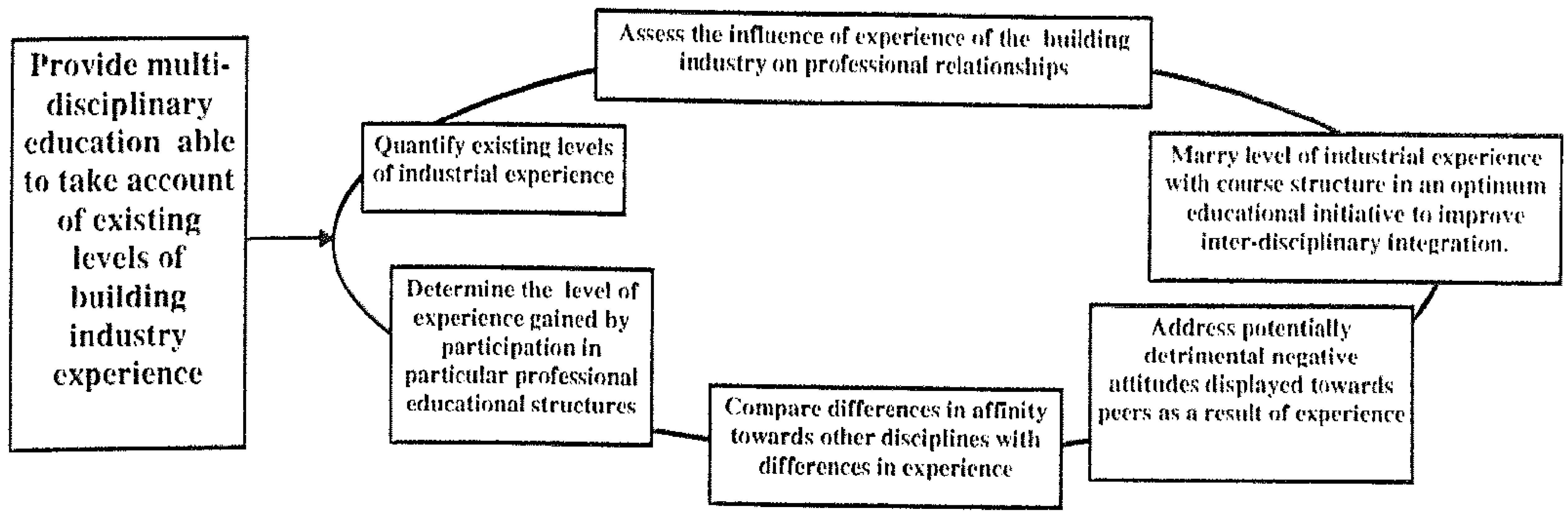

Figure 4.6
Activity bubble which seeks to address the need to provide multi-disciplinary education that takes account of existing levels of industrial experience.

Accommodating different stages of vocational courses

The third condition to allow vocational courses to progress towards an identification of educational initiatives which may be able to instil professional empathy can be stated as: the need for an educational process able to educate students to participate in a multi-disciplinary team, with due regard given to the idiosyncrasies peculiar to particular stages of disparate vocational courses. Educational establishments must recognise the developmental nature of professional attitude in an academic environment.

The activity bubble proposed, in the model, to address the need for multi-disciplinary education to accommodate the different stages of a vocational course is as follows:-

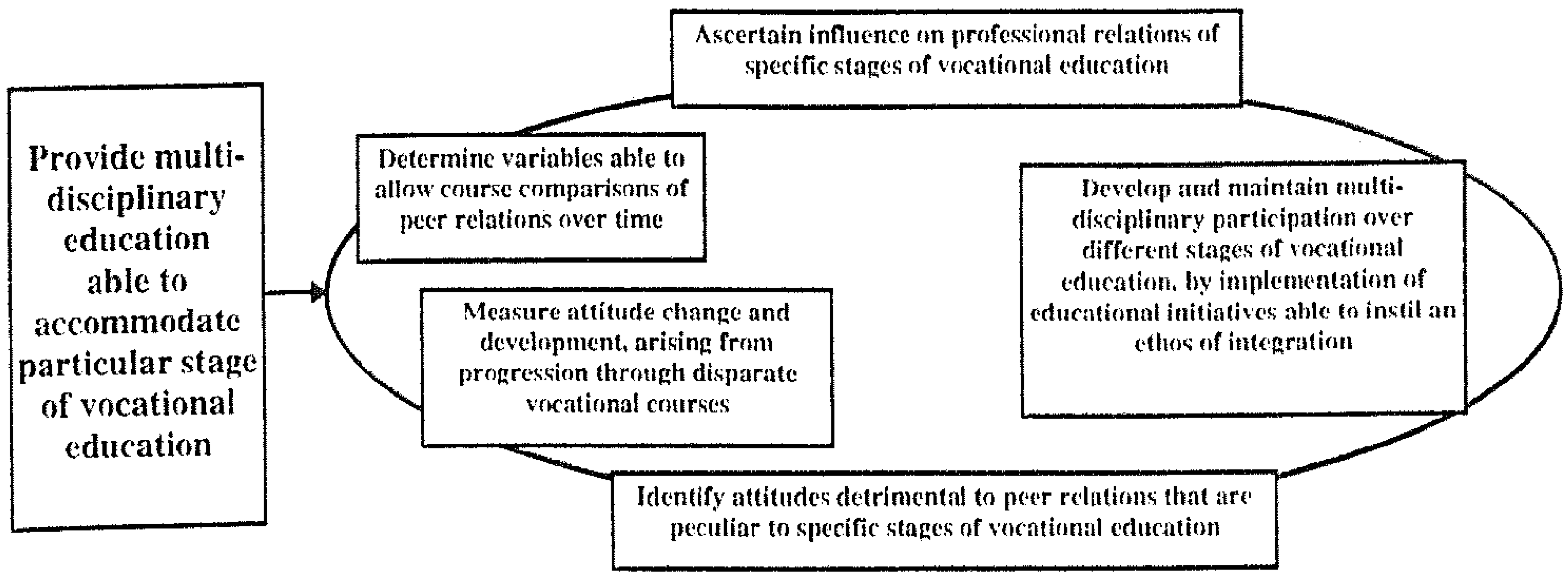

Figure 4.7
Activity bubble proposed to address the need for multi-disciplinary education to accommodate the different stages of a vocational course

What now follows in PART 2 of this thesis is the original empirical work which is used to substantiate or otherwise these three sets of activities in the model.

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[335]Plato (427BC-374BC); critique in Kolb, D. (1990) 'Post modern sophistications: philosophy, architecture and tradition' University of Chicago press
[336] Plato is argued to adhere to the philosophic position of *Idealism,* which regards ideas as conceived by the mind, to be the *truth.* Idealism regards as *real* the mind as it reflects upon the real world. Development of the mind in order to determine truth and ideas, is the Idealists definition of what is good.
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[351] Broadbent, G. (1991) 'Deconstruction : a student guide', Academy Editions

[352] Immanuel Kant attempted a reconciliation between, on the one hand, the strong empirical philosophy which adheres to a view that our knowledge derives entirely from sensory experience (championed by David Hume, 1711-76) and, on the other hand, the idea that certain kinds of knowledge are inborn.

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[360]John Dewey (1859-1957) is argued to adhere to the philosophic position of *Pragmatism*, which regards that which is *true* to be based on that which works or functions well. Pragmatists regard *reality* as the results of our experiences through such processes as problem solving and searching. The consequences for the community are their basic criteria of *goodness*.

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PART 2

ORIGINAL, EMPIRICAL STUDIES

PART II

CHAPTER 5

METHODOLOGY: AN ASSESSMENT OF PROFESSIONAL ATTITUDES

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METHODOLOGY: AN ASSESSMENT OF PROFESSIONAL ATTITUDES

5.1 Introduction

The need to obtain reliable information about the design professionals, is the starting point for effective team-building. Data-gathering about disparate professions, is of major importance in the determination of training programme effectiveness. Education is argued as the key to addressing communication problems in the building design team. An educational initiative, which seeks to improve multi-disciplinary integration, must identify and address the factors of inter-professional conflict, so this section describes a methodology able to achieve this aim.

A methodology, able to examine and measure the sociometric perception[592, 593] of students who take part in multi-disciplinary training initiatives, is presented. The section describes the selection process of important variables influencing professional attitude toward colleagues in the design team. Existing techniques to facilitate the measurement of attitude are then discussed, and the steps undertaken to develop, internally validate and establish the reliability of an optimum attitude scale questionnaire, are described. From a range of educational courses representative of current pedagogic approaches to disparate course integration, a selection of locations are highlighted as providing the best potential vehicle(s) for measuring multi-disciplinary activity. Investigation of these different approaches provides the foundations for the development of a simplified system of variables giving conditions for achieving an optimum educational initiative able to encourage and instil empathy in members of the building design team. This section also discusses possible limitations to the methodology.

The methodology is presented sequentially as follows:

(a) Section 5.2 describes the identification of the principal factors which determine how an individual perceives the character of building design team relationships.

(b) Section 5.3 emphasises the importance of attitudes in inter-professional communication, and describes the selection of an approach able to measure public domain attitudes held by building professionals.

(c) Section 5.4 brings together the principal factors of professional relationships, and the chosen attitude measurement technique. The methods to establish the *internal validity* and *reliability* of the resultant Attitude Scale Questionnaire, developed to measure attitudes held towards the peer professions of the building design team, are then presented. The method of attitude scale application is introduced.

(d) Section 5.5 assesses current pedagogic philosophies for the integration of construction disciplines. Building upon information generated by consultation of appropriately qualified academic experts in the field of inter-professional education, this section identifies optimum experimental locations for the implementation of the Attitude Scale Questionnaire.

(e) Section 5.6 outlines briefly the approach adopted for interpretation of the data set. Discussion concerning the development of an educational model, able to address dissonance in the building design team, is presented.

(f) Section 5.7 describes possible limitations to the methodology.

5.2 Identifying factors which influence professional relationships

Moser and Kalton[594] argue that if a researcher can use an established technique in the gathering and assessment of a data-set, they can better utilise time and resources which would otherwise be spent in the construction, and (reliability and validity) testing of a new technique. They add that the use of an existing technique also gives the researcher an opportunity to compare their own results with the results obtained by previous study. In this case however, an existing technique able to satisfy all these projects objectives does not exist. No research to date has attempted to examine the development of sociometric perception in built environment disciplines taking part in multi-disciplinary education. Whilst an earlier section outlined literature concerning trait differences between design and non-design disciplines, little work has been done which establishes the evolution and development of professional attitude toward other professions. The lack of attention given to professional attitude development can be said to represent a gap in the existing body of knowledge concerning multi-disciplinary education. Indeed the lack of research into this field, in many respects, further emphasises the need for and importance of the work carried out by this project.

This project proposes to investigate building design team relationships. Identification of the principal factors that determine how an individual perceives the character of building design team relationships, is the first step towards the construction of a methodology able to move the project towards a more empirical evaluation of the thesis hypothesis. To this end, existing work which sought to understand better the disparate professionals perception of themselves, in relation to their design team colleagues, has been identified.

Three important studies have been utilised in the process of building up a picture of the important factors in professional relationships. These studies looked at cognate areas relating to a professional's place within the building design team; variables of professional peer assessment were established from these. The studies were as follows: Higgins and Jessop's 1965 (Tavistock) report of a pilot study into communications in the building industry[595]; Stringer's 1971 study of design professional self-image[596]; and, Faulkner and Day's presentation of the images of status and performance in building team occupations, which compared the construction industry in 1986 with Higgins and Jessop's 1965 study[597]. The age of these studies, detracts little from their relevance to the contemporary multi-disciplinary building industry in general, and this project in particular.

The Tavistock report identified the fact that ratings given by disparate design team disciplines to their professional colleagues, in terms of *social status*, and, *contribution to the building industry*, differed greatly. Based on the finding of this small pilot study, Higgins and Jessop tentatively suggested that '*the main difficulties in communications (in the building industry) had to do with the relationships between resource controllers, and less so with the techniques of communication*'[598]. To recap, the variables identified as influencing professional relationships were *social status*, and, *contribution to the building industry*.

Peter Stringer's research measured architectural and engineering students' self-assessments of their chosen profession in terms of personality factors and role perceptions. Stringer used a 50 item Q-sort questionnaire[599], adapted from an existing pro-forma developed by the Institute of Personality Assessment and Research at the University of California in the early 1960's[600]. He found significant differences in the *self-image* of architectural students when compared with the *self image* of engineering students. He also found that significant differences in *self-image* existed within the architectural student grouping, when comparisons were made of the responses given by those at different Universities, as well as, by those at different stages of their course. He identified 5 empirical factors of self image, which he labelled: *aesthetic-creative motivation*; *orientation toward other people*; *mental habits*; *purpose and responsibility*; and, *information handling*. Stringer made generalised statements about educational implications, of greater (or lesser) emphasis being placed on these 5 factors of self-image, for courses dealing with architecture and with engineering. No additional work was carried out. To recap the variables identified as able to influence professional relations were the variables of *aesthetic-creative motivation*, *orientation toward other people*, *mental habits*, *purpose and responsibility*, and, *information handling*.

The third piece of work, which helped the current project identify different variables in the field of building profession peer assessment, was conducted by Faulkner and Day. Their study carried on the work of Higgins and Jessop, some 3 decades earlier. Faulkner and Day identified that stereotypical views about design team occupations, held by the disparate professionals towards their design team colleagues, were still evident in the contemporary building industry. Ratings which displayed a stereotypical perception of social status and a contribution to the building industry, were found to mirror findings obtained 32 years earlier. In addition Faulkner and Day measured ratings given by professionals to their design team colleagues in terms of: *leadership quality*; *usefulness of information generated*; *level of training received*; and, *level of education received*. The implications of these deep rooted traditional attitudes were discussed briefly by Faulkner and Day. The researchers concluded their study by making generalised statements about the potential of their findings for education, and working relationships. No additional work was carried out. Again to recap, the variables identified as able to influence professional relations were *leadership* *quality*, *usefulness of information generated*, *level of training received*, and, *level of education received.*

These three studies did not attempt to do any more than identify factors which might influence inter-professional relationships. In this respect they were effective. Indeed the factors identified can be said to cover the major aspects, discussed earlier, which are important for professional interaction in the building industry. Each one of the 11 variables identified above are worth noting since they examine different areas of professional relations in the construction industry. The 11 factors, established from different approaches to the same problem of dissonance in the building design team, can be said to broach the most important aspects of professional interaction.

Utilising the collective information detailed in the research papers outlined above, 11 specific factors in building design team interaction were identified: *social status*; *contribution to the building industry*; *aesthetic-creative motivation*; *orientation toward other people*; *mental habits*; *purpose and responsibility*; *information handling*; *leadership quality*; *usefulness of information generated*; *level of training received*; *level of education received.* These 11 variables were considered to be important indicators of how an individual might perceive professional relationships with design team colleagues.

The identification of these different aspects of building profession peer assessment, provided this project with specific topics which would ultimately allow an examination of the evolution and development of attitude towards disparate building design team disciplines. In addition it was felt that the three source studies identified above, might also allow the opportunity for comparing the findings anticipated from this current research project with findings from a cognate field of interest.

5.3 Inter-professional communication, attitude and attitude measurement

5.3.1 The link between inter-professional communication and professional attitude

Previous sections have developed the view that organisation and group culture is based more on shared meanings and cultural norms, and less on factors such as:- professional language, communication media and presentation tools. Group misunderstanding, at a face to face level, should be treated as a cultural issue rather than an issue of individual personality.[601] Cultural differences which exist within multi-disciplinary organisations in terms of: (i) differences in appropriate social rituals between disparate specialists and professionals; (ii) reliance on stereotypes rather than professional realities; and (iii) different non-verbal communication systems, lead ultimately to communication problems within the organisation. The quality of interaction between disparate specialists was discussed earlier and apparently has an influence on communication, and ultimately the success of a project.[602,603] .

An analysis of multi-disciplinary relationships must concentrate on factors influenced by: perceived hierarchies, changing roles and the professional training of the participants. The innovative process is influenced by the *attitudes* which the organisation members hold. Evidence suggests there is a positive relationship between education and attitude toward change and innovation[604]. Acknowledging the potential of change, precedes a wish for a multi-disciplinary team to seek innovative solutions [605,606].

Conflict, which exists in an inter-personal and inter-group environment, is open to influence from the perceptions and cognitions of the members interacting within established professional cultural rules and values[607 608]. Research looking at conflict resolution, concluded that the process of communication, the perception of the group, and the attitude held toward peers, were positively linked in a co-operative organisation, and that co-operation was induced by (and induced) a perceived similarity in overarching beliefs and attitudes. Positive *attitudes* therefore were argued to be determinants of open and effective *communication*[609]. It was argued that professional attitudes could be studied using an individual's opinion of conventional and more recent building professional stereotypes, and that perceptions of peer group empathy (attitudes which affect ego involvement and trust) influence co-operative input to the innovative design process[610].

A consensus of previous research, argued that differences in dealing with people are largely a matter of values and attitudes, and that these attitudes *can* be modified by 'training'. Indeed it was argued that what a specialist does when dealing with other disparate disciplines, is determined by what their attitudes let them do. The way to improve interactive skills, therefore, was argued to be largely a function of influencing positively professional attitudes and behaviours (where behavioural changes can themselves be said to induce attitude change)[611].

Effective design and construction was seen as resulting from efficient communication. Efficient communication may be defined as a function of a cultural system; culture may in turn be defined as consisting of derived and selected ideas and especially attached values[612]. These values are applied to objects of need, desire and attitude. Attitude therefore is seen as an important variable of effective communication. The sections below investigated how attitude is measured and addressed.

5.3.2 Measuring professional attitude

Thurstone[613] points out that when attitudes are measured, even if the questions are about beliefs, thoughts, intended behaviour or actual self-reported behaviour, what is actually being assessed is the feeling component. Every question which seems to focus on beliefs or likely behaviours actually implies something about feelings, and it is this that is the basis of the measurement of the attitude. Whilst debate exists as to whether or not there is a *simple* relationship between people's attitudes and their specific behaviours, addressing attitudes *can* be of practical use in informing policy decisions which affect social environments[614]; or more specifically in the case of this thesis, policy which seeks to affect an educational process attempting improvements in integrative action.

Attitudes held by the disparate professions of the building design team require description and definition. Public domain[615] beliefs, feelings and behavioural tendencies[616] held more or less in common by those at the same stage in their professional development require examination. It has been proposed that the public domain attitudes of importance to this research would be best studied by a nomothetic approach to understanding personality traits, which carefully compares *many* individuals in terms of the personality traits commonly found in most people to some degree.[617] This nomothetic method was adopted to extract the common elements of individual attitude which go towards development of professional attitude. The rationale for the approach adopted, draws on a number of social psychological texts.[618] These provided essential information about the field of attitude measurement, and facilitated the choice of the optimum technique to determine attitude measurement in this particular research project.

The development of an *attitude* scale[619] was held to be of prime importance. Moser and Kalton[620] state that '*by employing an attitude scaling procedure individuals can be assigned a numerical score to indicate their position on a dimension of interest*'; scores allow inference of meaning. Of the principal scaling methods, explained and expounded in various social psychological texts[621] and summarised as: the method *of equal appearing intervals*; the *social distance scale*; the *cumulative-scaling* method; the *scale discrimination* technique; and, the method of *summated ratings*, the last was chosen as most appropriate to this project.

The method of *equal appearing interviews* (sometimes termed differential scaling) and the *scale discrimination technique* both require subjective vetting by suitably qualified and experienced judges before the scale can be applied. This intermediate stage often creates problems in that attitudes held by the judges may influence attitude measurement of a given sample. Attitude analysis of those individuals deemed suitably qualified to judge is apt to confuse the main objective. The *social distance scale* measurement technique, used mainly to differentiate international cross opinion was felt to be inappropriate for the prospective sample. The *cumulative scaling method* was felt to be too restrictive, since this method seeks to attain a high degree of unidimensionality. In other words the cumulative scaling method seeks perfect correlations between item scores to show that the attitude statements all belong to the same dimension.

The method chosen, that of *summated ratings in the study of attitudes*, was developed by Likert in his studies of imperialism and internationalism in the mid 1930's. The Likert scale can be said to perform well when it comes to a reliable ordering of people with regard to a particular attitude, and gives more precise information about a respondents degree of agreement or disagreement. It also provides a flexibility of questioning which allows a number of experimental 'wild-card' statement enquiries to be made. Such flexibility was utilised in the case study analyses carried out by this project.

In summary, to allow sensitive measurement of favourable or unfavourable feelings towards the disparate professions, a (Likert) Attitude Scale Questionnaire[622] was developed.

5.4 The development, internal validity, reliability, and application of the attitude scale questionnaire

5.4.1 Development of the attitude scale questionnaire

Section 5.2 above describes the identification of the important factors of building profession peer assessment. These are restated as: *social status*; *contribution to the building industry*; *aesthetic-creative motivation*; *orientation toward other people*; *mental habits*; *purpose and responsibility*; *information handling*; *leadership quality*; *usefulness of information generated*; *level of training received*; and *level of education received.* Having identified the different aspects of the topic of building profession peer assessment, a pool of potential questionnaire items was formulated. This pool of questionnaire statements was devised to incorporate the factors above. Subject agreement or disagreement with devised statements would indicate a favourability or unfavourability towards a design team colleague at a specific stage in the respondents professional development.

Of the 50 statements originally adapted by Stringer[623], from an existing pro-forma developed by the Institute of Personality Assessment and Research at the University of California[624], 26 of these statements were further adapted by *this* research project to examine aspects of professional peer assessment. The 26 statements chosen, were adapted to incorporate variables of professional attitude dealing with the respondents disposition towards their professional colleague(s) in terms of: *aesthetic-creative motivation*; *orientation toward other people*; *mental habits*; *purpose and responsibility*; and, *information handling*. A further 5 questionnaire statements were devised to reflect the aspects, identified by Higgins and Jessop,[625] of *social status*; and *contribution to the building industry*. In addition to these, 11 statements were constructed to incorporate other important variables of professional relations, identified by Faulkner and Day[626] as: *leadership quality*; *usefulness of information generated*; *level of training received*; and *level of education received*.

Collectively, the 42 statements formed the foundation of an attitude scale questionnaire. The statements were formally identified as either favourable or, alternatively, unfavourable, and randomised to avoid the possibility of an automatic response set of agreement or disagreement on the part of the respondent.

Each of the items was internally 'scored'. Favourable items were given a high score of 5, unfavourable items were given a low score of 1, as shown below:

Favourable statement scoring (pro-)		Unfavourable statement scoring (anti-)	
strongly agree	5	strongly agree	1
agree	4	agree	2
uncertain	3	uncertain	3
disagree	2	disagree	4
disagree strongly	1	disagree strongly	5

Table 5.1
Attitude scale questionnaire: internal score reference

The finalised questionnaire which contained similar numbers of statements where agreement would imply either favourable or unfavourable attitudes, also contained a covering sheet requesting respondents to give details such as:- course; year of study; sex;

domicile; age; construction industry experience; and, parent or guardian occupation involvement in the construction industry. See ***Appendix A, item 5.1***, which shows the attitude scale questionnaire development table (pre-internal validity procedure).

5.4.2 Testing the internal validity of the attitude scale questionnaire

To establish the *internal validity* of the questionnaire (to verify that all items measure attitudes held towards other building design disciplines) any of the 42 items which did *not* appear to measure attitudes towards other disciplines, were identified and removed. The precedent for the process of validation adopted, by this study, is well documented[627]. The *internal validity* procedure is described below:

(i) A group was identified to take part in the pilot study to internally validate the attitude scale.

(ii) The scores for each respondent were calculated, and equal numbers of subjects with High and Low scores were identified. This corresponded to Positive and Negative Score Groups respectively.

(iii) Each questionnaire statement was assessed in turn to decide whether or not it discriminated between the High and Low attitude groups. Did the people in the High attitude group actually give a high score on each individual item. Did those in the Low attitude group actually give low scores to each individual item.

(iv) The frequency of scores of 4 or 5 for each item in the questionnaire were identified among the High Scorers and alternatively among the Low Scorers. Tally's were made for all (High Group and Low Group) respondent replies of 4 or 5, for statement number one, sequentially through to statement number forty two in the original questionnaire.

(v) If High Group and Low Group frequency scores for each item were equal, then that item was *not* discriminating, and was eliminated from the questionnaire. If on the other hand there was a clear difference between the scores of the High and Low groupings, this indicated that the statement in question was discriminatory, and thus was retained by the questionnaire. (There is no definite rule which determines the size of difference required before an item is eliminated, or the level of similarity before an item is retained. Careful subjective analysis of the results was carefully carried out)

Using the above procedure, the 42 statement attitude scale questionnaire (see ***Appendix A, item 5.2***) was given to 24 intermediate stage students from the Faculty of Design, Robert Gordon University in Aberdeen. A group of eleven high scorers (those holding an overall positive attitude towards peers), and by way of comparison a group of eleven low scorers (those holding an overall unfavourable attitude towards peers) were identified (two mid-range median scoring students were eliminated from the validation process).

Favourable responses (of 4 or 5) for each of the 42 statements were noted for both groupings, and tallies were compared to determine whether or not the statement actually discriminated between favourable and unfavourable attitudes held towards peers. In 18 of the 42 statements, the favourable responses given by the High score grouping, and the favourable responses given by the Low score grouping, were found to be the same or nearly the same. These 18 items were eliminated from the questionnaire. The remaining 24 items were found to display clear differences between scores given by the High score grouping and scores given by the Low score grouping. ***Appendix A, item 5.3*** shows internal validity, item by item analysis. The *internally validated* questionnaire now contained only 24 of the original 42 attitude scale statements

5.4.3 Testing the reliability of the attitude scale questionnaire

After the attitude scale questionnaire was amended using the process of internal validation described above, *reliability* levels of the questionnaire were sought. Test - retest results require to give a (high) positive correlation. In other words the questionnaire is required to give the same measurement of attitude, or almost the same, when it is given to the same group of people on two separate occasions. The *reliability* procedure adopted is described below:

(i) The original questionnaire was given to a sample group (the same group and same responses used originally in the internal validation process were further utilised)

(ii) The amended, internally validated questionnaire was then given to this same sample group, not less than 7 days after the original sitting. However only the internally validated (24) items were to be used in the test - retest calculation of the questionnaire's reliability co-efficient.

(iii) Test-retest reliability data was then generated by applying a statistical test (Spearman's rho) to the data in order to establish a coefficient of correlation. This conventional method of expressing the degree of reliability[628], would indicate the degree to which the subjects give roughly similar scores on the retest, to those which they gave in the first testing.

Using the above procedure the internally validated 24 item questionnaire was again given to the same group (Intermediate stage students from the Faculty of Design, Robert Gordon University in Aberdeen) 14 days after gathering their responses to the original 42 item questionnaire. This interim period contained no irregularities in curricula. These retest responses, coupled with responses (taken only from the 24 internally validated items) gained in the first sitting, were used to assess the *reliability* of the internally validated questionnaire. A test - retest calculation of the questionnaire's reliability coefficient was generated by applying a Spearman's rho calculation. The initial and re-test responses calculated for 19 students, were used to generate the rank correlation. The correlation co-efficient gained from this data-set gave a value of *0.8* (see ***Appendix A, item 5.4***). This value of 0.8 indicated that there was indeed a marked relationship between the original attitude scores, and the retested attitude scores gained 14 days later. The attitude scale questionnaire developed by this study was found to be reliable.

The finalised attitude scale questionnaire having been developed and internally validated, was now found to be reliable and ready to use. ***Appendix A, item 5.5*** shows the internally validated and reliability tested 24 statement attitude scale questionnaire.

5.4.4 Defining the subject

The attitude scale questionnaire required the sample of students to agree or disagree with a series of statements about a building design profession that was different to the profession they had chosen for themselves. The project sought to establish attitudes held towards disciplines which differed from the students own future professional objectives. It was recognised that there are few construction specialisms that oppose one another directly, therefore the choice of questionnaire subject for a particular sample grouping required attention.

Traditionally accepted building professional objectives in the UK allow very broad classification into design related activities on the one hand and building and management activities on the other.[629] The interaction of these two broad activities has seldom been completely trouble free.[630] In addition it was decided that tertiary educational courses which differ extensively in curricula, must also reflect a difference in field of interest. Based on these conditions, the profession chosen as the subject of the attitude scale questionnaire for the different sample groups was predetermined and allocated prior to the completion of the questionnaire. This approach allowed a wide range of disciplines to be questioned about their attitudes towards disparate design team colleagues.

5.4.5 Application of the attitude scale questionnaire: methodological approach

This project seeks ultimately to address holistically the *disparate* evolution of attitudes held at different stages of professional development by different specialisms. Tertiary education is seen as the key. The research postulate presented by this thesis, described simplistically in terms of research design and methodology, might be stated as: change in the independent variable of attitude, brought about by addressing such attitude(s) through multi-disciplinary educational initiatives, will produce a change (an improvement) in what may be described as the dependent variable of inter-disciplinary communication and participation. A proposition such as this requires an *experimental approach*[631] to be adopted.

Before the experimental approach was made more explicit in this project however, important factors required recognition. Principally it was acknowledged that some Higher Educational Institutions were already conducting a degree of multi-disciplinary education. A number of courses concerned with the creation and maintenance of the built environment, had already begun to address their isolated curricula through inter-disciplinary workshops and project work. However, these existing independent educational *experiments* were found not to be addressing the potential for change in the independent variable of student attitude. Indeed no attempt had been made by the educational establishments currently running different forms of inter-disciplinary training, to measure changes in attitude by participants, as the necessary gauge for project success. Building upon this knowledge (section 5.5 below), the methodological approach adopted by this project sought to utilise these existing unproven programmes of inter-disciplinary education, and measure their effectiveness empirically. Effectively this project tapped directly into the *experiments* set up by others, as part of its own experimental methodology. This approach provided the optimum experimental environment(s) to measure attitude change in a number of different scenarios.

To chart the evolution, development, and potential for change of professional attitudes, a *longitudinal comparison*[632] of a sample participating in the different experimental inter-disciplinary programmes was conducted. The sample selected (section 5.5 below) consisted of students from different stages of a number of disparate design, building and engineering courses. Vocationally disparate students, at different stages of professional development, formed sample groupings. Each of the sample groupings were given the finalised attitude scale questionnaire. Scores calculated from the responses, obtained from the application of the attitude scale questionnaire, allowed the compilation of a data base of attitudes held towards peer professions.

Sample groups which were about to participate in multi-disciplinary educational initiatives were identified (section 5.5). Data gained from these sample groupings at two different times (before and then again after participation in integrated educational initiatives) allowed *longitudinal* analysis. Similarly, combining the different groupings into the same data base, allowed a *comparison* analysis.

An examination of student responses in successive years of the same course was used to give an idea of attitude development over time *without* influence from multi-disciplinary integrative educational initiatives. The year-by-year comparison of different students at different points in a particular course gave a *cross-sectional* or *simulated longitudinal* comparison. Indeed with vocational courses in design, building and engineering taking up to seven years to complete, an approach which sought to examine the development of *individuals* over that time, was not seen as feasible. It was felt that the comparison of *groups,* subjected to similar selection, education and maturation processes, would give a satisfactory idea of (vocationally isolated) attitude development over time.

In practical terms, it was felt that an experimental approach that sought to *recreate* different experimental inter-disciplinary programmes, when various forms were already known to exist, would be at best inadequate, and at worst unrepresentative of the alternative educational initiatives having the potential to change attitude. Therefore the experimental approach adopted by this project, in which data was generated from a longitudinal comparison (and simulated longitudinal comparison) of sample groupings, participating in existing educational initiatives, represents a pragmatic approach to the charting and subsequent prediction of a building design team integration ethos.

5.5 Contemporary multi-disciplinary education: establishing sample groupings

5.5.1 Assessing current pedagogic philosophies for the integration of construction disciplines

In an effort to build upon data provided by previous studies, and to gain an up-to-date picture of the nature of multi-disciplinary education for courses in subjects related to the built environment, this project conducted an investigation of Higher Educational Institutions in the UK. Consultation of academics knowledgeable in the field was carried out. This consultation process sought to clarify the current state of inter-disciplinary design, building and engineering education in the UK.

All UK Higher Educational Institutions, who offered more than one building design discipline, were identified[633]. These Institutions were sent a written request for information. Letters requested knowledge and information of in-house and/or external research into the examination and measurement of sociometric perception of students from disparate disciplines, who had taken part in multi-disciplinary educational initiatives. Letters requesting information (***Appendix A, item 5.6*** which shows an example of the letter sent), were sent to relevant Faculty Deans, Heads of School, and Tutors teaching in Higher Educational Institutions in the UK cities of:

Aberdeen (Urquhart/Donald)	Bath (A. K. Day)	Belfast (Peter Fawcett)
Birmingham (Tom Muir)	Cambridge (Peter Carolin)	Dundee (James Paul)
Brighton (Robert MacLeod)	Edinburgh H.W. (Hunter Cairns)	Glasgow (A. MacMillan)
Edinburgh U. (Andrew Gilmour)	Hull (Tom Woolley)	Leeds (Barry Fryer)
Huddersfield (George Calderbank)	Liverpool P. (Douglas Wall)	Liverpool U. (J. N. Tarn)
Leicester (George Henderson)	London Kingston (Peter Jacob)	London South (James Franks)
London Central (Michael Romans)	Manchester U. (Rodger Stonehouse)	Newcastle (Rodger Tillotson)
Manchester P. (Raymond Burton)	Portsmouth (J. A. Powell)	Reading (Bob Kennedy)
Plymouth (Adrian Gale)	Strathclyde (Lamond Laing)	Sheffield (Kenneth Murta)

Comments obtained from this information request are detailed in the table below:

University	*Perception of Need for cross-disciplinary education*	*Preferred Stage of Implementation (if any)*	*Dual-disciplinary Opportunities*	*Multi-disciplinary Opportunities*	*Future Plans*
University of Cambridge, Department of Architecture, Peter Carolin	Carolin is very suspicious about the need for multi-disciplinary education. He states that: 'Virtually none of the pleas come from Architects or Engineers of distinction. They come instead from academic entrepreneurs wishing to enlarge their academic power base, and from others who have climbed onto a fashionable bandwagon'.	Post graduate Masters stage is said to provide the best integrative opportunities. Cambridge offer an MSc in Collaborative Design. Frank Newby, at a conference in Bath, is cited as providing the reason why 'formative year' integration is scorned: 'a young Architect can learn more from an experienced Engineer, than from an engineering student'.	Architectural and Engineering integration only. *Final* year Architectural & Engineering *students* run a collaborative design project for *first* year students. The School of Architecture employs several Engineering tutors.	Nil	It is recognised that 'Architectural & Engineering education is not perfect'. There is a strong case for an Architectural option to be established within the *final* stages of an undergraduate Engineering course at Cambridge
University of Central England in Birmingham, Faculty of the Built Environs., Tom Muir / John Kirwan.	Integration seen as very important at UCE.	Integration of disciplines is encouraged at all stages of each vocational course offered. There is a 12 year tradition for *final* stage cross-disciplinary student projects	Multi-disciplinary approach preferred	*Final* stage *project work* comprises the disciplines of: Architecture (stage 4/5), Building Surveying (stage 3), Quantity Surveying (stage 4), as well as intermediate stage students in the disciplines of Building, Estate Management, Housing, Planning, and Landscape Architecture. An *Initial* stage Core and Foundation module serves stage 1 of the disciplines mentioned above.	A recently validated course structure makes common 7 units out of a total of 36, for each of one of 8 vocational disciplines. The 7 'common' units, spread over 4 or 5 stages, bring students together in: General Presentation and Learning Skills; General Construction Tech.; Basic Building History; Industrial Development; European Studies; General Management Skills; and the multi-disciplinary projects outlined opposite.

Table 5.2 Multi-disciplinary educational opportunities in UK Higher Educational Institutions

University	*Perception of Need for cross-disciplinary education*	*Preferred Stage of Implementation (if any)*	*Dual-disciplinary Opportunities*	*Multi-disciplinary Opportunities*	*Future Plans*
De Montford University, Leicester, School of the Built Environment, Department of Architecture, D. George Henderson.	Henderson believes that 'Multi-disciplinary education requires an over-structured course which, more often than not leads to the tail wagging the dog'	Multi-disciplinary learning is felt to be best left until the senior stages, when students 'have a grasp of their particular subject area'.	Multi-disciplinary available	Best alternative is felt to be multi-disciplinary *tutor* deployment; although *previous* projects have involved Architectural, Surveying, and Interior and Industrial Design *students* at an their undergraduate stage.	nil
University of Dundee, Duncan of Jordanstone College of Art, Departs. of Architecture & Engineering, James Paul	*Students* encouraged to develop their *own* ad hoc cross-disciplinary contacts within their peers in the final stages.	Final stages felt to be optimum	Multi-disciplinary opportunities available	As part of final year (open) thesis, Architectural students liaise with other students in subjects including: Art, Public Art, Computing, & Surveying disciplines. This occurs by unstructured personal initiatives made by the students themselves.	Laissez-faire outlook
Edinburgh University, David Cowling	In the early 1960's inter-disciplinary initiatives between Architectural & Engineering were widely reported. Today these courses exist as separate vocational units.	A (post graduate) Masters course in Construction and Design provides the main cross-professional educational outlet	Architecture & Engineering shared commonality in the early 1960's. Little interaction occurs today	Multi-disciplinary education opportunities exist at a post graduate stage.	Concentration on Masters level integration.
Heriot Watt University, Department of Building Engineering, Hunter Cairns	Integration of courses deemed important.	Final stage (collaborative design project) is deemed best suited to cross-disciplinary education	Multi-disciplinary available	Collaborative design project for *final* stage students in Architecture, Civil Engineering, Building, Building Surveying, Building Services Engineering, Estate Management, & Quantity Surveying	Concentration on this collaborative project

Table 5.2 Multi-disciplinary educational opportunities in UK Higher Educational Institutions

University	*Perception of Need for cross-disciplinary education*	*Preferred Stage of Implementation (if any)*	*Dual-disciplinary Opportunities*	*Multi-disciplinary Opportunities*	*Future Plans*
University of Huddersfield, School of Design Technology, G. Calderbank	Multi-disciplinary *tutor* deployment important	Multi-disciplinary *tutor* deployment to all relevant years	Huddersfield only caters for Architecture students	Huddersfield only caters for Architecture students	nil
Leeds Metropolitan University, Leeds School of the Environment, Barry Fryer, David Whitney	In the mid 1980's inter-disciplinary initiatives between several courses were widely reported. Today these courses exist as separate vocational units.	Intermediate and Final stage cross-disciplinary project-work is encouraged	Dual disciplinary projects:- Stage 2 Building students pair with stage 2 Environmental Health students Stage 3 Planning students pair with Stage 5 Architects; Intermed. Landscape Archs with intermed. 3D Design; Final stage Landscape Archs with Final stage Archs; Stage 4 Quantity Surveyors with final stage Architects.	Concentration on Dual-disciplinary projects	Plans for stage 1: Quantity Surveying, Building Surveying, Construction Management, 3D Art and Art students to participate in 'Presentation and Learning Studies' module. BS & QS students to pursue Development Process unit also at stage 1.
University of Manchester, School of Architecture, Martin Symes	Manchester perceive a need to integrate aspects of Architecture & Structural Engineering to facilitate a more cross-disciplinary approach to design	A *joint* undergraduate degree is offered in Structural Engineering with Architecture. Masters stage integration is also promoted	A dual-disciplinary degree in Architecture and Structural Engineering is established	Multi-disciplinary opportunities exist at post-graduate stage, for Architects, Landscape Architects, & Town Planners, in an Urban Regeneration MA	Concentration on the joint design degree, as well as the Urban Regeneration MA
University of Newcastle, Dept. of Architecture, Rodger Tillotson	Perceived need to integrate Architectural & Engineering courses.	*Final* stage project co-operation encouraged	Architectural students are paired with Services Engineering students from the neighbouring Newcastle University of Northumbria. The students 'use one another as consultants' in the fulfilment of final degree submissions.	nil	nil
University of Plymouth, School of Architecture, Adrian Gale.	Cross-disciplinary integration is unavailable	ditto	ditto	ditto	ditto

Table 5.2 Multi-disciplinary educational opportunities in UK Higher Educational Institutions

University	*Perception of Need for cross-disciplinary education*	*Preferred Stage of Implementation (if any)*	*Dual-disciplinary Opportunities*	*Multi-disciplinary Opportunities*	*Future Plans*
The Robert Gordon University, Aberdeen, Faculty of Design, J. Donald, D. Urquhart	Perceived need to integrate Architecture and Surveying disciplines	Intermediate stage preferred	Multi-disciplinary opportunities available	Stage 3 Architectural, Building Surveying, and Quantity Surveying students take part in a Feasibility, Development & design project workshop	Concentration on the stage 3 workshop
South Bank University, London, Faculty of Design, James Franks	Franks comments that South Bank have, since the publication of the Banwell Report in the mid 1960's, embraced the concept of greater integration in the educational process of building professionals.	Although they currently integrate students in the *final* stages of their course, South Bank express a belief that this may be 'too late to start bringing the disciplines together'.	Multi-disciplinary opportunities available	Final stage undergraduate 'Architectural and Building discipline' students take part in a 'design, cost & build' project. At post graduate level Franks states that 'an MSc in Construction Management provides an opportunity to reconcile differences which might have developed among disparate disciplines, by recruiting as a matter of policy, all disciplines onto (a) course' where various projects encourage working in inter-disciplinary teams. Concern arises that this MSc may be 'too late to alleviate the them and us attitudes so prevalent in the construction industry'	Ensuring the continued 'success' of current initiatives
University of Strathclyde, Glasgow, Centre for Building Design Engineering, Lamond Laing.	Strathclyde perceive a need to integrate aspects of Architecture, Structural Engineering, Building Services Engineering and Management to facilitate a more cross-disciplinary approach to design.	A *joint* undergraduate degree is offered in Building Design Engineering. Also, promotion of inter-professional communication in the design process occurs through an MSc in Integrated Building Design	Multi-disciplinary opportunities available	Architecture, Structural Engineering, Building Services Engineering and Management are integrated within a joint degree. An MSc in Integrated Building Design is also offered	Consolidate the joint degree and the MSc

Table 5.2 Multi-disciplinary educational opportunities in UK Higher Educational Institutions

University	*Perception of Need for cross-disciplinary education*	*Preferred Stage of Implementation (if any)*	*Dual-disciplinary Opportunities*	*Multi-disciplinary Opportunities*	*Future Plans*
University of Westminster, School of Architecture and Engineering, Paul E. Regan.	Westminster perceive a need to integrate Architecture and Structural Engineering to facilitate a more cross-disciplinary approach to design.	A *joint* undergraduate degree is offered in Architectural Engineering. The impact which Architectural Engineering graduates have on the Diploma in Architecture, which many graduates subsequently pursue, has yet to be assessed.	Regan suggests that 'This hybrid between Architecture & Structural Engineering is intended as the first stage of education for a career in either discipline, or for a cross-disciplinary one... Whilst the RIBA recognise this qualification as fulfilling the RIBA Part One Exam, the Institute of Structural Engineers has yet to validate the course' The course is seen as a technical version of Architecture and attracts more students interested in Arch. than Engineering	nil	Consolidate and fully validate the course with the ISE

Table 5.2 Multi-disciplinary educational opportunities in UK Higher Educational Institutions

5.5.1 *(cont.)* Assessing current pedagogic philosophies for the integration of construction disciplines

Table 5.2 outlines comments received as a result of a written request for information, made to academics involved in cross-disciplinary education for vocational courses concerned with the built environment. It is clear that each Higher Educational Institution has different ideas on how to organise their own specific resources. Any educational approach which seeks to improve professional integration through education must also address differences in available resources. Recommendations advanced in further sections of this research project explore resource restriction at length.

Interpretation of the information contained in Table 5.2 seems to emphasise further areas of contention already discussed namely that, in the field of multi-disciplinary education: (i) There is a great deal of tutor difference of opinion regarding the needs and merits of educational integration for disparate design, building and engineering courses, (ii) Much difference exists in what is perceived to be the preferred stage to introduce integration initiatives, (iii) Relatively closer links exist between architecture and engineering than between other building disciplines, and, (iv) Controversy exists as to whether *commonality and attendance at common core lectures*, or, *integrated project work*, or, *a combination of commonality and project work*, or, *an isolated undergraduate status quo*, or, *an overarching post graduate course* is the best approach to achieve effective integration of a disparate student body.

Building upon this initial request for information, further correspondence was conducted with several Higher Educational Institutions. These Higher Educational Institutions were involved in cross-disciplinary project-work which had attracted a degree of media attention. Contact was made with relevant members of staff (see ***Appendix A, item 5.7*** describing contact procedure).

An overview of the processes adopted by the various departments and individuals for the provision of inter-disciplinary education was obtained. More formal discussions concerned trends towards integrated education for students of the built environment, and concentrated on finding the extent of work done in an examination and measurement of the sociometric perception of students from disparate disciplines, who had taken part in multi-disciplinary educational initiatives. This project sought to ascertain whether the effects of participation in educational projects, on student perceptions of the status of self and peers, had been quantitatively studied elsewhere. It was found that little attention is given to professional attitude development. It is further emphasised that this presents a gap in the existing body of knowledge concerning multi-disciplinary education.

From the information received and reviewed above, contemporary multi-disciplinary educational initiatives appear to offer no extrinsic means to test, or determine the extent of, success or failure in terms of *improving inter-professional relationships*. Little opportunity is found to exist for objective assessment or improvement in, what may be stated simplistically as professional relations programmes. Yet an examination and measurement of the attitude development towards peers, of students who take part in multi-disciplinary educational initiatives, can provide much essential information. Establishing a sample for the longitudinal comparison of attitude scale questionnaire responses was imperative. Choice of experimental locations, based on the format and structure of existing inter-disciplinary educational programmes, is now described.

5.5.2 Establishing sample groupings: preferred case study locations

Previous sections have highlighted dissatisfaction with the traditional isolated curricula of tertiary education for construction professionals. The dual-disciplinary and multi-disciplinary educational initiatives outlined in Table 5.2 represent contemporary philosophies in the pursuit of a more integrated professional educational process. The choice of sample for the experimental case study needed to be representative of the various approaches to cross-disciplinary education employed by the Higher Educational Institutions. The location chosen for case study had to exhibit a number of important pedagogic factors: (i) the opportunity to investigate both full time and part time students, (ii) the opportunity to investigate sandwich year returning students, (ii) the opportunity to investigate a full range of vocational initial stage, intermediate stage, and final stage students, (iii) investigation of common-core units for students, (iv) the opportunity to assess *joint* undergraduate design courses, and, (v) investigation of different types of collaborative projects/workshops.

It was felt that no location could singularly provide the opportunity to explore these important pedagogic factors. Specific case study experiments were subsequently highlighted which could best afford an examination of (1) common core unit and collaborative project assessments for initial stage students from several vocational courses, (2) common core unit and collaborative project assessments for final stage students from several vocational courses, (3) short intensive collaborative workshops for intermediate stage courses, and, (4) an examination of a joint (Architectural and Engineering) design course.

Three case study locations were chosen based on their abilities to provide the most suitable experimental environments. These locations provided the potential vehicles for measuring current levels of integrated education. The University of Central England in Birmingham, The Robert Gordon University Aberdeen, and The University of Strathclyde in Glasgow were approached, and permission was obtained to access the student participants, the University tutors and all relevant course/unit documentation. A summary of the projects chosen, as reflecting and affording a detailed analysis of existing pedagogic integrative techniques, are described below:

5.5.2.1 Case study 1

University of Central England in Birmingham, Stage One, Multi-disciplinary Participation

The 'Common Learning Skills - C1 Unit' was a programme common to: all first year full-time students, full-time with sandwich period employment students, and (in isolation) part-time students, enrolled on six degree courses in Architecture, Building Surveying, Environmental Planning, Estate Management, Landscape Architecture, and Quantity Surveying. The objectives outlined for this unit were described as: '(i) Promoting contact between students studying in different, but related, professional disciplines associated with the Built Environment, in order to encourage a greater understanding of each others contribution; (ii) Encouraging the recognition of common value systems between the built environment professions, in addition to those of their own chosen specialism, and (iii) Providing a range of *general and basic* educational skills to assist in coping with the more complex work which lies ahead'.

Performance in the stage 1 Common Learning Skills Unit was said to 'contribute' to the overall assessment of the individual student. This 'C1-Unit' occurred one day per week during the first semester (in other words, one day per week during the initial 15 weeks of each disciplines first year). Three main subjects occupying equal time and rating, taking the form of mixed lectures and seminars[634], covered non-vocational topics. These were titled: (i) Personal Management and Data Accessing, (ii) Collection and Presentation of Data and Technology, and, (iii) Communication Skills & *Group Project* (where the Group Project occupied approximately 12 *x* 1 hour per week segments of the C1-Unit).

The *Group Project* segment was carried out in mixed discipline 'teams', comprising of approximately 15 students, randomly chosen from the six participating Schools of the Faculty for the Built Environment. Its general purpose was stated as a means to allow the students to:- (i) explore the advantages and disadvantages of working in groups with common objectives, (ii) discover how different skills and interests can be harnessed, and (iii) utilise the contents of the non-vocational subject lectures and seminars to solve a series of practical problems. The *Group Project* required the student groups to undertake the organisation of 'a carnival to celebrate the birth of a new University in the English Midlands'. The student groups were required to work as a team to prepare a report detailing all aspects of the *planning* and *organisation* of such an event.

5.5.2.2 Case Study 2

University of Central England in Birmingham, Stages Three to Final, Multi-disciplinary Participation

The Inter-Professional Project (IPP) was undertaken by approximately 300 full-time (and in isolation 150 part-time) undergraduate and postgraduate students from 7 schools of the Faculty of the Built Environment: Architecture (Stage 4/5 students), Building Surveying (Stage 3 students), Quantity Surveying (Stage 4 students), as well as intermediate stage students from the disciplines of Building, Estate Management, Environmental Planning, and Landscape Architecture.

The IPP took place over one semester; 1 day per week for 15 weeks. It involved an examination and analysis of the opportunities and obligations which exist for the development of a given site, in relation to its physical and socio-economic context. This was performed in randomly chosen multi-disciplinary, 15 member, teams. The project was split into two phases. The first phase required a written 'initial strategic study' of the site by the various groups. This task was performed in conjunction with a series of 'Management' skills lectures which examined 'teamwork' as well as more specific lectures which concentrated on logistical, financial and legislative areas. The second phase required the development of initial strategic studies, to produce a 'viable plan of development' for the chosen site.

Assessment of the IPP unit was evenly distributed between the three areas of 'Strategic Study', 'Management Skills' & 'Project Report'. Student peer group assessment in these three areas accounted for 50% of the overall mark. The remaining 50% was allocated by tutor assessment of the presentations for phase 1 & phase 2. Contribution of these marks to the individual students overall vocational assessment for the year were unspecified.

5.5.2.3 Case Study 3

The Robert Gordon University Aberdeen, Stage Three Architectural / Building Surveying / Quantity Surveying Participation

This Interdisciplinary Workshop was conducted at Stage 3 of the participating disciplines honours degree curricula. The aims of the project were described as seeking (i) to encourage interdisciplinary group working in the resolution of complex problems, (ii) to foster an awareness and appreciation of the contribution of other disciplines, (iii) to encourage informed debate and an analytical process to assess clients needs and the definition of a problem, and, (iv) to develop skills in the definition and management of tasks within a group situation.

The project required students from the courses of Architecture, Building Surveying and Quantity Surveying to work together in given inter-disciplinary teams of 5 or 6, to prepare a 'feasibility study' of a given underdeveloped site. The workshop was conducted over 5 consecutive days during which time the teams were (i) briefed, (ii) visited the site, (iii) prepared and informally presented an interim report to staff, (iv) developed the initial proposal, and, (v) formally presented their proposal. Individual student marks were allocated by combining an overall tutor-consortium group mark, with a peer assessment mark. These marks were said to contribute to the vocational students overall year assessment.

5.5.2.4 Case study 4

University of Strathclyde, Centre for Building Design Engineering, undergraduate course in Building Design Engineering.

This design based honours degree, integrated elements from vocational courses such as: Architecture, Building Services Engineering, and Structural Engineering, into a flexible course structure which allowed a choice of classes to be undertaken. Stage 1 & 2 followed the same common-core syllabus which incorporated: Building Technology; Building Design; Civil Engineering Design; Building Services Systems; Structural Systems Engineering; and Mathematics. Stage 3 & 4 chose to follow either: (i) the Architectural Stream (which allows exemption from the RIBA part 1 professional examinations); (ii) the Civil Engineering Stream (which allows exemption from the Institute of Civil Engineers part 1 & 2 professional examinations); or (iii) the Building Services Stream (which allows exemption from the Institute of Structural Engineers part 1 & 2 professional examinations). These streams are pursued towards Honours stage, and in many cases provide the stimulus to pursue the preferred discipline to Masters stage and professional chartership.

5.5.2.5 Summary of the choice of location for the case studies

In summary, the experimental case study sample groups, outlined above, were held to be representative of contemporary philosophies adopted by Higher Education Institutions in the pursuit of a more integrated professional education process. Detailed analysis of these educational outlooks was proposed to allow the development of empirical and measurable data sets able to examine further the project hypothesis. A full breakdown of the sample is tabulated below. Sample respondent numbers are categorised by University, discipline and course, and, stage of study, and as belonging to one of three educational curricula, pre-educational initiative disciplinary isolation, exposure to inter-disciplinary initiative, and, common curricula format. Column 1 and 2 of the table describe the course and stage. Columns 3, 4, 5, 6 and 7, describe numbers tested from segregated and alternatively integrated curricula from the locations of Aberdeen, Birmingham and Glasgow respectively.

Sample Breakdown		**University**				
		Aberdeen, RGU		**Birmingham, UCE**		**Glasgow, Strathclyde**
Discipline / Course	**Stage Year**	**Segregated**	**Integrated: Post-initiative**	**Segregated**	**Integrated: Post-initiative**	**Common curricula**
Arch.	(i)	49		48	16 (+ 1 rogue)	13
Arch.	(ii)	34				2
Arch.	(iii)	28	25			
Arch.	(iv - vi			9	21	9
B. D. E.	(i)					15
B. S.	(i)	12		28	37	
B. S.	(ii)	22				
B. S.	(iii)	12		14	24	
E. Mngmnt	(i)			45		
E. Planning	(i)			34		
Int. Design	(i)			4		
Land. Arch.	(i)			26		
Q. S.	(i)	29		25	25	
Q. S.	(ii)	24				
Q. S.	(iii)	27	25			
Q. S.	(iv)			25	18	

Cumulative total sample respondent number = **726**

Where:

Arch.	= Architecture
B. D. E.	= Building Design Engineering
B. S.	= Building Surveying
E. Mngmnt	= Estate Management
E. Plnning	= Environmental Planning
Int. Design	= Interior Design
Land. Arch.	= Landscape Architecture
Q.S.	= Quantity Surveying

Table 5.3
Attitude scale questionnaire: sample breakdown

This study has postulated that:- *Communication difficulties are primarily a function of cultural differences instilled by vocational education*; and that, *Communication gaps require educational initiatives able to bridge cultural differences instilled by vocational traditions in the educational process*. Analyses of student attitudes towards peers, held at various stages of professional development, facilitate empirical examination of these propositions.

5.6 Interpreting the data set: a brief discussion

Distribution of the attitude scale questionnaire to the sample groupings, described above, provided a data base of response scores. Considered interpretation of the data base was imperative.

A better understanding of the target group for multi-disciplinary pedagogic initiatives was deemed essential. A capacity for classifying respondents into one of several mutually exclusive groups, on the basis of an observed set of characteristics, was seen as allowing educators an opportunity to adapt integrative techniques to best suit identifiable groups. The attitude-scale questionnaire required each student to provide additional independent variables:- age, construction industry experience, course (title at matriculation), domicile (outwith term dates), full-time or part-time study, parent/guardian occupation (construction or other), pre or post participation in an integrative educational initiative, profession being described, sex, university, and, their current year of study. These independent variables were to be initially examined in terms of their ability to act as potential predictors of score outcome. Multiple regression[635] was carried out to allow a better understanding of the target group for multi-disciplinary pedagogic initiatives.

Also of importance in the examination of the data-base, was the ability to assess the significance of differences between the attitude scale responses of two or more sample groupings. Indeed if the methodology embraces longitudinal comparison, investigation of the data-set must include a facility to determine differences between *before* and *after* participation in particular cross-disciplinary projects, as well as determine differences between different groups of the combined data-set. Non-parametric tests[636], allowed assessment of the significance of differences between the attitude-scale responses of two, or more, independent sample groupings.

A more in-depth study of attitude-scale response is also required to allow Higher Educational Institutions an opportunity to adapt inter-disciplinary training techniques to identify and explore a relatively small number of factors that explain association among sets of interrelated attitude-scale items. This knowledge would allow educational initiatives an opportunity to address factors which have the potential to *improve* inter-disciplinary relationships. Factor Analysis[637] of the data-set allows Higher Educational Institutions to address directly potentially influential factors in inter-disciplinary relations.

Data analysis provided an extensive interpretative examination of the experimental case study locations. The information generated was used subsequently in the development of a simplified system of variables giving conditions for achieving an optimum educational initiative able to encourage and instil professional empathy.

5.7 Limitations of methodology

The methodology, described above, has been chosen as best suited to the examination of the nature of professional attitude towards other disciplines. Notwithstanding this assertion however, limitations to the methodology are acknowledged.

It is argued that the literature referenced at the end of this chapter (refs. 20 - 28) provided suitable source material to allow this project to taylor an established scaling technique, for measuring direction and extremity of attitudes, to a large scale survey of students of building, design and construction. However this study recognises that attitude is a complex concept which has been the subject of much study in social psychology. As a result this project has avoided the detailed social psychological ideas which surround attitude. This limitation is acknowledged.

It is recognised also that the link between attitude and behaviour does not have blanket support in the field of social psychology. It is argued however that enough support does exist to allow the assertion that differences in dealing with people are largely a matter of values and attitudes, and that these *can* be modified by structured training programmes.

Structured training programmes, to address integration, are a major concern of this study. It is recognised however that some commentators reject calls for initiatives at undergraduate level. Support exists instead for the retention of traditionally isolated specialist curricula, with the implementation of initiatives to integrate disciplines only at post-graduate or practitioner stage, if at all. Whilst the majority of academic and industrial literature endorses at least some form of undergraduate inter-disciplinary interaction, the alternative position which regards initiatives as *unable* to address inter-disciplinary problems, represents a limitation to the universality of the methodology adopted.

Whilst this study considers that the methodology chosen reflects progression *beyond* the existing knowledge base of research and literature, it is recognised that the methodology adopted may not satisfy those who see undergraduate education as unsuited to the instillation of empathy. This study would only reiterate that discussion, presented in previous sections, has found post-graduate education, and contextual variables such as contractual arrangement and inter-disciplinary practice as *less* able to address the main problem of design team latent conflict and communication difficulty, than structured initiatives proposed during undergraduate vocational education and professional development. The methodology chosen is sustained, although limitations are recognised.

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CHAPTER 6

RESULTS: SAMPLE ANALYSIS

CHAPTER 6

RESULTS: SAMPLE ANALYSES

6.1 Introduction

This section presents results which indicate the current state of the traditional vocational education process. Results come from the analyses of a sample which has had no exposure to experimental educational initiatives.

Professional disparity is examined at the outset of the section. Findings are then presented of the extent to which differences are instilled by vocational education. Results reflecting the evolution and development of professional affinity towards peers are then presented. A summary of the sample analyses concludes this section.

6.2 Professional disparity

This section initially re-examines the link between problems in communication and professional disparity. The differences between the professional disciplines are then investigated in terms of representing a major influence in the contribution to group differences in attitude scale scoring. Findings are then presented which address attitude differences, between different specialist disciplines, in terms of design or non-design orientation.

6.2.1 The link between problems in communication and professional disparity

This study has postulated that '*there are problems in the building design team created by difficulties of communication between different professional disciplines*'. Earlier sections of the thesis reviewed literature and discussed this proposition. Salient points, explored previously, are outlined in the paragraphs which follow.

Earlier discussion has argued that the split initiated, centuries ago, by the early building design guilds into design on the one hand and construction on the other, as well the protectionist seeds sown by the localised craft guilds, inadvertently nurtured the beginnings of an environment of confrontation within the British building design process[638]. Indeed it is clear that a high degree of dissatisfaction currently exists with contemporary procurement procedure and the processes of the building design team[639].

The UK Government, industrialists and academics who express concern about the performance of the *home* building industry are not alone. There appears to be a growing international trend to fractionalise professional input. As a result, uncertainty has arisen on how best to prepare future design team specialists to succeed in changing legislative and economic environments[640]. Government and industry are currently appealing for an improvement in communication across *disparate* professional interfaces, as the way towards a more efficient and effective construction industry. These appeals represent an impressive body of opinion, which believes that the construction process in the UK has yet to achieve an optimum level of production[641].

One of the strongest reported barriers to project team performance is professional power struggles and inter-professional conflict[642]. The need to address the perceptions and cognitions of each participating specialist towards their peers, to reduce conflict in the multi-disciplinary design process, is clear[643]. It is more the building professions and their disparate value systems, and less an adherence to organisational procedure, which influences the occurrence of conflictual exchange in the building design team[644].

The results presented below investigate the extent to which attitudes held towards peer professions, argued as potentially detrimental to the communication process of the building design team, are a function of the differences between disciplines. The findings below describe whether pursuing a particular specialist course of study during the vocational educational process influences significantly attitude scale scoring.

6.2.2 Disparate professional disciplines: the major influence in the contribution to group differences in attitude scale scoring

To assess the extent to which adherence to a specialist discipline is able to predict attitude scoring, analysis of the data-set was carried out. Evaluation of attitude scale scores in relation to respondent nominal details was conducted.

The attitude scale questionnaire required each student to provide additional independent variables. These independent variables were coded and input into the data set. The following independent variables, examined as potential predictors of attitude scale scoring, were:- age, construction industry experience, course undertaken, curriculum structure, domicile, parent/guardian occupation, sex, university, stage of study, and, the subject of questionnaire submitted.

To estimate and evaluate the data set in terms of relating the dependent variable of the respondent attitude scale score to the other independent variables, a technique called

Multiple Regression[645] was carried out. A stepwise multiple regression allowed each of the independent variables to be entered and removed, step by step, until all the independent variables present could be evaluated in terms of making a significant contribution to the attitude scale score.

Multiple regression allowed estimation and evaluation of the data set[646] to investigate respondent scale scores in terms of the following independent variables of age, experience, course, curriculum, domicile, guardian occupation, sex, university, stage and subject.

The results indicated that the *Course* undertaken by the respondent and to a lesser extent the *University* attended by the respondent are important in predicting the attitude scale scoring of the sample (see **Appendix B item 6.1**).

This research seeks ultimately to examine the effect of educational integration initiatives. Pre-participation and post-participation responses were therefore separated. The next stage of analyses examined only those respondents who had not yet participated in cross-disciplinary project-work. A sample of 534 attitude scale response scores were identified for more in-depth analysis.

The two variables of *Course* and *University* identified by multiple regression as key contributors to attitude scale scoring, were further investigated. Conventional Mann-Whitney[647] and Kruscal-Wallis[648] tests were used to determine significant differences in the mean scores between the subgroup *Course*, and then independently *University*.

Further analysis of *University*, found this independent variable to be of *no* significance in attitude scale scoring. No significant differences were recorded for the non-paramentric

Kruscal Wallis 1-Way Anova test concerning overall attitude scale scoring by University at the three Universities used in the sample: Robert Gordon, Aberdeen; Strathclyde, Glasgow; and, UCE, Birmingham (**See Appendix B item 6.2**). Similarly, no significant differences were recorded for the non-parametric Mann Whitney U - Wilcoxon Rank Sum W test concerning overall attitude scale scoring by University, in an analysis of the two Universities which made up the majority of the sample: Robert Gordon, Aberdeen, and UCE, Birmingham. (**see Appendix B item 6.3**).

Based on the tests above, the variable of *University* is not seen to be a significant indicator of attitude score.

Examination of the variable of *Course* on the other hand, produced results indicating that this independent variable was indeed responsible for significant differences in attitude scale scoring. A non-paramentric Kruscal Wallis 1-Way Anova test of mean rank attitude scale scores for the eight disciplines of Architecture, Quantity Surveying, Building Surveying, Landscape Architecture, Estate Management, Environmental Planning, Interior Design and Building Design Engineering, records a 0.0001 highly significant difference between the eight different disciplines (**see Appendix B item 6.4**) Further examination of this test allows inference that the mean ranks displayed by the disciplines of Architecture, Building Surveying and Quantity Surveying are considerably lower than the other five disciplines, Landscape Architecture, Estate Management, Environmental Planning, Interior design and Building Design Engineering used in the study (**see Appendix B item 6.4).** In other words Architecture, Building Surveying and Quantity Surveying students have less favourable attitudes towards colleagues than the other five disciplines.

When a Kruscal Wallis 1-Way Anova test examined only the three disciplines of Architecture, Building Surveying, and Quantity Surveying, no significant differences were found to exist between the scores of these three courses. The level of significance was found to be 0.1086, indicating no significant difference between the attitude scores of respondents from Architecture, Building Surveying, and Quantity Surveying (**see Appendix B item 6.5**).

Further analysis, conducted on this three discipline grouping again using the independent variables of: age, construction industry experience, course, curriculum structure undertaken, domicile, parent guardian occupation, sex, university, stage of study, and, subject of questionnaire, found definite population similarities.(see **Appendix B item 6.6**) This similarity is based on the relatively low scores given by all three disciplines, towards their professional peers.

In summary, the results above highlight the variable *Course* as influential in the contribution to group differences in attitude scale scoring. Adherence to traditional vocational courses influences attitudes held towards professional peers, which in turn can be argued to influence the potentially detrimental communication processes of the building design team.

6.2.3 Disparate professions: design and non-design building specialists

The grouping of Architecture, Building Surveying and Quantity Surveying, which showed similar characteristics based on mutually low scores given towards peers, was further analysed. More in-depth examination was conducted since the variable 'course pursued by the respondent' was still found to be an influential factor of the attitude scale score (**see**

Appendix B item 6.6). In other words there were yet more differences, based on attitude scale scores, between the three courses of Architecture, Building Surveying and Quantity Surveying.

To examine this similar-population group further, non-parametric tests were applied to determine whether any differences in scoring could be found between pairings of Architectural with Building Surveying, Architecture and Quantity Surveying, and, Building Surveying and Quantity Surveying respectively. Conventional Mann Whitney tests examined the respective discipline pairings. These tests did indeed reveal differences in levels of group population similarity.

The Mann Whitney test of the Questionnaire scores for the disciplines of Architecture and Quantity Surveying emphasised population similarities displayed by the Discriminant Analysis. No significant difference was found in their respective attitude scale scores towards peer professions. (**see Appendix B item 6.7**)

An analysis of the pairing of Building Surveying and Architecture did however reveal a significant difference, recorded as 0.0363, in respective attitude scores towards design team peer professions. The mean rank attitude score displayed by Architectural students was significantly lower than the mean rank score displayed by Building Surveying (**see Appendix B item 6.8**). In other words Building Surveying students displayed significantly more favourable attitudes towards non-design oriented colleagues than Architectural students.

This finding, which suggests that respondents from the course of Building Surveying are significantly more favourable to *non-design* professions than traditionally design orientated

Architects, is worth noting. The profession of Building Surveying has long sought to promote itself as able to participate within *all* areas of the construction industry[649]. Although seeing itself as a building profession which carries out design[650], Building Surveying has traditional links with the *non-design* professions of the building design team. Building Surveying is a specific grouping within the Royal Institute of Chartered Surveyors. Building Surveying also shares many course similarities with non-design orientated surveying courses[651]. Architecture shares little common curricula with non-design professions.

The *Mann Whitney U - Wilcoxon Rank Sum W* test of the pairing of Building Surveyors and Quantity Surveyors revealed *no* significant differences in attitude score towards design team peer professionals. This result is in line with earlier findings indicating population similarities. Although little emphasis can be attributed to the mean rankings displayed, closer inspection does reveal that Building Surveying respondents again display the higher mean rank score. In other words the Building Surveying students were more favourable towards design team peers than the Quantity Surveying students tested. (**see Appendix B item 6.9**)

This latter result, although *statistically insignificant*, is also worth noting. Building Surveying students and Quantity Surveying students share many aspects of course curriculum. However, Building Surveying students, regarding themselves as a design discipline with non-design interests, scored Architecture, a design oriented profession, higher than the non-design orientated Quantity Surveying cases. Building Surveying respondent's relatively favourable attitude scale score towards *design* orientated professions, in comparison to the traditionally non-design oriented Quantity Surveyors, is in line with Building Surveying efforts to promote their ability to provide a full range of architectural design services[652].

Although apparently representing a *common ground* between design and non-design building activities, Building Surveying cases were found to display attitude score differences towards design based professions on the one hand, and non-design based professions on the other. Professional bias was found to exist in this, arguably, common ground approach to the building design process. This result is described below.

A conventional Mann Whitney test compared attitudes expressed by Building Surveying respondents toward the design oriented (Architectural) profession on the one hand, with attitudes expressed by Building Surveying respondents toward the non-design oriented (Quantity Surveying) profession on the other hand. A significant difference was found to exist in attitude scores held towards these two subject areas, (**see Appendix B item 6.10**). Building Surveying respondents displayed a significantly higher mean rank score towards *Architecture* than the mean rank displayed towards *Quantity Surveying* professionals. In other words Building Surveyors were found to express significantly more favourable attitudes towards *design* oriented Architects, than towards *non-design* oriented Quantity Surveyors.

Building Surveying respondents, representing a common ground between the design and non-design professions, are found to display significant differences in attitudes towards the disparate building design team professions. However, Building Surveying attitude scores are still found to be more favourable towards disparate professional peers, than the disciplines of Architecture and Quantity Surveying.

This project is concerned chiefly with the integration of specialists who seek to fulfil dissimilar professional objectives, within the remit of the building design process. It may be inferred, from the tests described above, that the courses of Architecture and Quantity Surveying provide the most suitable disparate pairing for further study. The Architectural students and the Quantity Surveying students represent a pairing, within a similar population, whose similarity appears to be based upon their relatively unfavourable attitude scores towards their disparate, *non-design* or *design* based, professional colleague. Based on this evidence it was decided that further investigation must concentrate on the design oriented Architectural respondents, and the non-design orientated Quantity Surveying respondents.

In summary, the results above highlight the variable of *Course* as the key contributor to group differences in attitude scale scoring. The results go further and highlight that adherence to either a *design* or *non-design* activity influences greatly the contribution to group difference in attitude scale scoring.

6.3 Differences instilled by vocational education

Results are presented which examine the extent to which attitudes gained in full-time education reflect the differences between different professional outlooks.

6.3.1 The link between professional disparity and vocational education

This study has postulated that '*communication difficulties are primarily a function of cultural differences instilled by vocational education*'. Discussion in previous sections, towards this proposition, argued that there is a historical precedent, within academic institutions, to make a distinction between the arts, and science. The limited levels of collaboration between academic disciplines in those early days, was further argued to be a major cause of specialist dissonance in the construction industry today. Academic adherence to vocational tradition, often detracts from the much needed multi-disciplinary approach demanded of today's built environment design team[653].

Professional institutions adopt a protectionist outlook towards their knowledge bases. This creates obstacles to effective participation, in an industry which requires professionals to continually reassess their role, in terms of the technical and contractual evolutionary processes which occur in building[654]. Professional institutions are ultimately responsible for the accreditation of many academic courses. The argument exists that an optimally efficient industry requiring high levels of integration, creates discord with the Professional institutions[655]. Moves toward integration by the Higher Educational Institutions, reflect largely Professional institution opinion, and, is cautious. Traditional educational approaches are retained. Previous sections argued that cultural development of (traditionally procured design team) relationships affords little opportunity for optimum multi-disciplinary design team participation[656].

In an international context, adherence to disparate tradition was also found to be problematic. Trends toward the harmonisation of international construction markets, emphasise further cultural differences instilled by education. Education which is *internationally* disparate was argued to deserve much blame for the inefficient construction industries and the unimpressive building design, which exists in countries where high percentages of design professionals have been educated in foreign building, design and engineering courses [657].

Much Governmental and industrial literature recommends acceptance that a greater inter-disciplinary approach to professional education is necessary without losing the expertise of individual professions. UK Reports appeal for improvements in communication across professional interfaces, as a way towards a more efficient and effective construction industry[658].

It was argued that often it is the methods taught to different disciplines, which lead to the lack of understanding between differing approaches and conflict within the building design team[659]. When differences, resulting from different patterns of thinking, lead to a reduction in respect for, or lack of trust in professional colleagues, the design suffers[660]. Barriers encountered by co-operative teams, were argued to testify to the fact that the effort to integrate the disciplines for applied purposes may come too late in the educational process. Much literature argues that integration should be developed at an early stage[661].
Previous sections suggested that decision making within the group entails a struggle among different interests and values for control over action. This social interaction takes place within a social environment that has developed various (professional) cultural rules and values[662]. It was suggested that communication between individuals, who adopt heterogeneous (professional) attitudes towards the realisation of a project, is often found to be largely confrontational[663]. Literature presented previously voices opinion that mutuality is attained when there are no inequalities built into cultural structures, and where social structures and acts are allowed to come about through the mutual approval of each member[664].

6.3.2 Attitudes gained in full-time education: a major factor in differences of professional culture

Vocational courses exert considerable influence on an individual's attitude towards the disparate professions who make up the building design team. The following discussion examines the extent to which attitudes gained in higher education differ from the attitudes shaped by traditional hierarchical building design team relationships in industry. Of major importance to the discussion at hand, are the differences between *full-time* vocational students, who have minimal contact with industry, and *part-time* students, whose professional education complements industrial practice.

Conventional Mann-Whitney tests were conducted to investigate initially:- full-time multi-disciplinary respondent attitude scores on the one hand, and part-time multi-disciplinary respondent attitude scores on the other.

Comparison between *full-time* stage 1 Architectural attitude-scale questionnaire scores and *full-time* stage 1 Quantity Surveying attitude-scale questionnaire scores, found *no* overall significant attitude difference displayed towards professions with roles different to the respondents own (see **Appendix B item 6.11**).

On the other hand, *part-time* stage 1 Architectural respondents and *part-time* stage 1 Quantity Surveying respondents, *did* display a significant overall difference in attitude scale scores towards professions performing tasks outwith the respondents own professional remit. *Part-time* stage 1 Architectural respondents displayed substantially less favourable attitudes towards design team colleagues than *Part-time* stage 1 Quantity Surveying respondents (see **Appendix B item 6.12**). Indeed *part-time* Architects scored 25% of the 24 item attitude scale statements *significantly* lower than *part-time* Quantity Surveying respondents.

Results from these tests suggest that exposure to the traditional hierarchical building design team relationships which exist in industry, has influenced the attitude scores of respondents from the part-time courses. Further Mann-Whitney tests were conducted to examine these attitude scale scores.

When comparing students in stage 1 of a *part-time* course of studies in Quantity Surveying, with students in stage 1 of a *full-time* course of studies in Quantity Surveying, *no* overall significant difference was found in attitude scale scores (see **Appendix B item 6.13**). Indeed 23 of the 24 item statements indicated high similarities between part-time respondent scores and full-time respondent scores. By contrast, when comparing students in stage 1 of a *part-time* course of studies in Architecture, with students in stage 1 of a *full-time* course of studies in Architecture, a *significant* overall difference *was* found (see **Appendix B item 6.14**). *Part-time* Architectural students displayed a significantly less favourable attitude towards the non-design oriented profession than *full-time* Architectural stage 1 respondents, in terms of the non-design discipline's aptitude for:- *contribution, management skill, organisational skill, perceptiveness, and helpfulness.*

The question why part-time and full-time Quantity Surveying respondents were so similar, when part-time and full-time Architectural respondents were so dissimilar, was then addressed. An analysis of respondent nominal details explored this apparent inconsistency.

Stage 1 Quantity Surveying part-time and full-time respondents were found to exhibit similar levels of *(construction) industrial experience*, similar *ages*, similar *parental backgrounds* and similar *domiciles* (see **Appendix B item 6.15**). By contrast, stage 1 Architectural part-time and full-time respondents were found to display noticeably different levels of *industrial experience* and differences in *age*. Examination of these differences revealed that the part-time Architectural cases exhibit a higher level of *industrial experience* and are *older* than full-time architectural cases (see **Appendix B item 6.16**).

The higher level of *experience in the building industry* displayed by *older* stage 1 part-time Architectural respondents appeared to have considerably influenced the (more negative) attitude towards their non-design oriented professional colleague. Indeed it is logical to suggest that their relatively unfavourable opinion of the profession of Quantity Surveying, in terms of:- *project contribution, management skill, organisational skill, perceptiveness,* and *helpfulness*, mirror directly relationships in the traditional building design team hierarchy. The Architectural role is seen in industry as generating all design information, which is then handed off to other specialists in a sequential process[665]. *Part-time* stage 1 Architectural students see their future profession of Architecture, as leading the building design team. Results presented in the test (see **Appendix B item 6.14**) above, find that *part-time* stage 1 *experienced* Architectural respondents conform very much to these traditional relationship(s).

Adherence by *part-time* students to traditional relationships was examined further from a non-design profession point of view. Since it was established above that *stage 1* full-time and part-time Quantity Surveying students displayed similarly low levels of industrial experience, and similar attitudes towards disparate professional colleagues, an alternative sample grouping, from another stage, was used. To investigate the influence of higher levels of academic experience on attitude scores by non-design professionals, stage 3 full-time and stage 3 part-time Quantity Surveying students were identified.

Again using a Mann-Whitney U - Wilcoxon Rank Sum W test, stage 3 *part-time* Quantity Surveying respondent attitude scores were compared with stage 3 *full-time* Quantity Surveying respondent attitude scores. Although an overall similarity of attitude scores, repeated the results gained from the stage 1 analysis, *part-time* respondents were found to be significantly *more* favourable towards the Architectural profession in three specific areas: *suitability to lead the building design team*; *the Architectural profession deserving its prestigious position*; and *the Architects ability to recognise their responsibility to other members of the design team.*(see **Appendix B item 6.17**).

Again it would appear that the higher level of *Experience in the building industry* gained by the stage 3 part-time Quantity Surveying respondents, has considerably influenced these (more favourable) attitudes towards their design oriented professional colleague. Full-time student respondents, who are more attuned to developing and promoting their own specialist skill in an academic environment, and less attuned to performing in the traditional hierarchy of practice, are significantly less willing to accept the (Architectural) design professions *prestigious place*, *ability to lead*, and *ability to recognise responsibility to other specialists* in the design process.

A key finding indicated that attitudes towards other disciplines gets worse as students progress through their respective academic courses. A comparison of attitudes displayed by full-time Quantity Surveying students as they progress from the initial stages of vocational education to the final stages of vocational education, display a significant drop in favourability towards their design team colleagues *after* stage 1. (see **Appendix B item 6.18**). A similar trend, although not statistically significant, is displayed by Architectural respondents (see **Appendix B item 6.19**). Clearly participation in the educational process affects negatively student affinity towards the disparate design team colleague

Whilst there are many variables which may influence this sudden significant drop in attitude score towards disparate professional colleagues, it appears logical to suggest that the *full-time* students realisation of their own professional worth to the building design process, must be a major factor. Developing knowledge base(s) in an isolated academic environment, vocational *full-time* students quickly (findings suggest after stage 1) come to see their role to be *more* than simply:- (i) providing specialist support to the traditional team leader in the case of the Quantity Surveyor, or alternatively, (ii) providing the initial design information for development by others, in the case of the Architectural students

In summary, it becomes clear that *full-time* students in a relatively isolated academic environment appear to develop attitudes dissimilar to their *part-time* student colleagues, who are more attuned to the restrictive nature[666] of the traditional building design team. Indeed it has been said that higher education may instil students with *too high* an opinion of their own relative worth(s) to the building design team[667]; and that less problems would arise if they were simply prepared only for those tasks which are required by the traditional building design process.

Whilst such an assembly-line manufacturing outlook may indeed represent a logical solution to the problem of difficulties in communication between disparate professional disciplines, *innovative* building design requires a more holistic approach from its specialists. Good building design requires professionals able to *go beyond* a production-line mentality of semi-skilled operators only able to bolt on their respective parts without knowledge of the whole picture[668]. Higher Education must continue to inspire students if building and construction is to be effective, efficient and innovative. Higher Education must also however encourage empathy among disparate specialists.

At present it would appear that full-time education, instilling a wish to realise fully a dynamic professional potential, develops attitudes which are at odds with the co-operative multi-disciplinary approach demanded by today's technologically complex building industry. The key point to be made at this point is that attitudes are found to worsen as students progress through their academic course of studies. The findings indicate that attitudes held towards peer professions, potentially detrimental to the building design process, are indeed a function of differences instilled by vocational education.

The potential for the creation and development of positive professional attitudes towards integration, by vocational education, is explored in greater detail below.

6.4 The creation and development of professional attitude over time

This section presents findings which investigate the creation and development of professional attitude over time.

6.4.1 Educational initiatives: the potential to bridge cultural differences

This study has postulated that:- '*communication gaps require educational initiatives able to bridge cultural differences instilled by vocational traditions in the educational proces*'. Salient points, explored previously to address this proposition, are outlined in the paragraphs which follow.

It has been argued previously that specialists who recognise the potential of the multi-disciplinary team for themselves are more likely to participate effectively, than professionals who interact simply as a necessary requirement of existing procurement and contractual procedure[669]. Indeed there is recognition in most quarters of the potential for some form of educational process to encourage empathy with the issues faced by other disciplines[670]. Research finds that, generally, students become *less* co-operative in the later years of their academic careers when the pressure to succeed, and an increased emphasis on individual attainment, engenders a competitive, and not an integrative co-operative, attitude[671]. Thus, to address the professional mind-set of detrimental attitudes toward peer disciplines, it was argued that education requires to present, during the development of the building professional, an integrative initiative able to show the potential of the multi-disciplinary building design team[672].

Specialist activities taught in tertiary education are found *not* to come automatically together once they enter industry. Educational curricula for the construction professionals, held to influence professional trait and personality variables, needs therefore to introduce an overarching mechanism directly into the educational process, to encourage integration[673] [674]. It was argued that Educational establishments must address the creation and development of professional attitudes, which have a close relationship with education and behaviour[675], since member attitudes play a critical role in predicting innovation and organisational efficiency[676].

It was suggested that traditional and modern philosophies of education provide the foundations of educational initiatives which seek to encourage specialist integration and empathy, address the growth in specialist knowledge provision, and allow assessment of the individuals place in the multi-disciplinary decision making process[677]. This literature appeals for learning through experience. The need for integrative project-work in contemporary vocational education was argued to have roots in these early traditional and modern educational philosophies[678]

Previous sections argued that vocational education is the logical place to attack the root of the problem of inter-professional conflict[679]. Professional education must recognise that the processes of communication, perception of the group, and attitude toward one another, are positively linked in a co-operative organisation[680]. Higher Educational Institutions must also recognise that cultural assumptions made by the individual, once established, are virtually impossible to change[681]. Thus, if change *is* sought to better the efficiency and effectiveness of the building design team organisation, previous sections argued for a process, reflecting the tenacity which cultural assumptions exhibit during the formative years of professional education.

It was suggested that behavioural effects are important in any educational initiative which seeks to instil an atmosphere of co-operation in the building design team[682]. Behaviour patterns are largely group-formed and are modifiable by controlled group exercise[683]. It was argued that problems in communication, and differences in dealing with people are largely a matter of values and attitudes, and that these can be modified by training programmes[684]. Training programmes which acknowledge the creation and development of attitudes can address positively the problems of communication in the building design team.

The results presented below show that attitudes instilled by vocational traditions, potentially detrimental to the building design process, can be identified. These are then available to be addressed at a later stage by educational initiatives that bridge cultural differences and promote the integration of disparate professionals.

6.4.2 Addressing attitudes in vocational education

The section which follows looks individually at each of the 24 statements which make-up the attitude scale questionnaire, and highlights the significant differences which are found to occur between disciplines, and also, as a result of time. The findings detail an investigation of the 500 or so students who took part in the 24 item attitude scale questionnaire.

The findings represent the current state of attitudes held as students progress through their educational courses. These findings describe the trends which exist *before* any experimental work is done.

6.4.2.1 The major differences which exist between design and non design attitude development: comparisons between the combined attitude scores of *disparate disciplines* at stage 1, stage 2, stage 3 and stage 4 respectively

Comparisons in the previous section, between part-time students and full-time students, found that attitudes towards peers are shaped by vocational courses in academia. Additional indication that cultural differences are being instilled by vocational education is gained from an analysis of aggregate Architectural and Quantity Surveying cases, over four specific stages of academic courses. All findings describe the current, isolated curricula, situation before any experimental work is done.

In a *Kruskal - Wallis 1 - Way Anova test* to compare stage 1, stage 2, stage 3, and stage 4[685], a significant difference was found to exist in overall attitude scores, between respective stages. Stage 1 respondents from the disciplines of Architecture and Quantity Surveying are found to have the highest mean rank scores in comparison with subsequent stage students from the same disciplines. (see **Appendix B item 6.20**).

Carrying on from the previous section it is restated that findings indicate that initial favourable attitude(s) displayed towards peer professions at the first stage of professional education quickly disappear. Indeed stage 2 respondents display the least favourable attitude scores of all 4 stages. Stage 3 attitude scores return to a more favourable mean rank; however stage 4 attitude scores drop once more. The result above is based on aggregate Architectural and Quantity Surveying cases from each stage; this allows general assumptions to be made at this point. The findings indicate strongly that education has influenced negatively student attitudes towards their peer groups. Indeed attitudes displayed in stage 3, which show a more favourable mean rank score, might logically be a reflection of sandwich year employment, away from full-time education, which many students undertake after stage 2. These general findings are examined in more detail below.

The potential for the creation and development of professional attitude by higher educational courses in subjects related to the built environment, was examined further, in terms of the differences that exist between disparate vocational students. Differences in attitude score between Architectural students and Quantity Surveying students were compared at different stages. *Mann - Whitney U Wilcoxon Rank Sum W* tests were carried out to compare Architectural and Quantity Surveying respondent scores at stage 1, stage 2, stage 3, and also at stage 4 of respective courses.

A *Mann - Whitney U Wilcoxon Rank Sum W* test of *stage 1* cases found that a significant difference in overall attitude scores did exist. Quantity Surveying respondents were found to display significantly higher, more favourable, attitudes towards their design team colleagues than the Architectural respondents (see **Appendix B item 6.21**). Although *stage 2* cases did not display a significant difference in overall attitude score, Quantity Surveying respondents were again found to score design team colleagues slightly more favourably than the Architectural respondents.(see **Appendix B item 6.21**).

Stage 3 cases were found to have no significant difference in overall attitude score in a comparison between Architectural and Quantity Surveying respondents. *Stage 4* cases were also found to have no significant difference in overall attitude score in a comparison between the disciplines of Architecture and Quantity Surveying. However both *stage 3* and *4* Architectural respondents were found to display slightly more favourable scores towards design team colleagues than the Quantity Surveying respondents (see **Appendix B item 6.21**).

Findings above suggest that a relatively positive attitude displayed towards Architectural colleagues, by Quantity Surveying respondents at the initial stages of academic study, is significantly diminished in later years. Architectural respondents displaying a relatively unfavourable attitude towards Quantity Surveyors are found to display more favourable attitude scores in subsequent years. Reasons why these trends should occur, can be argued to lie within the public perception of the building design team. Media attention given to Architecture clearly identifies this profession as having a major role in the creation and maintenance of the built environment. Other construction disciplines receive comparatively little attention. Indeed Government inspired programmes such as the CITB 'curriculum centre initiatives' highlight the lack of public awareness of the processes of, and personnel involved in, the construction industry[686]. Schemes such as this, which seek 'to raise awareness of what the construction industry is and what it has to offer young people; give construction a higher profile and better image; and attract more and better qualified young applicants'[687], clearly identify the lack of public knowledge of building and the disparate professions who make up the design team.

Initial positive attitudes expressed towards the Architect, logically reflect the *existing* perceptions of the new student, shaped by the popular media, of the role of Architecture in building. As students learn of the complexity of the construction industry and develop their own specialist skills, attitudes towards the Architect clearly change. New Architectural students, on the other hand, exhibit a level of ignorance of the construction industry which initiatives such as the CITB attempt to address. New Architectural students may logically see other professions as relatively unimportant. Architectural student attitudes change, as they too learn of the complexities of the multi-disciplinary building process.

Differences between attitude scores, given by respondents from the disciplines of Architecture and Quantity Surveying, were examined further. A stage by stage analysis of each questionnaire statement was conducted.

Analysis involved examination of the scores given for each one of the 24 item statements making up the attitude scale:

(i) An analysis of cases in *stage 1* found 13 of the 24 questionnaire statements scored significantly differently by the Architectural respondents and the Quantity Surveying respondents.

(ii) An analysis of cases in *stage* 2 found 5 of the 24 item statements scored significantly differently.

(iii) An analysis of cases in *stage 3* found 9 of the 24 item statements scored significantly differently by the Architectural respondents and the Quantity Surveying respondents.

(iv) An analysis of *stage 4* cases found 4 of the 24 statements scored significantly differently.

A summary of these differences in scoring for each of the individual items, for successive course stages, is outlined in Table 6.1. The scores given by the Architectural students and the Quantity Surveying students are compared directly in each one of the 24 item statements. Only those items which were found to have significantly different scores are included. The table outlines respectively the discipline who scored the item highest and then the discipline who scored the item lowest. Some of the 24 item statements are found to be scored significantly differently for successive stages, whilst other item statements are scored significantly differently at only one stage.

Statement	**Stage One**		**Stage Two**		**Stage Three**		**Stage Four**	
Summary of item content: *item number*	*Scored as Significantly Favourable: high relative mean ranking*	*Scored as Significantly Unfavourable: low relative mean ranking*	*Scored as Significantly Favourable: high relative mean ranking*	*Scored as Significantly Unfavourable: low relative mean ranking*	*Scored as Significantly Favourable: high relative mean ranking*	*Scored as Significantly Unfavourable: low relative mean ranking*	*Scored as Significantly Favourable: high relative mean ranking*	*Scored as Significantly Unfavourable: low relative mean ranking*
Seeks help and advice to solve problems: *1*							Q.S.	Architect
Contribution to building process: *2*			Architect	Q.S	Architect	Q.S.		
Communication with laymen: *3*	Q.S	Architect						
Grasps other peoples ideas: *5*	Architect	Q.S.						
Most suitable to lead the design team: *6*	Architect	Q.S.	Architect	Q.S.	Architect	Q.S.		
Generates ideas to overcome problems: *7*	Architect	Q.S	Architect	Q.S.	Architect	Q.S.		
Quality of training given to graduate: *8*	Architect	Q.S.			Architect	Q.S.		
Mental efficiency: *9*	Q.S.	Architect			Q.S.	Architect	Q.S.	Architect
All-embracing educational curricula: *11*					Q.S.	Architect		
Acknowledges professional limitations: *12*	Q.S.	Architect						
Usefulness of information produced: *14*	Architect	Q.S.			Architect	Q.S.		
Organisational talent: *15*	Q.S.	Architect						
Accurate, error free work: *17*			Q.S.	Architect			Q.S.	Architect
Professional prestige: *18*	Architect	Q.S.						
Affinity to team-working: *20*	Q.S.	Architect			Q.S.	Architect	Q.S	Architect
Neat and orderly manner of work: *22*					Q.S.	Architect		
Professionally stimulating catalyst: *23*	Architect	Q.S.						
Professional responsibility to others: *24*	Q.S.	Architect						

Table 6.1
Discipline ranking, relative to one another, for attitude scale items

Closer inspection of the table above reveals a number of interesting points.

Stage 1

Comparison of the attitude scores received from stage 1 Architectural and Quantity Surveying respondents, reflects professional conventions of the disparate roles within the building design team. Scores received for the design professional (relative to those received for the non-design building professional) display favourable attitudes towards: project contribution, ability to generate ideas, and ability to stimulate and lead the project team. Design professionals also scored favourably in terms of: prestige, the usefulness of the information generated, and the quality of training given. Unfavourable attitudes displayed towards design professionals highlight:- an inability to communicate with laymen, an inability to recognise professional limitations and an inadequacy in organisation. Design professionals also scored unfavourably in terms of:- having a self-interested outlook, rejecting team working, and having an inefficient, unorganised approach.

By contrast the non-design building professional (relative to the design professional) received favourable attitudes towards:- their ability to work within a team, feel a responsibility to other professions, and communicate easily. Favourable attitudes were also expressed towards their ability to solve organisational problems, achieve high levels of mental efficiency, and display an awareness of their own professional limitations. Unfavourable attitudes towards non-design building professionals were received for:- contribution and idea generation, inability to stimulate, provide information of only limited use, and display an unsuitability for project leadership. Non-design building professionals were also scored relatively lowly in terms of:- having limited levels of professional prestige and a low quality of training.

Contradictions in the scoring of the individual attitude scale statements can be found. These contradictions appear to reflect traditional building design team hierarchies. Of note is the Architects perceived inability to communicate, inability to organise, dislike of team work, and self interested outlook. (Indeed similar traits were recognised by MacKinnon[688] in the late 1950's and early 1960's as identifying the successful American Architect.) Notwithstanding these negatively scored variables, architects are still perceived as best suited to lead the project team. By contrast the Quantity Surveyor is seen as a profession able to:- organise, communicate, work within a team, and recognise the importance of other professions; yet the Quantity Surveyor is given an attitude scale score which indicates that the profession is deemed to be unsuited to lead or stimulate the design team.

At stage 1 disparate professions are given scores which reflect the most frequent, common, combination of traits assigned by one group of building professionals to another. As discussed above, vocational students can be argued to have only a limited idea of both their own, and other, potential skill base(s), at this initial stage in the educational process. Attitudes displayed towards the building design professional and the non-design building professional, by disparate construction courses, reflect a lack of knowledge concerning specific multi-disciplinary roles.

Stage 2

Comparison of stage 2 Architectural and Quantity Surveying cases, finds few significant differences in attitude scores for each of the individual statements which make up the 24 item attitude scale questionnaire. The design professional (relative to the non-design building professional) is scored favourably in terms of: project contribution, idea generation, ability to stimulate, and leadership qualities. However the design professional is scored unfavourably in terms of: perceived inaccuracies and frequency of errors in their work.

The non-design building professional (relative to the design professional) is scored favourably for the production of accurate, error-free work. Unfavourable attitudes towards non-design building professionals were given for:- limited idea generation, limited project contribution, an inability to stimulate, and an unsuitability to lead. Professional conventions still appear to influence attitude score, although not to the same extent as is found in stage 1.

Findings detailed above (see **Appendix B item 6.20)** show cases at stage 2 to display significantly low mean rank attitude scores, when compared to stage 1, stage 3 and stage 4. Indeed it appears that the lack of significant difference in mean rank scoring, for 19 of the 24 item statements, is due to low scores given reciprocally, by both courses, to respective disparate disciplines. At this second stage it would appear that students from both design and non-design orientated courses share similar unfavourable attitudes towards respective design team peer professions. Higher education can logically be argued to have instilled higher levels of expert knowledge, at the same time as instilling inadvertently a mutual disregard for other professions making-up the building design team.

Stage 3

Stage 3 students, at the degree stage of professional qualification, display a return to many of the significant differences found to exist between the disciplines at stage 1. Design oriented disciplines are given favourable scores in terms of:- project contribution and usefulness of information produced, idea generation, and, confidence in the professions training. Unfavourable scores are given for: an enmity to team-working, too specialised an outlook, having a disorganised approach mental approach, and a disorderly working manner.

Non-design oriented disciplines score highly in terms of: ability to work within a team, involvement within an all-embracing educational process, neat and orderly working manner, and ability to achieve high levels of mental efficiency. Unfavourable attitudes towards non-design building professionals were received for:- contribution and idea generation, the provision of information of only limited use, an unsuitability for project leadership, and a low quality of training.

Clearly attitudes about professional colleagues return to the somewhat standard combination of traits assigned by one group of building professionals to another. This may be argued to have occurred as a result of cases, examined in this third stage, having returned to academia after an industrial placement year of employment. No exact figures were noted, although almost all of the Quantity Surveying students in this analysis had worked in industry, pursuing sandwich year employment, prior to stage 3 full-time education. It is logical to assume that a growing realisation of the complex nature of building design, perhaps coupled with industrial participation within a traditional hierarchical building design team, has instilled a return to the stereotypical attitude towards professional colleagues, displayed at stage 1.

This is a key finding and links with the previous discussion which stated that education is found to instil professional dissonance. The findings here suggest that short term exposure to industry is able to address the negative attitudes instilled by professional education. The evidence indicates that conflictual attitudes, potentially detrimental to the building design process, stem from vocational education.

Stage 4

Stage 4 found overall attitude scores drop, in comparison to stage 3 overall attitude scores (see **Appendix B item 6.20**). This result is similar to the stage 2 analysis in that, the lack of significant difference in mean rank scoring, for 20 of the 24 item statements, appears again to be due to low scores given reciprocally, by both courses, to respective disparate disciplines. -

Significant differences were noted in 4 of the 24 item statements making up the questionnaire. Design oriented disciplines received unfavourable scores in terms of: their preference to work alone, an inability to seek advice in the pursuit of problems outwith their remit, a disorganised approach, and, the production of inaccurate work. By contrast the non-design oriented discipline received favourable scores towards: their affinity to team-working and willingness to seek help from other professions, their organised approach and error free work. Again it would appear, on the majority of questionnaire items, that students from both design and non-design orientated courses share similar unfavourable attitudes towards their respective design team peers.

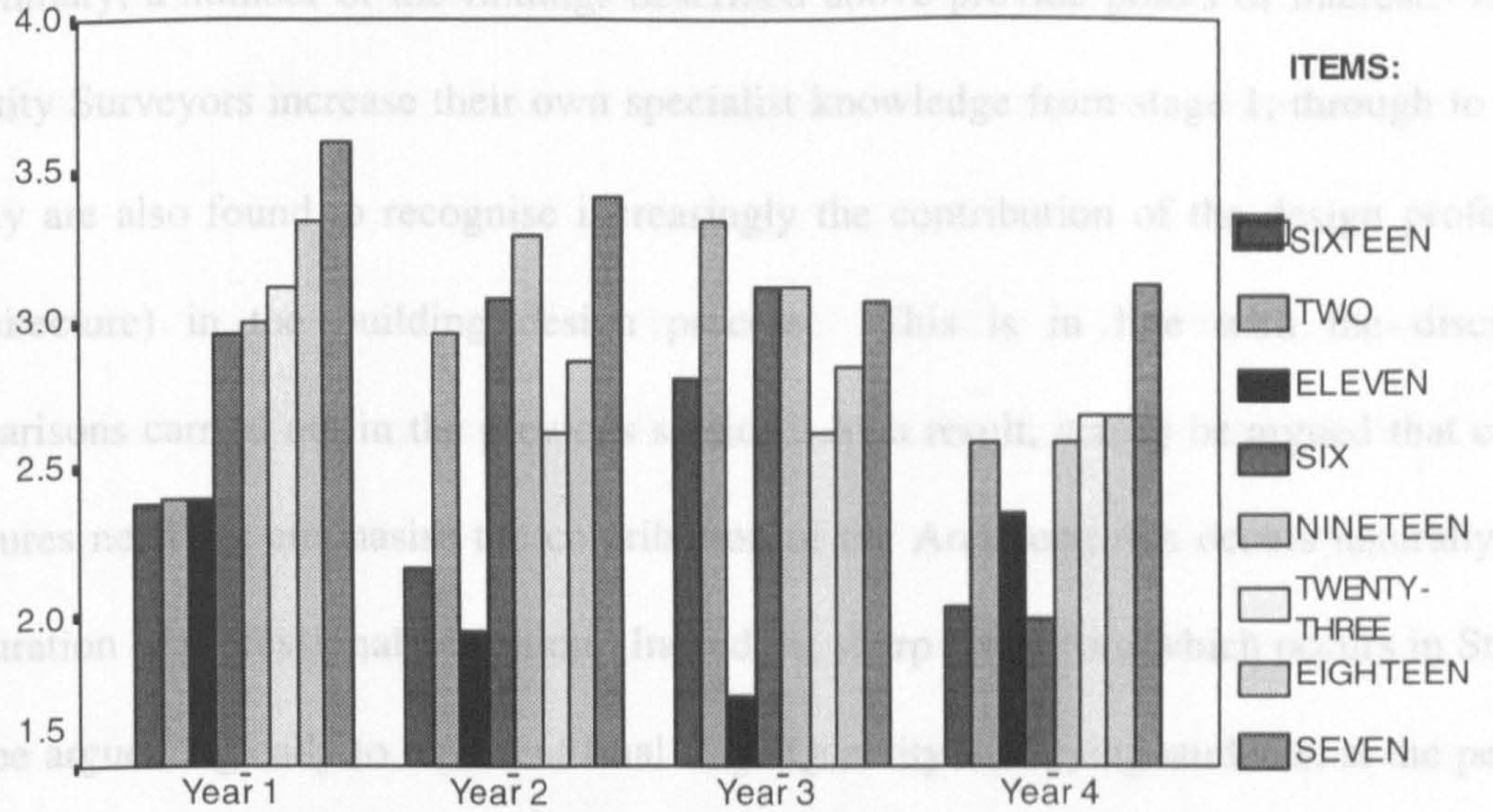
Overall attitude differences appear to oscillate; with stage 1 and stage 3 displaying attitudes that comply with what seem to be traditionally accepted professional norms. Stage 2 and stage 4 on the other hand, held to be the most academically isolated stages of professional education in these analyses, display attitudes that appear to reflect a mutual disregard for professional colleagues. Clearly Higher Educational Institutions require to address both the traditional hierarchy of professional relationships, potentially detrimental to innovative design, and the mutual disregard for ones peers which appears to occur through participation in vocational building courses.

6.4.2.2 The major differences that exist between design and non design attitude development: comparing the attitude scores of *individual disciplines* at stage 1, stage 2, stage 3 and stage 4 respectively

The previous section compared the attitude scores of disparate disciplines at all stages of the educational process. This section charts the attitude score(s) of individual disciplines over the 4 stages of professional education. The cases analysed in the first instance are taken only from the Quantity Surveying respondents. Quantity Surveying respondent attitude scores towards a design oriented discipline are charted over 4 stages of professional education. The cases analysed in the second instance are taken only from the Architectural respondent attitude scores. Architectural respondent attitude scores towards a non-design discipline are also charted over the 4 stages of professional education.

6.4.2.2.1 Quantity Surveying attitudes to design oriented professions over time

A stage by stage analysis of each questionnaire statement was conducted for all Quantity Surveying respondents. A *Kruskal - Wallis 1 - Way Anova test* compared stage 1, stage 2, stage 3, and stage 4. Over the 4 stages tested, significant differences in attitude score were found to exist in 8 of the 24 statements making up the attitude scale questionnaire. Mean rank attitude scale score comparisons for each of these 8 statements were compiled, year by year, in the bar chart below.



Questionnaire items which differ over the 4 years by mean rank attitude score

Figure 6.1
QS Item score significant change by year

The significant attitude trends, charted above, are summarised as follows:

SIXTEEN	The attitude score for the design profession's *suitability for project management* (item 16 of the 24 item attitude scale questionnaire) drops from stage 1 to stage 2, recovers and rises in stage 3, then drops again in stage 4.
TWO	Attitudes towards the design profession's *contribution to the building process* (item 2) can be seen to become steadily more favourable from stage 1 to stage 3, then drop sharply in stage 4.
ELEVEN	Attitudes towards the design profession's *need for an all-embracing educational curricula* (item 11) drops steadily from stage 1 to stage 3, then improves slightly in stage 4.
SIX	Attitudes towards the design profession's *suitability to lead the design team* (item 6) also becomes steadily more favourable from stage 1 to stage 3, then drops sharply in year 4.
NINETEEN	Attitudes towards the designers *enjoyment of working in an ill-defined field* (item 19) rises slightly from stage 1 to stage 2, drops again in stage 3, then drops sharply in stage 4
TWENTY-THREE	Attitudes towards the design profession acting as a *stimulating catalyst for other professions* (item 23) drops sharply from stage 1 to stage 2, and retains at this lower level in stage 3 and stage 4.
EIGHTEEN	Attitudes towards the design profession's *level of prestige*(item 18) also drops from stage 1 to stage 2, recovers and rises in stage 3, then drops again in stage 4.
SEVEN	Attitudes displayed about the design profession's *ability to generate ideas to overcome problems* (item 7) become steadily less favourable from stage 1 to stage 4.

Table 6.2
QS Item score significant change by year

In summary, a number of the findings described above provide points of interest. As the Quantity Surveyors increase their own specialist knowledge from stage 1, through to stage 4, they are also found to recognise increasingly the contribution of the design profession (Architecture) in the building design process. This is in line with the discipline comparisons carried out in the previous section. As a result, it may be argued that course structures need not emphasise the contribution of the Architect; this occurs naturally over the duration of professional education. Indeed the sharp down-turn which occurs in Stage 4 may be argued logically to represent final stage Quantity Surveying students, at the peak of their specialist knowledge base, rejecting their perceived role as support to Architectural contribution. This same explanation may be said of the rise, then sudden down-turn at stage 4, in attitudes which occur towards the suitability of the Architect to *lead the design team*. Acceptance of the traditional hierarchy is put into question by final stage students made confident by an extensive specialist knowledge base.

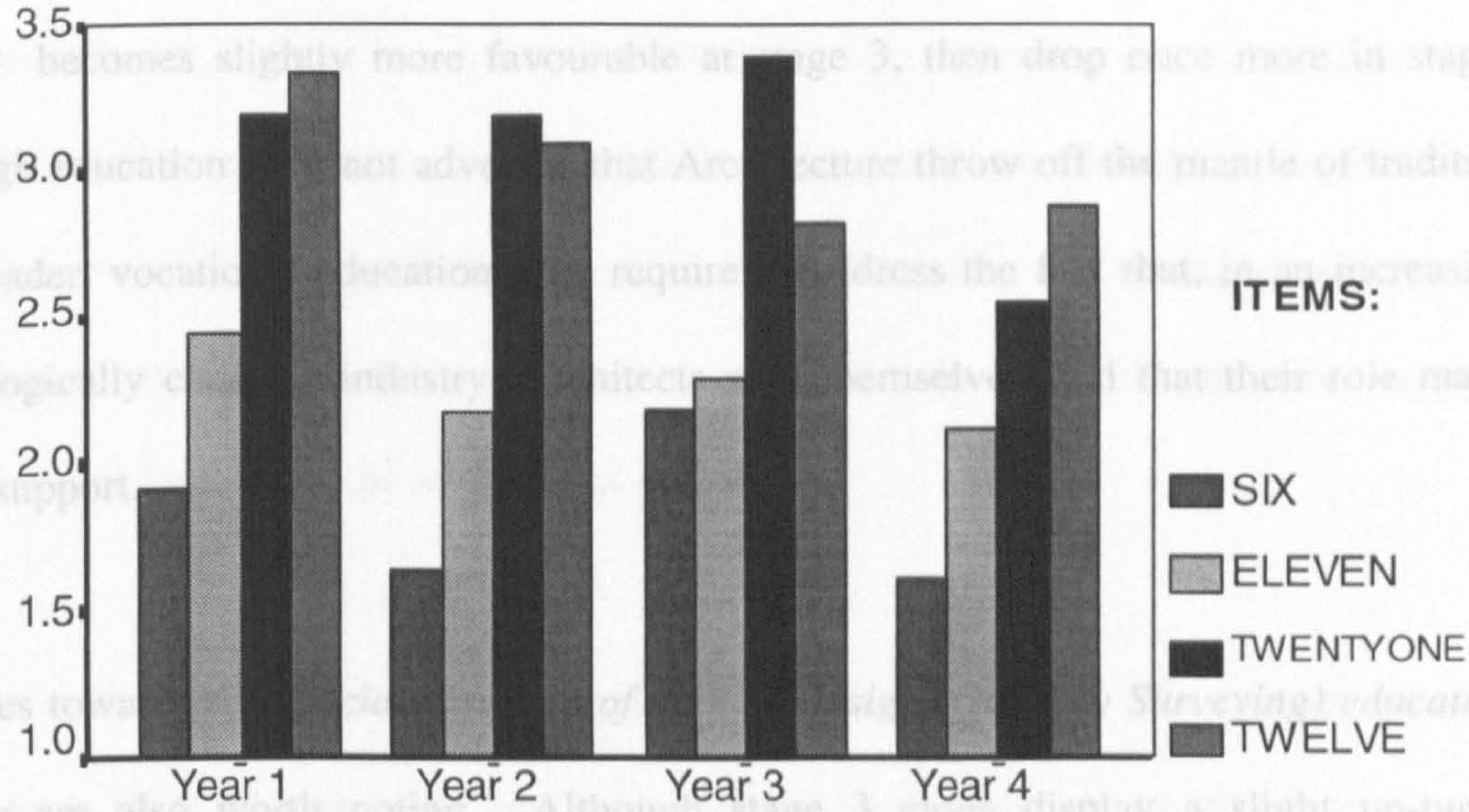
The *creativity*, traditionally attributed to Architects, is scored steadily less and less by subsequent stage Quantity Surveying students. Whilst a downward trend is clearly evident, this finding *appears* to be at odds with previous discipline comparison results. In fact, this anomaly has its basis in the association of creativity as a definite *design* trait, *not* shared by *non-design* disciplines. The design discipline is gradually seen as *less* creative over the duration of professional education. Clearly education must not allow the non-design professional to loose confidence in their design colleague; since innovative building requires a design team confident about its creativity. Recognition of the *specialist requirement of design (Architectural) education* is also seen to drop steadily from stage 1 through to stage 3. Stage 4 displays a slight up-turn. Clearly Architectural contribution is acknowledged. What is less clear, in the eyes of the Quantity Surveying students, is what sort of contribution the Architects make. Education would be well advised not to allow the specialist nature of design, to diminish in the eyes of non-design oriented courses.

The transition from acceptance of the traditional hierarchy to confidence regarding ones own specialist contribution, appear to shape the remaining significant changes which occur over time, in Quantity Surveying attitudes towards disparate colleagues. Questionnaire statements testing attitudes concerning the design professions: *suitability for the role of project manager*; *prestigious position within the design team*; *aptitude to work in an ill-defined field*; and, *degree to which they act as a stimulating catalyst for the other professionals*, are all found to record significantly decreasing attitude scores from stage 1 to stage 4. Stage 3 cases display an up-turn in attitude scores, however these are again reversed by the stage which follows.

Traditional hierarchies are changing slowly as a result of an increasingly complex construction industry. Education however, must be ready and able to address student resentments that may arise from the widespread adherence to *traditionally* procured professional relationships; since an adherence to the traditional hierarchy is at odds with the dynamic potential of specialist education taught to the individual.

6.4.2.2.2 Architectural attitudes to non-design professionals over time

A stage by stage analysis of each questionnaire statement was conducted for all Architectural respondents. A *Kruskal - Wallis 1 - Way Anova test* compared stage 1, stage 2, stage 3, and stage 4. Over the 4 stages tested, significant differences in attitude score were found to exist in only 4 of the 24 statements making up the attitude scale questionnaire. Mean rank attitude scale score comparisons for each of these 4 statements were compiled, year by year, in the bar chart below.



Questionnaire Items which differ over the four stages, by mean rank attitude score

Figure 6.2

Architectural item score significant change by year

The significant attitude trends, charted above, are summarised as follows:

SIX	Attitudes towards the non-design profession's *suitability to lead the design team* (item 6 of the 24 item attitude scale questionnaire) can be seen to become less favourable from stage 1 to stage 2, rise slightly in stage 3, and drop again in stage 4.
ELEVEN	Attitudes towards the non-design profession's *education which embraces a specialist approach* (item 11) can again be seen to become less favourable from stage 1 to stage 2, rise slightly in stage 3, and drop again in stage 4
TWENTY-ONE	Attitude scores for the *requirement of specialist teaching in the non-design discipline's educational process* (item 21) become increasingly favourable from stage 1 to stage 3, then fall sharply at stage 4.
TWELVE	Attitude scores towards the non-design profession's *knowledge of their own professional limitations* (item 12) fall steadily from stage 1 to stage 3, then rise slightly at stage 4.

Table 6.3

Architectural item score significant change by year

The relatively small number of attitude changes towards non-design (Quantity Surveying) professional colleagues, over the 4 stages tested, is a major point of interest. Clearly attitudes towards professional peers, highlighted in the discipline comparisons detailed in the previous section, as adhering to a traditional hierarchical relationship of other disciplines being mentally proficient support disciplines to their own Architectural leadership, change little. Relatively negative attitudes displayed by Architectural respondents towards the non-design (Quantity Surveying) profession in terms of *suitability to lead* becomes slightly more favourable at stage 3, then drop once more in stage 4. Although education need not advocate that Architecture throw off the mantle of traditional team leader, vocational education does require to address the fact that, in an increasingly technologically complex industry, Architects may themselves find that their role may be one of support.

Attitudes towards the *specialist nature of the non-design (Quantity Surveying) educational process* are also worth noting. Although stage 3 cases display a slight up-turn in favourability, the overall trend is for Architectural respondents to score lowly the need for a specialist vocational educational process for Quantity Surveyors. Higher education must be wary if design professionals, who themselves are gaining increasingly specialist knowledge, are rejecting the need for other disciplines to experience similarly specialised knowledge bases. Innovative building, in an increasingly technologically complex industry, must be recognised as requiring an effective integration of many specialist skills.

6.4.3 Attitude constructs: creation and development over time

To assess further the development of attitude towards peer professions, as a result of participation in specific vocational courses, a factor analysis was carried out on the data base. The output from factor analysis provides an opportunity to explore and identify a relatively small number of factors which explain the relationship among sets of interrelated variables. A construct may then be developed and derived from many observable variables. The basic assumption of factor analysis is that factors can be used to explain complex phenomenon. Observed correlations between variables may result from their sharing these factors[689 690].

The goal of factor analysis is to identify the not directly observable factor, based on a set of observable and measured variables. If individual high and low attitude scores, for each of the 24 statements that make-up the attitude scale questionnaire, can be explained in terms of groupings of attitudinal variables (attitude constructs), then, potentially detrimental aspects of attitude can be targeted by educational initiatives[691].

A factor analysis of all Quantity Surveying cases was carried out. The attitude constructs for students from all stages of Quantity Surveying were tabulated to obtain universal QS attitude constructs. These universal all stage constructs were then compared with scores obtained from students at particular stages of the Quantity Surveying course. This process was repeated for all Architectural cases. Findings below indicate that disparate attitude constructs are created and develop as a result of participation in disparate vocational courses of professional education.

6.4.3.1 Quantity Surveying attitude construct development

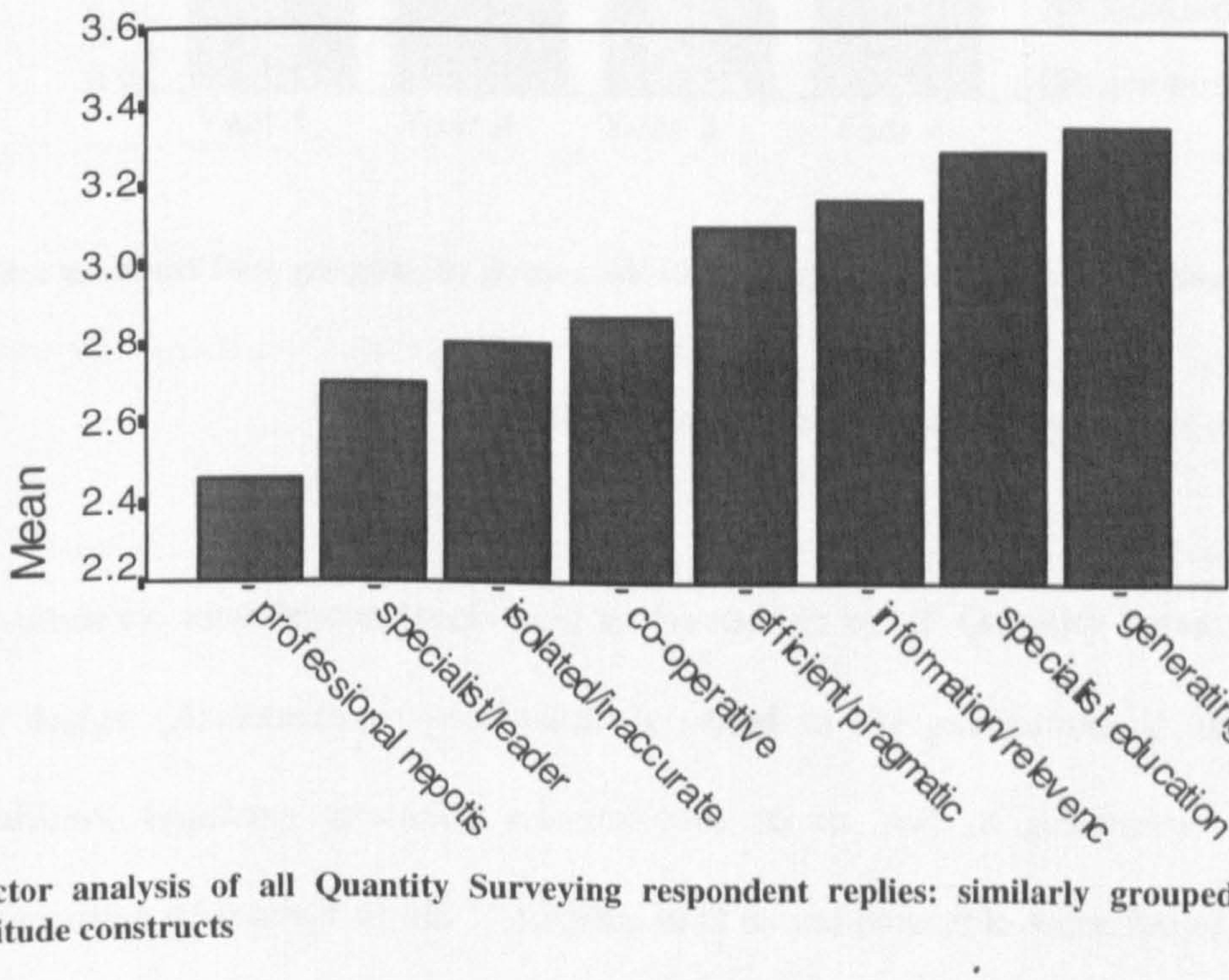
A factor analysis of all Quantity Surveying respondent replies (130 cases) was carried out. The rotated factor matrix produced 8 attitude constructs. These attitude factor constructs were derived from the individual scores for each of the 24 items making up the attitude scale questionnaire. Attitude constructs, held by the Quantity Surveying respondents towards the profession of Architecture, grouped similarly scored items together (**Appendix B item 6.22**). The similarly grouped items were then summarised into one single statement which seeks to incorporate the general themes of each one of the grouped items. Whilst there is a degree of subjectivity involved in this process, there is precedent[692] to suggest that Single Statement attitude constructs, able to convey the general feeling of the grouped items, are more useful in data analysis than very large cumbersome follow-on sentences.

Single Statement attitude constructs for the 8 groupings identified by factor analysis are described below. Barcharts then describe the mean rank scores of these factor constructs.

Single Statement attitude constructs	Barchart Reference Label
Item 1 and 24 formed a factor grouping which displayed an unfavourable attitude towards the design profession acting as: *professional nepotist.*	*professional nepotis*
A low (unfavourable) attitude scale score was recorded for the grouping comprising questionnaire item 2, item 3, item 6, and item 16. This factor grouping can be summarised as a relatively unfavourable attitude being shown towards the design (Architectural) profession as*: inarticulate specialists who attempt to lead and advance design team decision and process.*	*specialist/ leader*
Item 17, item 20 and item 23 of the attitude scale questionnaire formed the low scoring factor grouping of attitude towards the design (Architectural) profession as: *individualists lacking accuracy.*	*isolated/ inaccurate*
Item 5 and item 12 form a factor grouping which perceives the Architects need for: *co-operative idea development*	*co-operative*
Items 4, 9 and 22 formed a factor grouping which displayed a relatively favourable attitude towards the Architectural profession as one of: *informed efficient pragmatism.*	*efficient/ pragmatic*
Items 14 and 19 formed a factor grouping which displayed a favourable attitude towards the Architectural profession as suited to the: *provision of wide ranging information extensive interest.*	*information/ relevance*
Item 21 formed its own factor grouping. A favourable attitude is displayed towards the design professions need for *specialist education.*	*specialist/ education*
Item 7 formed its own factor grouping. A favourable attitude is displayed towards the Architectural profession as suited to: *the generation of ideas to overcome problems.*	*generating ideas*

Table 6.4
Single Statement QS attitude constructs

These attitude constructs are charted below by their attitude-scale mean rank score information.



Factor analysis of all Quantity Surveying respondent replies: similarly grouped items forming 8 attitude constructs

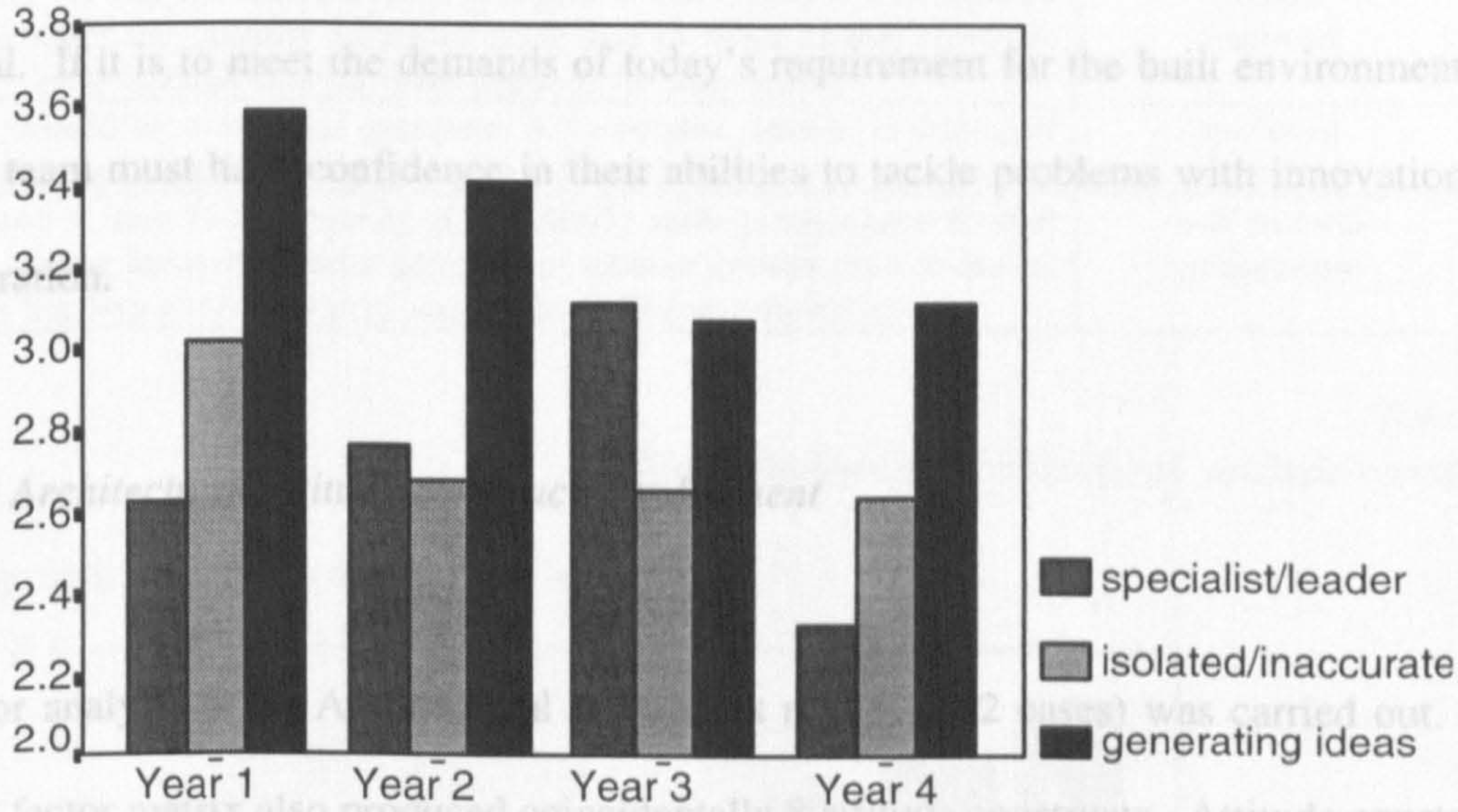
Figure 6.3
Single Statement QS attitude constructs

The 8 factor constructs allowed an investigation of the extent to which attitudes expressed in stage 1, stage 2, stage 3, and stage 4 differed from one another. Using the cumulative attitude factor constructs as the gauge to investigate the development of Quantity Surveying attitudes held towards the profession of Architecture, mean rank scores for the factor constructs were calculated for each stage, then compared using a *Kruskal - Wallis 1 - Way Anova* test.

Three of the attitude constructs were scored *significantly* differently in a comparison of stage 1, stage 2, stage 3 and stage 4 mean rank scores. These are tabulated below:

Factor construct changes over time	Bar Chart Reference Label
The universal unfavourable attitude construct shown towards the design (Architectural) profession as: *inarticulate specialists who attempt to lead and advance design team decision and process* was found to rise slightly, become more favourable, from stage 1 to stage 3 then drop sharply, become less favourable in stage 4.	*specialist/ leader*
The attitude construct towards the design (Architectural) profession as: *individualists lacking accuracy* dropped sharply after stage 1 and then levelled out in stage 2, 3 and 4.	*isolated/ inaccurate*
The cumulative favourable attitude displayed towards the Architectural profession as suited to: *the generation of ideas to overcome problems* also significantly differed in mean rank scoring between stages 1, 2, 3, and 4. This attitude fell steadily in stage 2 and stage 3, levelling out at stage 4.	*generating ideas*

Table 6.5
Single Statement QS attitude construct changes over time



Factor construct Item grouping by mean rank attitude score: significant changes over time

Figure 6.4
Single Statement QS attitude construct changes over time

In summary, attitude constructs held as favourable by all Quantity surveying cases regard the design (Architectural) profession as suited to *the generation of ideas to overcome problems, requiring specialist education* to do so, and as *generators of wide-ranging information of interest to all.* Attitudes held as unfavourable were found to be the design profession's leaning towards *professional nepotism*, apparent role as *inarticulate specialists* *leading design team decision and process*, and their *inaccurate isolationist nature*. Clearly if improvement in relations is to arise from an educational initiative for integration, it is the last three factors which require attention.

Also of note for any educational initiative seeking to instil a more integrative ethos, is the worrying trend towards a reduction in favourability for the factor which attained the highest of the 8 individual mean rank scores: that of the Architect as suited to the *generation of ideas to overcome problems*. If the factor that is seen as the most *favourable* attribute can fall steadily and significantly after stage 1, then education must address this attitude reversal. If it is to meet the demands of today's requirement for the built environment, the design team must have confidence in their abilities to tackle problems with innovation and co-operation.

6.4.3.2 Architectural attitude construct development

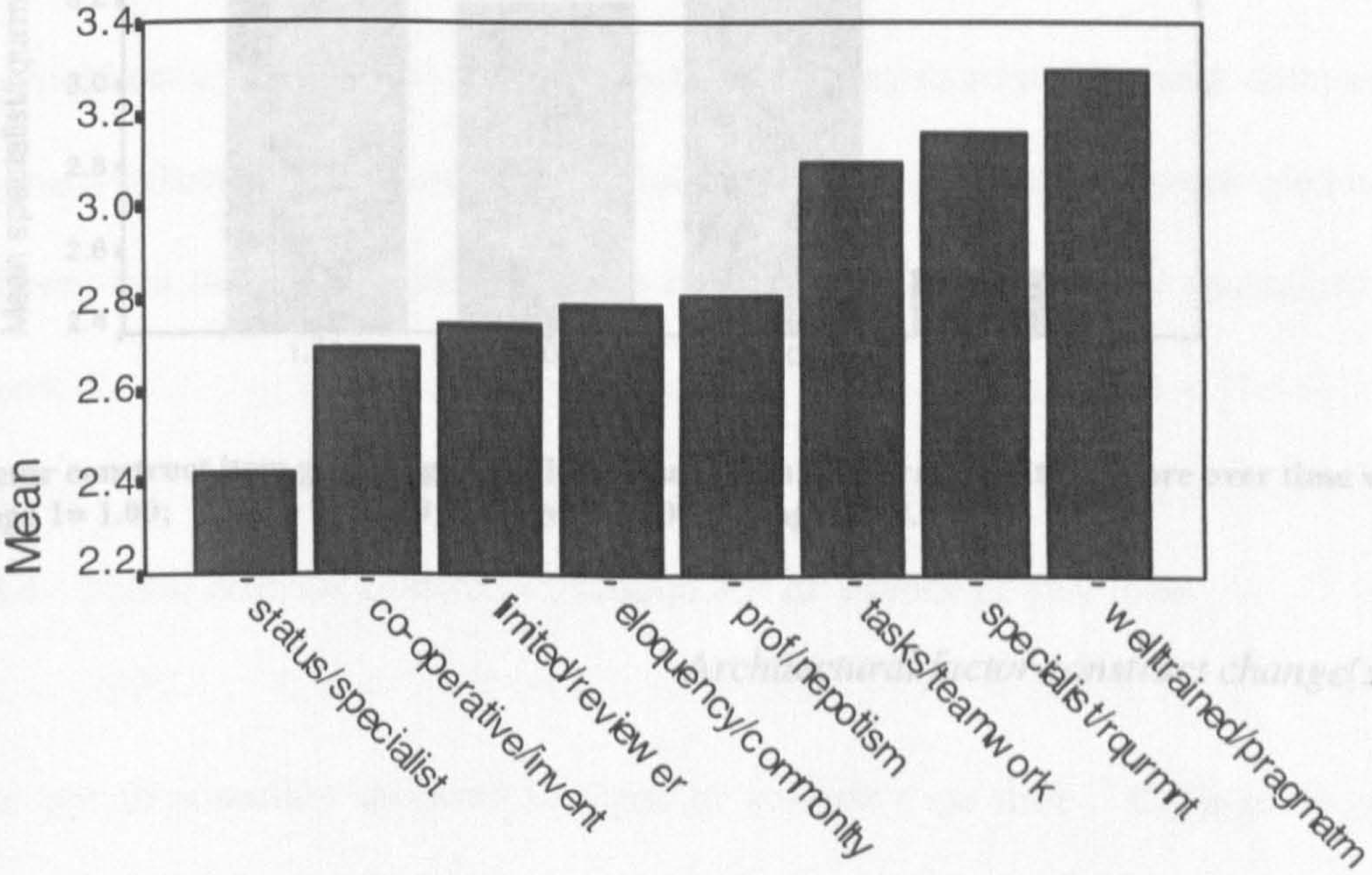
A factor analysis of all Architectural respondent replies (192 cases) was carried out. The rotated factor matrix also produced coincidentally 8 attitude constructs. Attitude constructs, held in this instance by Architectural respondents towards the non-design oriented Quantity profession, again grouped similarly scored items together (**Appendix B item 6.23**).

The item groupings, Single Statement to represent 8 attitude constructs, are presented below:

Single Statement attitude constructs	*Bar Chart Reference Labels*
A low (unfavourable) attitude scale score was recorded for the grouping comprising questionnaire item 2, item 6, item 15, item 16, item 18, and item 23. This factor grouping can be summarised as a relatively unfavourable attitude being shown towards the non-design (Quantity Surveying) profession as: *a non-prestigious uninspiring specialist, unsuited to leading the advancement of design team decision and process.*	*status/ specialist*
Items 5, 7, and 10 formed a factor grouping which displayed a relatively unfavourable attitude towards the Quantity Surveying profession as: *lacking in co-operative inventiveness.*	*co-operative/ invent*
Item 14 formed its own factor grouping. An unfavourable attitude is displayed towards the Quantity Surveying profession as a *reviewer of information of limited interest.*	*limited/ reviewer*
Item 3 and 11 formed a factor grouping which displayed an unfavourable attitude towards the non-design profession's abilities of: *eloquency gained from an all-embracing approach.*	*eloquency/ commonality*
Item 12 and item 24 form a factor grouping which perceives the Quantity Surveyor unfavourably as a *professional nepotist.*	*prof/nepotist*
Items 4, 11, 19 and 20 formed a factor grouping which displayed a favourable attitude towards the Quantity Surveying profession as suited to the: *provision of specific tasks through their informed capacity for team-work.*	*tasks/ teamwork*
Item 21 formed its own factor grouping. A favourable attitude is displayed towards the design professions need for *specialist education.*	*specialist education*
Item 8, item 9, item 17 and item 22 of the attitude scale questionnaire formed the high scoring favourable factor grouping of attitude towards the non-design (Quantity Surveying) profession *as well trained efficient pragmatists*	*well trained/ pragmatism*

Table 6.6
Single Statement Architectural attitude constructs

These attitude constructs are charted below.

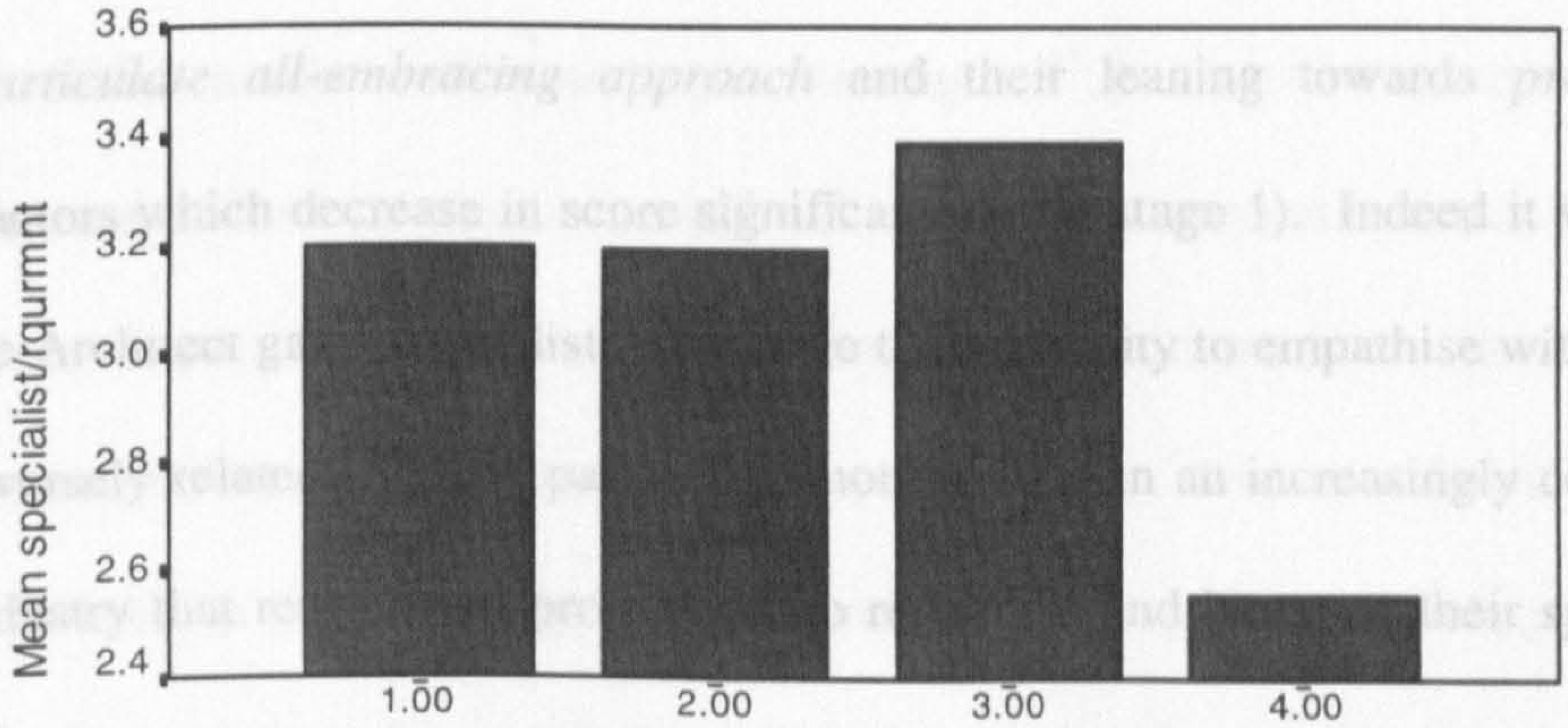


Factor analysis of all Architectural respondent replies: similarly grouped items forming 8 attitude constructs

Figure 6.5
Single Statement Architectural attitude constructs

The 8 factor constructs allowed an investigation of the extent to which attitudes expressed in stage 1, stage 2, stage 3, and stage 4 differed from one another. Using the cumulative attitude factor constructs as the gauge to investigate the development of Architectural attitudes held towards the profession of Quantity Surveying, mean rank scores for the factor constructs were calculated for each stage, then compared using a *Kruskal - Wallis 1 - Way Anova* test.

Only one of the attitude constructs was scored significantly differently in a comparison of stage 1, stage 2, stage 3 and stage 4 mean rank scores: The favourable attitude displayed towards the design professions need for *specialist education* was seen as a constant at stage 1 and stage 2, seen to rise in stage 3 and then drop sharply in stage 4. This is charted below.



Factor construct item grouping: significant changes in mean rank attitude score over time where: Stage 1= 1.00; Stage 2 = 2.00; Stage 3 = 3.00; Stage 4 = 4.00

Figure 6.6
Architectural factor construct change(s) over time

In summary, attitude constructs held as favourable by all Architectural cases towards the non-design, (Quantity Surveying) profession are found to be:- their outlook as a *well-trained efficient pragmatist, requiring specialist education*, and their ability to *perform specific tasks through an informed capacity for team-work.* Attitudes held as unfavourable, regard the non-design team colleague to be *a non-prestigious uninspiring specialist, unsuited to leading the advancement of design team decision and process*, having a lack of *co-operation and inventiveness*; their perceived role as a *reviewer of information of limited interest, an inarticulate all-embracing approach* and their leaning towards *professional nepotism.* Clearly if improvement in relations is to arise from an educational initiative for integration, it is these last factors that require attention.

Any educational initiative seeking to instil a more integrative ethos, must recognise the *increasingly* unfavourable attitudes expressed towards the non-design professions perceived *inarticulate all-embracing approach* and their leaning towards *professional nepotism* (factors which decrease in score significantly after stage 1). Indeed it would appear that as the Architect gains specialist knowledge their capacity to empathise with other specialists is inversely related. This is particularly note-worthy in an increasingly complex construction industry that requires all professions to recognise and integrate their specialists skills with others.

6.4.4 Factor analysis constructs: creation and development over time

The previous section assessed changes in attitude over time. *Cumulative stage* factor constructs of Architectural students on the one hand, and Quantity Surveying students on the other, were used as the common gauge to measure and compare differences in scoring between stage 1, stage 2, stage 3 and stage 4. The cross sectional approach adopted provided a good idea of attitude changes resulting from the progress of similarly placed vocational students.

Building upon this information, stage specific factor analyses were then carried out to expand upon information about the extent of attitude change over time. A factor analysis was conducted for stage 1 Architectural attitude scale scores. The factor analysis test failed to converge in 25 iterations[693]. In other words a factor model of item correlations was found to be inappropriate for the 49 stage 1 Architects at RGU Aberdeen, as well as the 43 stage 1 Architects at UCE Birmingham. When a factor analysis was conducted for stage 2 Architects, a similar result was obtained. Clearly for students at stage 1 and stage 2 of an Architectural course, a factor model of attitude scale item correlations is inappropriate. This inability to form attitude factors implies a lack of knowledge of other disciplines.

A similar number of cases from the stage 3 Architecture course *did* produce factor constructs based on the similarities of individual statement scores. Indeed these stage 3 factor constructs are found to display similar constructs to those devised from the cumulative factor analysis of all Architectural cases. The most favourable factor construct held towards the non-design oriented colleague being an *articulate pragmatism deserving of status*; the least favourable factor construct being the perceived *lack of creativity and co-operation and unsuitability to advance design team decisions* (see **Appendix B item 6.24**).

Stage specific factor analyses carried out for Quantity Surveying respondents at stage 1, stage 2, stage 3 and stage 4, each produced individual factor models. Similarities were found between the universal factor analysis measurements used to compare the 4 respective stages, and the individual factor analyses compiled for each stage independently. (see **Appendix B item 6.25**).

The identification of specific favourable and unfavourable attitudes held towards peer professions, which repeat to a large extent previous sections, are worth noting in that they support further the findings and discussion presented above. However, of more importance to the discussion at hand is the stage 1, and stage 2 Architectural result. When examined in isolation, students in the initial stages of the course of Architecture, failed to produce a matrix of item correlations. Only at stage 3 did Architectural students produce factor groupings of attitude statement correlations. Quantity Surveying students on the other hand produced factor correlations at all independent stages of professional education.

These results are in line with discussion above which argues that, populist media attention given to Architecture clearly identifies this profession, in the eyes of non-architectural students, as having a major role in the creation and maintenance of the built environment. Stage 1 and stage 2 Quantity Surveying students are thus able to form attitude constructs based on these external sources of information. New Architectural students however, can be argued to exhibit ignorance of the other professions who contribute to the building design process[694].

This would tend to support the proposition that *higher vocational education* must be regarded as a key variable in the evolution of attitude constructs toward peer disciplines, as well as having a major influence on attitude development. Clearly Architectural student attitude factor constructs are created as students progress through their course. Quantity Surveying attitudes are also influenced greatly by their academic course of studies. As students advance through vocational courses, they learn of the complexities of the multi-disciplinary building process and they develop disparate attitude constructs, towards peer professions, which are instilled by disparate educational processes.

6.5 Summary of sample analysis: commentary on attitude changes over time

This section summarises and presents a brief commentary on the findings described above. Section 6.5.1 describes non-design Quantity Surveying student attitudes held towards the design profession of Architecture. Section 6.5.2 describes design orientated Architectural student attitudes held towards the non-design profession of Quantity Surveying. Both summary sections define the analyses criteria used, the stage (initial, intermediate, or final) of the sample analyses; and give collective reports of trends from the start of the course through to the end of the course.

6.5.1 Non-design Quantity Surveying student attitudes held towards the design profession of Architecture

This section is presented as follows:-

Section 6.5.1.1 presents Analysis Criteria: (i) Analysis of Quantity Surveying respondent replies relative to Architectural respondent replies; (ii) 24 item attitude scale questionnaire; (iii) Individual statement analysis.

Section 6.5.1.2 presents Analysis Criteria: (i) An analysis of Quantity Surveying respondent replies relative to particular stage (1, 2, 3 & 4) replies; (ii)24 item attitude scale questionnaire; (iii)Individual statement analysis.

Section 6.5.1.3 presents Analysis Criteria: (i)Universal, cumulative stage, factor constructs displayed by Quantity Surveying respondents from all stages.

Section 6.5.1.4 presents Analysis Criteria: (i)Universal, cumulative stage, factor constructs displayed by Quantity Surveying respondents from all stages; (ii) Results relative to Quantity Surveying replies at stage 1, 2, 3 & 4 respectively.

Section 6.5.1.5 presents Analaysis Criteria: (i)Stage specific factor constructs displayed by Quantity Surveying respondentsat particular stages; (ii)Cases examined independently by stage.

6.5.1.1 Analysis Criteria:

(i) Analysis of Quantity Surveying respondent replies relative to Architectural respondent replies

(ii) 24 item attitude scale questionnaire

(iii) Individual statement analysis

Initial Stage: Initially Architects regarded to be: stimulating; original; deserving of prestige; and, idea developers. Also seen as: suited to lead; idea generators; well trained; providers of useful information.

Intermediate Stage: Architects regarded at this stage as: suited to lead; idea generators; well trained; providers of useful information.

Final Stage: Architects regarded at this stage as: not significantly different from design students attitudes towards the non-design profession.

Collective Summary (of trends from the start of the course through to the end of the course) 30% of the 24 statements which make up the attitude scale questionnaire are scored favourably (mean rank ≥ 3) by stage 1 QS students, relative to the scores gained from stage 1 Architects towards the profession of Quantity Surveying. This 30% favourability drops to nil in an analysis of final year relative attitude scores. (i)Initially the profession of Architecture scores favourably as the stereotypical design team leader; (ii)Quantity Surveying respondents become increasingly knowledgeable in their own specialist discipline; (iii)In the final stages attitudes scores displayed by QS students and Architectural students converge; and, (iv)Mutual disregard occurs

6.5.1.2 Analysis Criteria

(i) An analysis of Quantity Surveying respondent replies relative to particular stage (1, 2, 3 & 4) replies

(ii) 24 item attitude scale questionnaire

(iii) Individual statement analysis

Initial stage: Attitude scale scores found to be relatively high, fell in stage 2.

Intermediate Stage Many items again returned to stage 1 levels; in particular a positive swing was displayed towards Architectural prestige and abilities in: project management, and idea development.

Final stage: At this final stage ALL attitude scale scores dipped once more, displaying a more negative mean ranking, unfavourablity towards the design profession.

Collective Summary (of trends from the start of the course through to the end of the course: 33.3% of the 24 statements were scored significantly lowly by final stage students. From stage 1 to stage 4 important items become *more negative*, in particular attitudes towards Architectural abilities to generate ideas, the design professions need for specialist knowledge, their ability to stimulate and act as a catalyst, and their level of prestige. The stage 3 positive swing represents QS student training experiences in industry. Attitudes at this stage reflect a perceived role as a support discipline, which is in line with part-time QS student attitudes. Although stage 3 halts the negative trend, stage 4 finds academically isolated students displaying a realisation of their own potential and displaying a significantly low negative attitude towards their Architectural peers.

6.5.1.3 Analysis Criteria:

(i) Universal, cumulative stage, factor constructs displayed by Quantity Surveying respondents from all stages

Collective Summary: The most negative, unfavourable, factor construct is that which expresses Quantity Surveying student attitudes towards the Architect as: *a professional nepotist.* Whilst the most positive, favourable, factor construct is that which expresses QS student attitudes towards the Architect as: *an idea generator*

6.5.1.4 Analysis Criteria:

(i) Universal, cumulative stage, factor constructs displayed by Quantity Surveying respondents from all stages

(ii) Results relative to Quantity Surveying replies at stage 1, 2, 3 & 4 respectively

Generally factor construct changes over time agree with the item by item analysis described above: Overall score for *'articulate specialist leading advancement of design team decision and process'* becomes more *positive* from stage 1 to stage 3, then drops in stage 4. However, perhaps more importantly are the increasingly negative attitudes displayed towards the design profession as: (i)*isolationists lacking accuracy*, (ii)*uninformed idealists*, and, (iii) *being unable to generate ideas* (which was seen by the QS respondents as the most favourable trait)

A lack of detailed knowledge about the design profession gives way to a readily available stereotype of the Architect as dreamer/idealist, not able to link *divergent* thought with *convergent* activity. As the Quantity Surveying student is made increasingly aware of the complex nature of the design process, there is a feeling that the Architect is unable to overcome the real problems of construction. This is added to by the feeling that the design profession prefers to work alone and is unwilling to accept the potential of disparate specialist skills

6.5.1.5 Analaysis Criteria:

(i) Stage specific factor constructs displayed by Quantity Surveying respondents at particular stages

(ii) Cases examined independently by stage

Stage 1: Favourable attitude scale factor constructs: (i) neat and orderly in work and manner, (ii) able to fashion others ideas. Unfavourable attitude scale factor constructs: (i) held as professional nepotist, (ii) unaware of professional limit, and, (iii) seldom seeks advice.

Stage 2: Favourable attitude scale factor constructs: (i) specialist idea generator. Unfavourable attitude scale factor constructs: (i) held as professional nepotist.

Stage 3: Favourable attitude scale factor constructs: (i) Accurate idea generator. Unfavourable attitude scale factor constructs: (i) uninformed specialist, and (ii) uncommunicative nepotist.

Stage 4: Favourable attitude scale factor constructs: (i) information generated of wide interest. Unfavourable attitude scale factor constructs: (i) unstimulating and unsuited to lead

6.5.2 Design orientated Architectural student attitudes held towards the non-design profession of Quantity Surveying.

This section is presented as follows:

Section 6.5.2.1 presents Analysis Criterion: (i) Analysis of Architectural respondent replies relative to Quantity Surveying respondent replies; (ii) 24 item attitude scale questionnaire; (iii) Individual statement analysis.

Section 6.5.2.2 presents Analysis Criteria: (i) Analysis of Architectural replies relative to particular stage (1, 2, 3 & 4 respectively), (ii) 24 item attitude scale questionnaire, and (iii) Individual statement analysis.

Section 6.5.2.3 presents Analysis Criteria: (i)Universal, cumulative stage, factor constructs displayed by Architectural respondents from all stages.

Section 6.5.2.4 presents Analysis Criteria: (i) Universal, cumulative stage, factor constructs displayed by Architectural respondents from all stages: (ii) Results relative to Architectural replies at stage 1, 2, 3 & 4 respectively.

Section 6.5.2.5 presents Analysis Criteria: (i) Stage Specific factor constructs displayed by Architectural respondents at particular stages, and, (ii) Cases examined independently by stage.

6.5.2.1 Analysis Criteria

(i) Analysis of Architectural respondent replies relative to Quantity Surveying respondent replies

(ii) 24 item attitude scale questionnaire

(iii) Individual statement analysis

Initial Stage Initially Quantity Surveyors regarded to be, suited to communication, able to acknowledge professional limits, able to solve organisational problems, and, display a professional responsibility to others. Also: neat and orderly in work and manner, mentally efficient, and, a good team worker.

Intermediate Stage : Quantity Surveyors regarded at this stage as neat and orderly in work and manner mentally efficient a good team worker; and able to display a generalist education.

Final Stage Quantity Surveyors still regarded at this stage as, accurate, mentally efficient, a good team player, and, willing to seek help for problems outwith own remit.

Collective Summary (of trends from the start of the course through to the end of the course). Stereotypical view of the non-design profession as an efficient, organised, team player of limited contribution is retained throughout the 4 stages of professional education. Little alters the view that the non-design colleague is an efficient support discipline to the Architectural design team leader.

6.5.2.2 Analysis Criteria

(i) Analysis of Architectural replies relative to particular stage (1, 2, 3 & 4 respectively)

(ii) 24 item attitude scale questionnaire

(iii) Individual statement analysis

Initial Stage: After stage 1, statements become generally *less favourable* towards QS suitability to lead, QS need for general education, and QS ability to recognise limitations. The QS need for specialisation is found to increase in mean rank scoring.

Intermediate Stage: Existing attitudes towards the QS are found to increase become (more favourable) very slightly.

Final Stage: Final year attitudes are found to drop in favourability.

Collective Summary (of trends from the start of the course through to the end of the course): The slight increase in scores in stage 3, indicates a slightly more favourable attitude towards the disparate peer's specialists skill. However the QS profession is still not regarded with any real favourability. There appears a trend for the Architectural respondents to regard increasingly the disparate profession as requiring specialist knowledge, at the same time as seeing little need for improving their generalist knowledge.

6.5.2.3 Analysis Criteria

(i) Universal, cumulative stage, factor constructs displayed by Architectural respondents from all stages

The most negative, unfavourable factor construct is that which expresses Architectural student attitudes towards the QS as: a *specialist suited to project management and inspirational leadership.* Whilst the most positive, favourable, factor construct is that which expresses Architectural students attitudes towards the QS as: *an accurate efficient pragmatist*

6.5.2.4 Analysis Criteria

(i) Universal, cumulative stage, factor constructs displayed by Architectural respondents from all stages

(ii) Results relative to Architectural replies at stage 1, 2, 3 & 4 respectively.

Very few attitude scale score changes are found as students progress through professional education. The changes which *do* occur in factor constructs, as a result of time, are the mid range constructs of the following: Overall score for attitudes towards the QS as a '*provider of limited interest information*' become more negative in year 2 but gain in favourability again at stage 3 and 4. The requirement for *specialist knowledge* is found to improve at stage 3 then drop sharply at stage 4. In addition to the above, increasing negative attitudes towards the QS as professional nepotist, which might be argued to imply an Architectural fear of losing market share.

6.5.2.5 Analysis Criteria

(i) Stage Specific factor constructs displayed by Architectural respondents at particular stages

(ii) Cases examined independently by stage

Stage 1: no factor constructs.

Stage 2: no factor constructs.

Stage 3: Favourable attitude scale factor constructs: (i)articulate pragmatist deserving status. Unfavourable attitude scale factor construct: (i)unco-operative uncreative and unsuited to lead or project manage.

Final Stage: Repeats Universal factor constructs above.

Collective Summary: Limited knowledge of disparate professions at the initial stages gives way to stereotypical attitudes towards non-design professions as pragmatic helpers who are unsuited to lead are take a major role in the design process.

6.5.3 Overview

In summary, the findings above have produced reliable information about the design professionals of the future. In particular findings have identified the factors of inter-disciplinary attitude difference and the variables argued to make up inter-professional latent conflict, detrimental to building design process and product. Section 7, which follows investigates the extent to which experimental educational initiatives, to instil empathy, are able to address the inter-disciplinary differences found to exist.

Notes and Endnotes

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CHAPTER 7

RESULTS: EXPERIMENTAL EDUCATIONAL INTEGRATION PROGRAMMES

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CHAPTER 7

RESULTS: EXPERIMENTAL EDUCATIONAL INTEGRATION PROGRAMMES

7.1 Results: Attitude change arising from experimentation in educational integration

This project is concerned chiefly with the integration of specialists who fulfil dissimilar professional roles within the multi-disciplinary building design process. The courses of Architecture and Quantity Surveying were found to provide the most suitable disparate pairing for study. Architectural students and Quantity Surveying students represent a pairing, within a similar population, whose similarity is based upon their relatively unfavourable attitude scores towards their disparate, *non-design* or *design* based, professional colleague. This section presents findings gained by experimentation that addressed the potential of integrative education to influence attitude towards design team colleagues.

It was decided that further investigation must concentrate on comparisons between the design oriented Architectural respondents, and the non-design orientated Quantity Surveying respondents. As a result it was felt that further investigation of the *design* based Building Design Engineering honours degree offered by Strathclyde University, no longer fell within the remit of this research project. This predominately design based honours degree, integrating elements from Architecture and design Engineering no longer offered the opportunity to investigate the interaction of disparate disciplines. Whilst providing an essential contribution to the early stages of the project, cases from the University of Strathclyde were not used in subsequent analysis.

This section presents the results of findings from experiments in inter-disciplinary education, for courses concerned with the creation and maintenance of the built environment, which seek to encourage a more integrated outlook.

Detailed analysis of experimental training programmes, which seek to integrate *disparate* building professionals, examined educational initiatives at the University of Central England, Birmingham (promoting an initiative for new stage 1 students, and also an initiative for those in the final stages of their disparate courses), and the Robert Gordon University, Aberdeen (an initiative aimed at intermediate stage 3 students).

7.2 Case study 1: University of Central England in Birmingham, Stage One, Multi-disciplinary Participation

This section presents findings which compare attitude scale scores *before* participation in the stage 1 multi-disciplinary project developed by UCE Birmingham, with attitude scale scores *after* participation in the project. The section initially details findings which describe Quantity Surveying attitude score changes. The section then discusses findings which describe Architectural attitude score changes. Tutor input is then discussed. A synopsis of the programme of integration concludes the discussion of the findings of the stage 1 case study experiment.

Objectives outlined for this common learning skills unit were described as: (I) Promoting contact between students studying in different, but related, professional disciplines associated with the Built Environment, in order to encourage a greater understanding of each others contribution; (ii) Encouraging the recognition of common value systems between the built environment professions, in addition to those of their own chosen specialism, and (iii) Providing a range of *general & basic* educational skills to assist in coping with the more complex work which lies ahead.[695]

The unit took place one day per week during the initial 15 weeks of the first year. Three main non-vocational subjects, occupying equal time and rating, were presented in the form of mixed lectures and seminars. These were titled, (i) Personal Management and Data Accessing, (ii) Collection and Presentation of Data and Technology; and, (iii) Communication Skills and Group Project. The *Group Project* required the student groups to undertake the organisation of 'a carnival to celebrate the birth of a new University in the English Midlands'. Student groups were required to work in inter-disciplinary teams of 15 to prepare a report detailing all aspects of the *planning* and *organisation* of such an event. Its general purpose was stated as a means to allow the students to, (i) explore the advantages and disadvantages of working in groups with common objectives, (ii) discover how different skills and interests can be harnessed and, (iii) utilise the contents of the non-vocational subject lectures and seminars to solve a series of practical problems

7.2.1 Architectural and Quantity Surveying stage 1 analyses

The experiment discussed hereafter engaged initial stage students from several different disciplines in a programme of common foundation studies. A major part of this programme was an inter-disciplinary project: an organisational task requiring no specialist input. In line with findings presented in section 6 only Architectural and Quantity Surveying students were studied.

7.2.1.1 Quantity Surveying case analysis: stage 1

Comparison between stage 1 Quantity Surveying students prior to participation in the multi-disciplinary project, and stage 1 Quantity Surveying students just after participation in the multi-disciplinary project found no *overall* significant difference in attitude scale scores (see **Appendix C item 7.1**). Indeed *not one* of the 24 statements making-up the attitude scale questionnaire displayed a significant difference in scores recorded prior to the project and scores recorded after the project.

Further analysis was made using the universal factor constructs for Quantity Surveying identified and described in the previous section. A mean rank score for each of the 8 attitude constructs was calculated, from stage 1 cases, prior to participation in the project. This was compared with the mean rank score calculated for each of the 8 attitude constructs after the stage 1 students had participated in the project. Again no significant differences were found in *any* of the before and after mean rank attitude scores.

7.2.1.2 Architectural case analysis: stage 1

Comparison between stage 1 Architectural students prior to participation in the multi-disciplinary project, and stage 1 Architectural students just after participation in the multi-disciplinary project, again found no *overall* significant difference in attitude scale scores (see **Appendix C item 7.2**). Indeed 23 of the 24 statements making-up the attitude scale questionnaire displayed no significant difference in scores recorded prior to the project and scores recorded after the project.

Further analysis was made using the universal factor constructs for Architects identified and described previously. A mean rank score for each of the 8 attitude constructs was calculated, from stage 1 cases, prior to participation in the project. This was compared with the mean rank score calculated for each of the 8 attitude constructs after the stage 1 students had participated in the project. Again no significant differences were found in *any* of the before and after mean rank attitude scores.

7.2.2 Student view of tutor input and project structure: stage 1 case study

On completion of the multi-disciplinary project, all stage 1 students were asked 5 additional wild card questions about *tutor input and the overall success of the programme*. Questions were added to the attitude scale questionnaire presented to students who had participated in the project. Questions were structured to avoid automatic response sets, and conformed in style to the original Likert scale. A summary of the results are described below:

It was found that approximately 70% of Architectural stage 1 students thought that *attending lectures alongside students of different construction disciplines was a good method of achieving an integration of professional objectives.* Approximately 70% of Quantity Surveying students were also found to agree with the statement.

Question 2 asked if *Tutors teaching more than one school of the built environment were biased in favour of their own discipline.* Again the disparate courses gave similar views. Approximately 80% of both Architectural and Quantity Surveying students agreed with this statement.

Question 3 asked if students thought that *the quality of the tutor has little real effect on the success of a cross disciplinary project.* Again the disciplines concurred. Approximately 65% of the Architectural students disagreed with this statement. Similarly 65% of the Quantity Surveying students disagreed with this statement

Question 4 asked if *individuals taking part in cross disciplinary projects exhibit value judgements common to their own particular profession.* Approximately 70 % of Architectural and Quantity Surveying students agreed with this statement.

Question 5 asked whether *as a result of participating in a multi-disciplinary project, their own chosen discipline could be seen to be of more importance than most others.* Approximately 70% of Architectural students agreed with this statement. Conversely however, approximately 65% of Quantity Surveying students were found to disagree with this statement. It must be remembered that the project in question required neither specialist skill, nor adherence to traditional design team role playing.

7.2.3 Stage 1 project: findings overview

Prior to this stage 1 inter-disciplinary project, a number of unfavourable attitudes towards peer professions were detected. The profession of Quantity Surveying was deemed to be relatively lacking in the following areas: information provision; relevancy of contribution; leadership skills; problem solving abilities; and, training. Similarly, the profession of Architecture was deemed to be relatively lacking in areas relating to: team working; accuracy; efficiency; and, knowing (professional) limitations.

This project did not require specialist knowledge. Rather it sought to instil successful team development and an appreciation of group dynamics. Logically then, this project should have addressed some, if not all, of the variables identified in the previous paragraph. These negative attitudes, however, were *unaltered* by participation in this stage 1 non-specialist management project, and common skills teaching programme. The caveat that a particular profession may well be universally regarded as the most important discipline involved in providing a particular service or specific product must not be overlooked. However in this case the non specialist nature of the task sought ideally to overcome this eventuality. Indeed, even though specialist knowledge was not an issue, 70% of the Architects said that their discipline could be seen as the most important to the organisational task at hand, whilst 65% of Quantity Surveyors thought that their discipline was of less (or equal) importance to the multi-disciplinary programme of work.

Interestingly 70% of participants, with very limited knowledge of their own or other courses, thought that colleagues exhibited value judgements common to a particular discipline(s). This is noteworthy in the light of figures which indicate that 80% of students regard tutors to be profession biased, and that tutors are perceived to have a high degree of influence in the programme of studies. These figures clearly reflect the need for the tutors to adopt a more structured, holistic approach, if the programme is to fulfil its objectives. In summary it is argued that the stage 1 unit, which aims 'to encourage a greater understanding of each others contribution' and 'to encourage the recognition of common value systems between ... specialisms'[696] is unlikely to succeed in the current format.

7.3 Case Study 2: University of Central England in Birmingham, Final Stage(s), Multi- disciplinary Participation

This section presents findings which compare attitude scale scores before participation in the final stage multi-disciplinary project developed by UCE Birmingham, with attitude scale scores after participation in the project. Findings describe Quantity Surveying attitude score changes. Findings then describe Architectural attitude score changes. Tutor input is also discussed. A summary of the programme of integration concludes the discussion of the findings of the final stage case study experiment.

The final stage inter-professional project was conceived 'to address the problems of disciplines working together'[697]. It took place over one semester: 1 day per week for 15 weeks. It involved an examination and analysis of the opportunities and obligations which exist for the development of a given site, in relation to its physical and socio-economic context. This was performed in randomly chosen multi-disciplinary 15 member teams. The project work was performed in conjunction with a series of 'Management' skills lectures which examined 'teamwork' as well as more specific lectures which concentrated on logistical, financial and legislative areas. Teams were required to produce a 'viable plan of development' for the chosen site.

7.3.1 Architectural and Quantity Surveying final stage analyses

The results below are taken from experimentation which engaged final stage students, from several different courses, in a multi-disciplinary programme of studies. Architectural and Quantity Surveying students only were examined, in line with findings presented in section 6.

7.3.1.1 Quantity Surveying case analysis: final stage

Comparison between final stage Quantity Surveying students prior to participation in the multi-disciplinary project, and final stage Quantity Surveying students just after participation in the multi-disciplinary project found that an overall significant difference *did* exist in attitude scale scores. *The Mann - Whitney U Wilcoxon Rank Sum W* test revealed a significant overall difference (see **Appendix C item 7.3).** The post-project mean rank scores displayed significantly lower scores, indicating a LESS favourable attitude, than the pre-project mean ranking.

Of the 24 statements making-up the attitude scale questionnaire, several items displayed a significant difference in scores recorded after the project, when compared with scores recorded before the project. In *ALL* of the following items, post-project mean rank scores were found to be significantly lower, *less* favourable, than the pre-project scores:

Item 1, *this professional seldom seeks out help and advice when they hit a problem in their own work,*

Item 5, *this professional grasps others ideas quickly long before they finish explaining them,*

Item 6, *this professional is the most suitable candidate to lead the design team,*

Item 7, *this professional quickly generates a great number of ideas when confronted with a new problem,*

Item 8, *the level of training given to this graduate professional in practice is of a lower standard than the other professions*

Item 10, *this professional gives freely of their own time and ideas to other people, projects and tasks,* Item 20, *this professional prefers to work alone; they are not a team person*,

Item 23, *this professional is stimulating to other people, they seem to catalyse others into more original and productive work than they would otherwise achieve.*

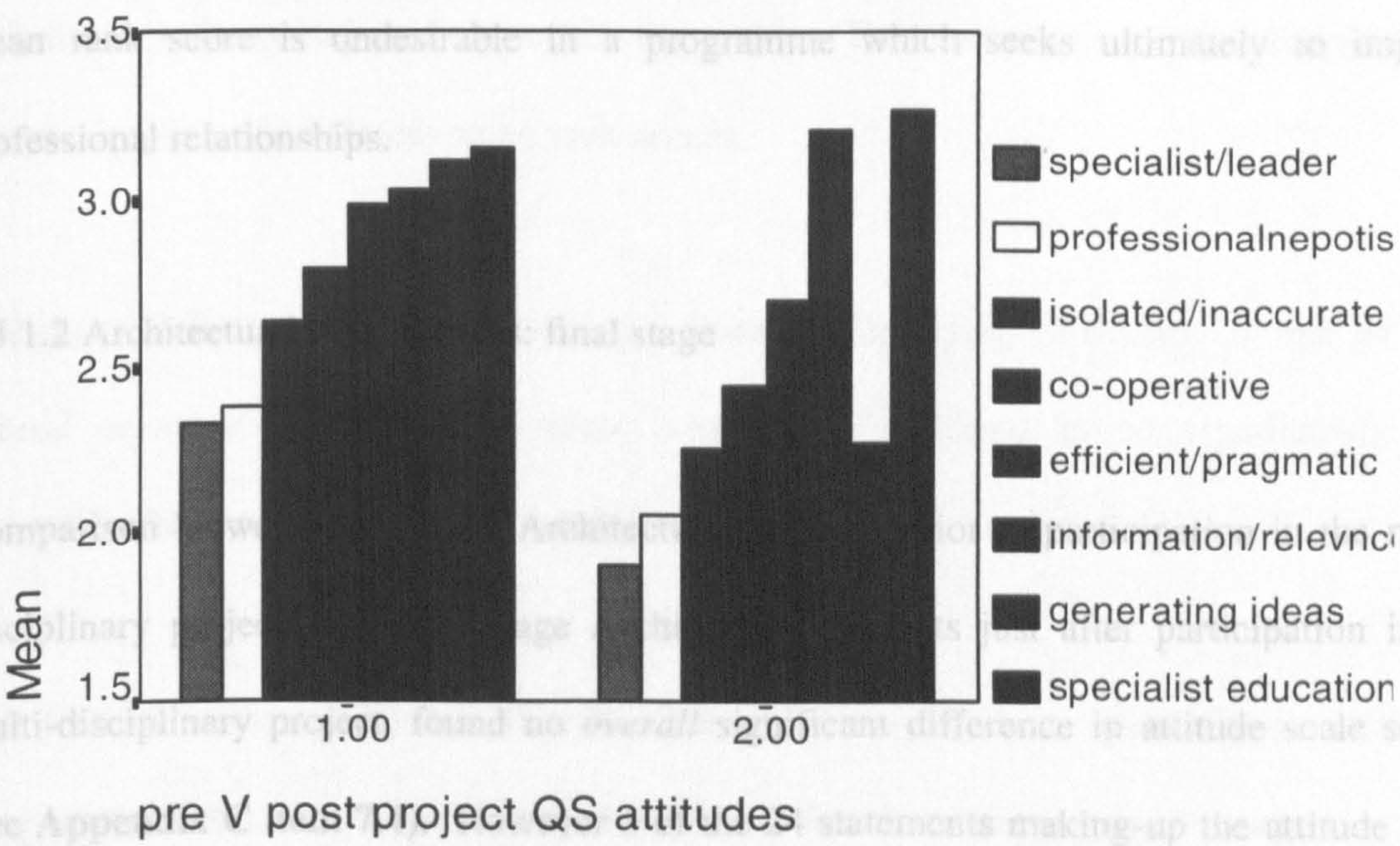
All items above were found to be scored significantly less favourably after participation in the final stage project.

Further analysis was made using the universal factor constructs for Quantity Surveying identified and described previously. A mean rank score for each of the 8 attitude constructs was calculated, from final stage cases, prior to participation in the project. This was compared with the mean rank(s) calculated for each of the 8 attitude constructs after the final stage students had participated in the project. Two factor constructs were found to display significantly different mean rank scores. In both of the following items, post-project mean rank scores were found to be significantly lower, *less* favourable, than the pre-project scores:

QS Factor construct 1, *inarticulate specialist leading the advancement of design team decision and process*, was found to be significantly lower, *less* favourable, than the pre-project scores.

QS Factor construct 2, *generation of ideas to overcome problems* was also found to be significantly lower, *less* favourable, than the pre-project scores.

A full comparison between pre-project Quantity Surveying factor construct scores and post-project Quantity Surveying factor construct scores are shown is Figure 7.1. The bar chart below shows a trend in 6 of the 8 attitude constructs towards a *less* favourable, lower mean rank score.



where:-

1.00 = pre-project attitude scores and 2.00 = post project attitude scores

and where:-

Single Statement QS student attitude constructs	*Barchart Reference Label*
The factor grouping questionnaire item 2, item 3, item 6, and item 16. can be summarised as a relatively unfavourable attitude being shown towards the design (Architectural) profession as: *inarticulate specialists who attempt to lead and advance design team decision and process*. The sample scored this construct lower, less favourably, after participation in the integrated project.	*specialist/ leader*
Factor grouping (item 1 and 24),an unfavourable attitude towards the design profession as: *professional nepotist*. Again scored lower after the project.	*professional nepotis*
Factor grouping (items 17, 20 and 23) of attitude towards the design (Architectural) profession as: *individualists lacking accuracy*. again scored lower post-project.	*isolated/ inaccurate*
Factor grouping (item 5 and 12) perceives the Architects need for: *co-operative idea development*. Factor score dropped post-project.	*co-operative*
Factor grouping (items 4, 9 and 22) which displayed a relatively favourable attitude towards the Architectural profession as one of: *informed efficient pragmatism*. The sample scored this factor lowered after participation in project.	*efficient/ pragmatic*
Factor grouping (items 14 and 19) displayed a favourable attitude towards the Architectural profession as suited to the: *provision of wide ranging information extensive interest*. Score improved after the project.	*information/ relevance*
Factor grouping (item 7), a favourable attitude towards the Architectural profession as suited to: *the generation of ideas to overcome problems* again score dropped after the project.	*generating ideas*
factor grouping (item 21), a favourable attitude is displayed towards the design professions need for *specialist education*. Scored higher after the project.	*specialist/ education*

Figure 7.1
Final stage project comparison of pre-project and post-project QS factor construct scores with reference to Single Statement QS attitude factor construct tabulation.

Clearly the negative trend in 6 of the 8 attitude constructs towards a *less* favourable, lower mean rank score is undesirable in a programme which seeks ultimately to improve professional relationships.

7.3.1.2 Architectural case analysis: final stage

Comparison between final stage Architectural students prior to participation in the multi-disciplinary project, and final stage Architectural students just after participation in the multi-disciplinary project, found no *overall* significant difference in attitude scale scores (see **Appendix C item 7.4).** However 3 of the 24 statements making-up the attitude scale questionnaire did display significant differences in scores recorded prior to the project and scores recorded just after the project.

item 3, *this professional can readily explain technical matters in their field to laymen*, was found to display a significantly less favourable, lower mean rank score after participation in the project.

Item 9, *this professional has an active, efficient and well organised mind*, was also found to display a significantly less favourable, lower mean rank score after participation in the project.

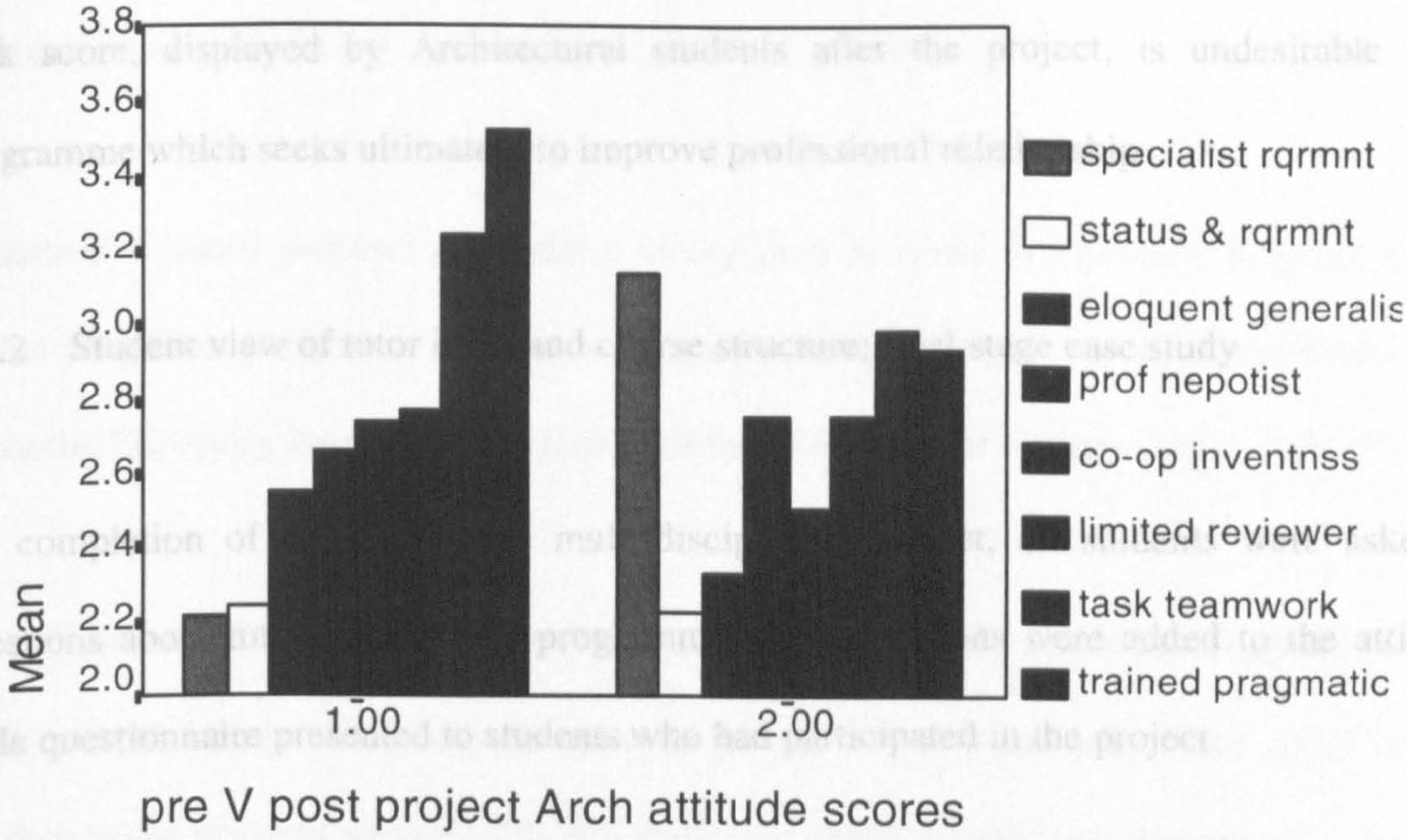
Item 21, *the teaching of this discipline during higher education should be of a highly specialised nature*, was found to increase in mean ranking, become more favourable, after participation in the project.

Further analysis was made using the universal factor constructs for Architects identified and described in section 6.4.3.2. A mean rank score for each of the 8 attitude constructs was calculated, from the final stage cases, prior to participation in the project. This was compared with the mean rank score calculated for each of the 8 attitude constructs after the final stage students had participated in the project. Two factor constructs were found to display significantly different mean rank scores.

Architectural Factor construct 2, that the Quantity Surveying profession is one of *well trained accurate efficient pragmatists*, was found to found to be significantly *less* favourable, have a lower mean rank score than the pre-project score.

Architecture Factor construct 8, that of Quantity Surveying as a *specialist requirement*, however was found to be significantly more favourable than the pre-project score.

A full comparison between pre-project Architectural factor construct scores and post-project Architectural factor construct scores is charted below. This bar chart shows a trend in 6 of the 8 attitude constructs towards a less favourable, lower mean rank score (co-incidentally repeating the QS student result).



where:-
1.00 = pre-project attitude scores and 2.00 = post project attitude scores
and where:-

Single Statement Architectural student attitude constructs	*Bar Chart Reference Labels*
Factor grouping (attitude scale questionnaire item 21), a favourable attitude towards the design professions need for *specialist education*, was scored higher by the sample after participation in the integrated project.	*specialist rqrmnt*
Factor grouping (item 2, 6, 15, 16, 18, and 23) summarised as a relatively unfavourable attitude being shown towards the non-design (Quantity Surveying) profession as*: a non-prestigious uninspiring specialist, unsuited to leading the advancement of design team decision/ process*, scored slightly lower after the project	*status & rqrmnt*
Factor grouping (item 3 and 11) displayed an unfavourable attitude towards the non-design profession's abilities of: *eloquency gained from an all-embracing approach*, scored lowered post-project	*eloquent/ generalist*
Factor grouping (item 12 and 24) perceives the Quantity Surveyor unfavourably as a *professional nepotist*. Score improved after the project.	*prof/ nepotist*
factor grouping (items 5, 7, and 10) displayed an unfavourable attitude towards the Quantity Surveying profession as: *lacking in co-operative inventiveness*. Factor score dropped after the project.	*co-op inventnss*
Factor grouping (item 14), an unfavourable attitude towards the Quantity Surveying profession as a *reviewer of information of limited interest*, score dropped slightly after the project.	*limited/ reviewer*
Factor grouping (items 4, 11, 19 and 20) a favourable attitude towards the QS as suited to the: *provision of specific tasks through their informed capacity for team-work*, score dropped after the project.	*task teamwork*
Factor grouping (item 8, 9, 17 and 22) of attitude towards the non-design (QS) profession *as well trained efficient pragmatists.* Scored lower after the integrated project.	*trained/ pragmatic*

Figure 7.2
Final stage project comparison of pre-project and post-project Architectural factor construct scores with reference to Single Statement Architectural attitude factor construct tabulation

This negative trend in 6 of the 8 attitude constructs towards a less favourable, lower mean rank score, displayed by Architectural students after the project, is undesirable in a programme which seeks ultimately to improve professional relationships.

7.3.2 Student view of tutor input and course structure: final stage case study

On completion of the final stage multi-disciplinary project, all students were asked 5 questions about tutor input to the programme. The questions were added to the attitude scale questionnaire presented to students who had participated in the project.

Question 1 asked whether a*ttending lectures alongside students of different construction disciplines is a good method of achieving an integration of professional objectives.* In general final stage Quantity Surveying respondents agreed with this statement (61% agreed, 22% disagreed). However final stage Architectural respondents, used to studio work, were split (48% agreed, 43% disagreed)

Question 2 asked whether *tutors teaching more than one school of the built environment are biased in favour of their own discipline.* Both Quantity Surveying students and Architectural students agreed with this. (Architecture: 76% agreed, 14% disagreed) (Quantity Surveying: 66% agreed, 6% disagreed)

Question 3 asked whether or not *the quality of the tutor had little real effect on the success of a cross disciplinary project.* Quantity Surveying students generally thought that the tutors did effect the success of the project (61% tutor does effect success of project, 33% tutor does not effect success of project) Architectural students, however were split (33%

thought that the tutor did effect success, 38% thought that the tutor did not effect the success of the project)

Question 4 asked whether *individuals taking part in cross disciplinary projects exhibit value judgements common to their own particular profession.* Both Architectural and Quantity Surveying respondents agreed with this (86% & 88% respectively)

Question 5 asked whether *as a result of participating in a multi-disciplinary project, their own chosen discipline could be seen to be of more importance than most others.* Architectural students agreed with this statement (86% agreed, 9% disagreed). Quantity Surveying students on the other hand were split (50% agreed, 44% disagreed)

Additional feedback

A multi-disciplinary final stage programme has been running at the University of Central England since the early 1980's. The co-ordinator[698] for the integrative experiment examined here was interviewed to determine whether the project had changed in format over the years. The programme co-ordinator stated that 'the project was originally conceived to address the problems of disciplines working together', he continued 'unfortunately this major objective began to be overlooked and was replaced with a concentration on technical solutions, with disciplines fractionalising the product to the extent that a team's final report was found to be disjointed and contradictory'. Attempts to address this fractionalisation, in the experimental programme under test, centred on the inclusion of a series of 'management/teamwork' lectures and talks at the initial stages of the programme.

In conjunction with the wishes of the Head of the School of Architecture at UCE[699] an informal feedback session was arranged with final stage Architectural students who had taken part in the project. Students were asked how they perceived the effectiveness of the project. Written comments about the case study educational programme were collected. The five areas outlined below summarise the thrust of the feedback. The recently introduced preparatory 'management/teamwork' lectures were one of the five areas of concern:

(i) Although management lectures were perceived to be good, they were considered to be too divorced from the task-at-hand to be useful. Project-specific lectures, on the other hand, were given too late to incorporate into the body of the report.

(ii) Teams too big to ensure that all members were motivated to contribute with conviction. Ironically this opinion was backed up by evidence presented in management/teamwork lectures. Unequal abilities & experience created problems; some member disciplines needed a lot of instructions to get them started. The range of professions in the team was too wide-ranging for effective speculative work.

(iii) Assessment techniques were regarded with suspicion, with a feeling that work was not being monitored or suitably checked.

(iv) The site chosen was too remote. Expenses involved in sites visits were excessive. Expense involved in providing 'glamorous' final reports (perceived as a major factor in tutor marking) were also excessive.

(v) In order to fulfil group expectations and individual professional pride, actual time spent on the report in the final weeks was almost 4 times the recommended 5 hours per week.

Additional informal student feedback from the previous 1991/92 project, collected by the Head of the School of Architecture and made available to this study, described: (i) 'teaching methods to be of very poor standard'; and (ii) concerns over an allocation of only 1 hour for tutor appraisal to assess a 15 week student project.

7.3.3 Final stage project: findings overview

Prior to this final stage multi-disciplinary programme of work, attitudes towards disparate design team colleagues repeated, to a large extent, the stereotypical views held by vocational disciplines at previous stages. This project sought to encourage discipline interaction, and the integration of the specialist skills gained through vocational education. *After* participation in the programme however, the changes that were recorded, displayed *less* favourable, lower mean rank score attitude swings. For example, established *positive* attitudes (retained throughout the early and intermediate stages) held towards Quantity Surveying professionals, that they are *well trained accurate efficient pragmatists,* were reversed. Similarly the established positive attitude held towards the Architectural profession's *ability to generate ideas to overcome problems* was reversed, scoring a significantly low mean rank score *after* participation in the project

This final stage programme of work can be argued to suffer from what the students perceive to be, both tutor bias and specialist content bias. Overall, students from this final stage gain little benefit from the common group-dynamics lectures. The project also suffers from a failure to recognise several of the logistical considerations outlined in the review of group-work research, presented in sections 4.5.1 and 4.5.2. of this investigation. Overall this extensive multi-disciplinary programme of studies has instilled an *unfavourable attitude* towards professional peers, among student participants. It can be argued that this final stage educational initiative for integrating disciplines, requires to be extensively revised if it is to address the problems of disciplines working together.

7.4 Case Study 3: The Robert Gordon University Aberdeen, Intermediate Stage Multi-disciplinary Participation

This section presents findings which compare attitude scale scores before participation in the intermediate stage multi-disciplinary project developed by RGU Aberdeen, with attitude scale scores after participation in the project. Quantity Surveying and Architectural attitude score changes are described. Tutor input is discussed and a synopsis of the programme of integration is given.

The Interdisciplinary Workshop conducted at Stage 3 of the participating disciplines honours degree curricula aimed to: (i) encourage interdisciplinary group working in the resolution of complex problems; (ii) to foster an awareness and appreciation of the contribution of other disciplines; (iii) to encourage informed debate and an analytical process to assess clients needs and the definition of a problem; and (iv) to develop skills in the definition and management of tasks within a group situation.

The project required students to work together in inter-disciplinary teams of 5 or 6, to prepare a 'feasibility study' of a given underdeveloped site. The workshop was conducted over 5 consecutive days during which time the teams were (i) briefed, (ii) visited the site, (iii) prepared and informally presented an interim report to staff, (iv) developed the initial proposal, and, (v) formally presented their proposal. Individual student marks were allocated by combining an overall tutor-consortium group mark, with a peer assessment mark.

7.4.1 Architectural and Quantity Surveying intermediate stage analyses

The results presented below are gained from an experimental inter-disciplinary workshop at the intermediate stages of three different courses. In line with findings presented in section 6 only Architectural and Quantity Surveying students were examined.

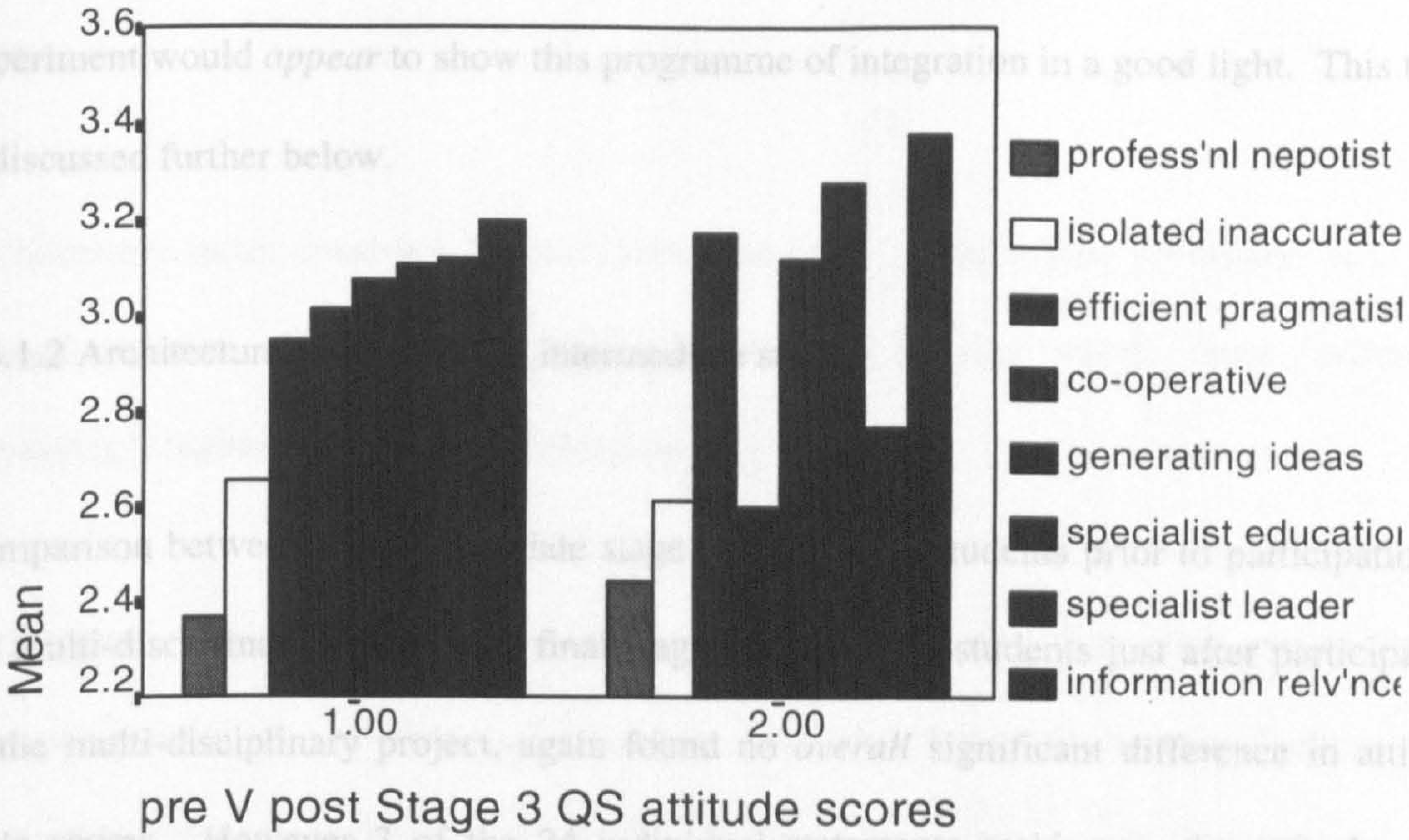
7.4.1.1 Quantity Surveying case analysis: intermediate stage

Comparison between intermediate stage Quantity Surveying students prior to participation in the multi-disciplinary project, and intermediate stage Quantity Surveying students just after participation in the multi-disciplinary project, found *no* overall significant difference in attitude scale scores (see **Appendix C item 7.5**). Indeed only 2 of the 24 statements making-up the attitude scale questionnaire displayed a significant difference in scores recorded prior to the project and scores recorded after the project:
item 12, *this professional is aware of their professional limitations; does not attempt what they cannot do* was scored significantly less favourably after participation in the project whilst item 14, found that attitudes towards the Architect (was *the information provided of use mainly in progress reports to the client*) were scored significantly more favourably after participation in the project (information provided deemed more useful)

Further analysis was made using the previously established universal factor constructs for Quantity Surveying students. A mean rank score for each of the 8 attitude constructs was calculated, for the intermediate stage cases, prior to participation in the project. This was compared with the mean rank score calculated for each of the 8 attitude constructs after the intermediate stage students had participated in the project. Only 1 of the 8 factor constructs displayed a significant difference in scores.

The QS factor construct referring to the Architectural professions affinity to *co-operative idea development*, was scored significantly less favourably, lower, after participation in the project.

A full comparison between pre-project QS factor construct scores and post-project QS factor construct scores, charted below, shows that 5 of the 8 attitude constructs displayed a trend towards a more *favourable*, higher mean rank score, whilst 3 of the 8 display a trend towards a less favourable lower mean rank score.



where:-
1.00 = pre-project attitude scores and **2.00 = post project attitude scores and where:-**

Single Statement QS student attitude constructs	*Barchart Reference Label*
Factor grouping (item 1, 24) an unfavourable attitude towards the design profession acting as: *professional nepotist* was found to score higher by the sample after the integrated project.	*profess'nl nepotist*
Factor grouping (item 17, 20 and 23) of attitude towards the design (Architectural) profession as: *individualists lacking accuracy*, scored lower after the project.	*isolated/ inaccurate*
Factor grouping (items 4, 9 and 22) displayed a relatively favourable attitude towards the Architectural profession as one of: *informed efficient pragmatism.* Scored higher after the project.	*efficient/ pragmatist*
Factor grouping (item 5 and 12) perceives the Architects need for: *co-operative idea development.* Score dropped after participation in the project.	*co-operative*
factor grouping (item 7) a favourable attitude towards the Architectural profession as suited to: *the generation of ideas to overcome problems* improved after the project.	*generating ideas*
factor grouping (item 21), a favourable attitude displayed towards the design professions need for *specialist education*, again improved in score after the project.	*specialist/ education*
Factor grouping (item 2, 3, 6, and 16) summarised as a relatively unfavourable attitude shown towards the design (Architectural) profession as: *inarticulate specialists who attempt to lead and advance design team decision and process*, scored less after participation in the project.	*specialist/ leader*
Factor grouping (items 14 and 19) displayed a favourable attitude towards the Architectural profession as suited to the: *provision of wide ranging information extensive interest.* Factor score improved after participation in the project.	*information/ relevance*

Figure 7.3
Intermediate stage project comparison of pre-project and post-project QS factor construct scores with reference to Single Statement QS attitude factor construct tabulation

This trend towards more positive attitude construct scores after participation in the experiment would *appear* to show this programme of integration in a good light. This trend is discussed further below.

7.4.1.2 Architectural case analysis: intermediate stage

Comparison between the intermediate stage Architectural students prior to participation in the multi-disciplinary project, and final stage Architectural students just after participation in the multi-disciplinary project, again found no *overall* significant difference in attitude scale scores. However 3 of the 24 individual statements making-up the attitude scale questionnaire did display significant differences in scores recorded prior to the project and scores recorded just after the project (see **Appendix C item 7.6**). Each of the following items displayed a significantly more favourable, higher mean rank score.

item 3, *this professional can readily explain technical matters in their field to laymen,*

item 4, *this professional fails to utilise the basic sources of literature available in their field,*

item 12, *this professional is aware of their professional limitations; does not attempt what they cannot do,*

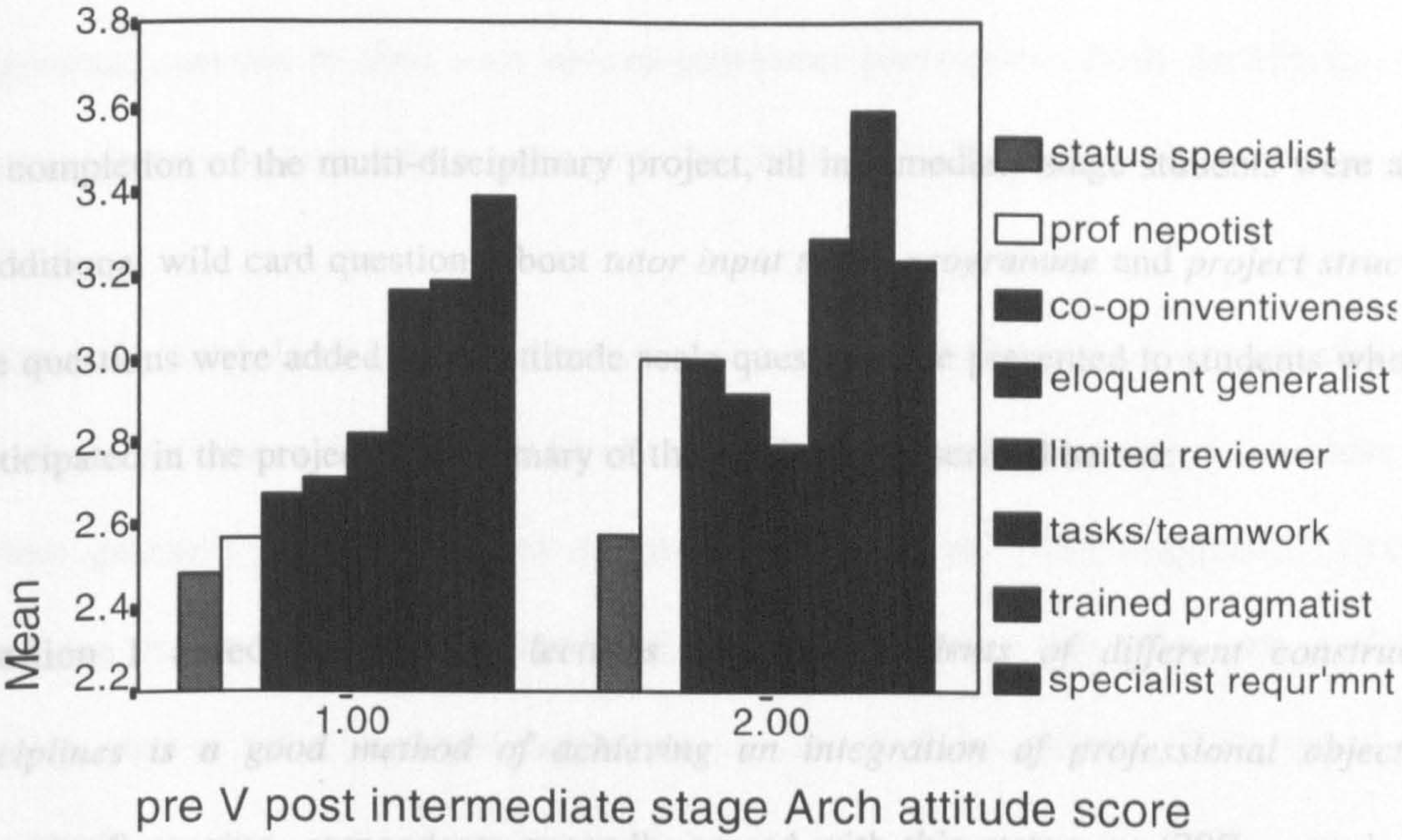
item 17 *this professional frequently makes errors, their work needs to be checked for accuracy,*

Further analysis was made using the universal factor constructs for Architects identified and described in section 6.4.3.2. A mean rank score for each of the 8 Architectural attitude constructs was calculated for cases prior to participation in the project. These scores were compared with the mean rank scores calculated for each of the 8 attitude constructs recorded from questionnaire replies after the intermediate stage students had participated in the project. Two factor constructs were found to display significantly different mean rank scores.

Architectural factor construct 2, which holds the Quantity Surveying profession as a *well trained accurate efficient pragmatist*, was found to be significantly more favourable, displaying a higher mean rank after the project.

Architecture Factor construct 7, which regards the Quantity Surveying profession as displaying traits of *professional nepotism*, was also found to be significantly more favourable (QS perceived as less nepotistic), scoring a higher mean rank after project.

A full comparison between pre-project Architectural factor construct scores and post-project Architectural factor construct scores, charted below, show a trend in 6 of the 8 attitude constructs towards a more favourable, higher mean rank score. Again this trend would *appear* to show this programme of integration in a good light.



where:-

1.00 = pre-project attitude scores and **2.00 = post project attitude scores** and **where:-**

Single Statement Architectural student attitude constructs	*Bar Chart Reference Labels*
Factor grouping (item 2, 6, 15, 16, 18, and 23) a relatively unfavourable attitude being shown towards the non-design (Quantity Surveying) profession as: *a non-prestigious uninspiring specialist, unsuited to leading the advancement of design team decision and process* was scored higher (slightly more favourably) after the project.	*status specialist*
Factor grouping (item 12 and 24) perceives the Quantity Surveyor unfavourably as a *professional nepotist*. Score improved after the project.	*prof/ nepotist*
Factor grouping (items 5, 7, and 10) a relatively unfavourable attitude towards the Quantity Surveying profession as: *lacking in co-operative inventiveness*. Scored higher after the project.	*co-op inventiveness*
Factor grouping (item 3 and 11) an unfavourable attitude towards the non-design profession's abilities of: *eloquency gained from an all-embracing approach*, was scored higher after participation in the integrated project.	*eloquent/ generalist*
Factor grouping (item 14) an unfavourable attitude towards the Quantity Surveying profession as a *reviewer of information of limited interest*, scored lower after the project.	*limited/ reviewer*
Factor grouping (items 4, 11, 19 and 20) a favourable attitude towards the Quantity Surveying profession as suited to the: *provision of specific tasks through their informed capacity for team-work*. was scored higher post-project	*tasks/ teamwork*
Factor grouping (item 8, 9, 17 and 22) of attitude towards the non-design (QS) profession *as well trained efficient pragmatists*. Score higher after the project.	*trained/ pragmatist*
Factor grouping (item 21) a favourable attitude towards the design professions need for *specialist education*, score dropped after participation in the integrated project.	*specialist rqrmnt*

Figure 7.4

Intermediate stage project comparison of pre-project and post-project Architectural factor construct scores with reference to Single Statement Arch. attitude factor construct tabulation

7.4.2 Student view of tutor input and project structure: intermediate stage case study

On completion of the multi-disciplinary project, all intermediate stage students were asked 5 additional wild card questions about *tutor input to the programme* and *project structure*. The questions were added to the attitude scale questionnaire presented to students who had participated in the project. A summary of the results are described below:

Question 1 asked if *attending lectures alongside students of different construction disciplines is a good method of achieving an integration of professional objectives*. Quantity Surveying respondents generally agreed with this statement (70% agreed, 23% disagreed). Architecture students also generally agreed (80% agreed, 8% disagreed)

Question 2 asked if *tutors teaching more than one school of the built environment are biased in favour of their own discipline*. Both Quantity Surveying students and Architectural students generally agreed with this. (QS 88% agreed, 11% disagreed) (Architecture 92% agreed, 8% disagreed)

Question 3 asked whether or not *the quality of the tutor had little real effect on the success of a cross disciplinary project*. Quantity Surveying students were split (42% though that the tutor did effect the success of the project, 35% thought that the tutor did not effect the success of the project). Architectural students were slightly against the idea that the tutor effected success. (32% thought that the tutor did affect the success of the project, 48% thought that the tutor did not effect the success of the project)

Question 4 asked if *individuals taking part in cross disciplinary projects exhibit value judgements common to their own chosen particular profession.* Both Architectural and Quantity Surveying respondents agree with this (80% & 73% respectively)

Question 5. asked if *as a result of participating in a multi-disciplinary project, their own chosen discipline could be seen to be of more importance than most others.* Architectural student generally agreed with this statement (72% agreed, 16% disagreed). Quantity Surveying respondents on the other hand generally disagreed that their own profession could be seen as more important than others as a result of the project. (27% agreed, 73% disagreed)

7.4.3 Intermediate stage: findings overview

This intermediate stage inter-disciplinary project sought to encourage interaction and the integration of specialist skills gained through vocational education. When the overall attitude scale score towards disparate disciplines *before* the project, was compared with the overall attitude score measured *after* participation in the project, no significant difference was found. However post-project scores were found to record a higher attitude scale mean rank score, than those before. In other words the post-project attitude scores held towards design team colleagues were *more favourable,* than those before the project.

When examined more closely, the project was found to intensify originally held positive attitudes about a profession, rather than address the, potentially detrimental, negative attitudes concerning design team peers. Attitudes before the project concerning the Quantity Surveying profession's: *low status unsuitability to lead; uncooperative outlook; low project contribution and limited idea development* were unchanged. On the other hand, positive attitudes such as being *a well trained accurate efficient pragmatist* were, as a result of the project, compounded yet further. Similarly, attitudes held towards the Architect as a *good idea developer; with good specialist knowledge*, were improved by the project; yet after the project, attitudes held which regard the Architectural profession as an *isolationist, uncooperative in the development of ideas and information* were unchanged.

A major reflection of the structure and content of the intermediate inter-disciplinary programme is suggested by student replies to the question whether '*as a result of participation in the multi-disciplinary project, their own discipline can be seen to be of more importance than others*'. 72% of Architectural students agreed with this statement, whilst only 26% of Quantity Surveying students recorded agreement. In this sample 90% of participants did agree that tutors were biased towards their own discipline.

Two of the four aims stated in the documentation of this intermediate case study experiment: 'to *encourage inter-disciplinary group working to resolve complex problems*' and 'to *foster an awareness ... of the contribution of other disciplines*' can be argued to have been fulfilled. Examination of the attitude scale changes that indicated intensified attitudes towards the Architect being *isolationist and uncooperative*, and the profession of Quantity Surveying as an *uncooperative pragmatic support profession* indicate that the third aim, which sought to '*encourage informed debate and an analytical approach to assessing clients needs and defining the problem*', has *not* been met. The fourth aim to '*develop skills in the definition and management of tasks within a group situation*' again does not appear to have been fulfilled, since 76% of respondents think that the other profession simply exhibited value judgements common to their own chosen discipline, and subsequently performed their necessary professional tasks. Tutor input to the project must reassess these perceived biases.

Notwithstanding the above, this intermediate stage multi-disciplinary project can still be said to have instilled an overall trend towards a more favourable attitude to design team colleagues. Clearly this project (and the UCE final stage project described above as displaying definite significant differences in attitude scale score) have shown that educational integration initiatives can indeed go towards addressing the need to bridge cultural differences instilled by vocational traditions in the educational process.

7.5 Summary: a commentary on experimental project effectiveness

Discussion above examines the ability of a particular project to fulfil the aims and objectives stipulated by project co-ordinators at respective Universities. Building upon the work above, this section summarises the results of the three experimental inter-disciplinary initiatives (for design and non-design disciplines), conducted at the initial, intermediate and final stages of tertiary education, in terms of their ability to address research findings presented previously by this project.

7.5.1 Initial stage integrative project

- *Major requirement(s) (argued in section 6) to encourage empathy for other(design orientated) disciplines amongst initial stage Quantity Surveying students are summarised as follows:* The programme of integration at this stage must allow initially a highly structured project which encourages Architects to be seen as having, an ability to solve organisational problems, acknowledging their own specialists limitations, displaying team work skills, displaying a recognition of the need for disparate skill input, displaying a degree of mental efficiency; and, an ability to communicate with laymen.

- *Major requirement(s) (argued in section 6) to encourage empathy for other (non-design orientated) disciplines amongst initial stage Architectural Students are as follows:* The programme of integration must allow initially a highly structured project which encourages Quantity Surveyors to be seen as, displaying an aptitude for leadership, having the ability to produce ideas and workable solutions, produce information acknowledged as important to the project, and, generally as deserving of a position within the design team. These factors remain important requirements at both stage 2 and stage 3.

- *Extent to which the existing experimental project encouraged empathy for other disciplines amongst initial stage Quantity Surveying Students is summarised as follows:* The existing project was generally *unable* to satisfy the major requirement(s) deemed necessary to achieve a more favourable attitude to be displayed towards a design orientated profession. However, an aspect deemed to have been successful was the change recorded in the attitude towards mental efficiency, which became slightly more favourable in the eyes of the Quantity Surveying students. Positively held attitudes displayed towards the Architects leadership qualities, and specialist contribution were *compounded.* Such a consequence is deemed to be of limited use in an initiative that seeks to encourage integration. Of most concern, was the projects inability to address attitudes held towards the Architectural profession that it is self interested and isolationist in outlook.

- *Extent to which the existing experimental project encouraged empathy for other disciplines amongst initial stage Architectural Students is summarised as follows:* The programme was generally *unsatisfactory*, however it did *attempt* to bring out the leadership qualities of the grouping(s). The attitude scale score was found to improve very slightly, in terms of the non-design orientated professional leadership abilities. *Co-operative work* attitude scores as well as *perceived requirement for the specialism* of Quantity Surveying were unchanged. In general, no changes occurred where they were needed most. A more structured programme, in the context of construction is required to allow the importance of non-design professional input to be acknowledged by stage 1 Architectural students.

7.5.2 Intermediate stage integrative project

- *Major requirement(s) (argued in section 6) to encourage empathy for other(non-design orientated) disciplines amongst intermediate stage Architectural Students are as follows:* At this stage the non-design (Quantity Surveying) profession is seen as providing useful supplementary information. However Architectural students still regard the non-design profession as having only limited contribution to the design process. Inter-disciplinary projects at this stage should also seek to address attitudes which regard the non-design profession as: unsuited to lead; and as unable to produce problem solving ideas.

- *Major requirement(s) (argued in section 6) to encourage empathy for other (design orientated) disciplines amongst intermediate stage Quantity Surveying students must reflect the fact that:* Stage 3 QS students, most of whom having just returned from a sandwich year's industrial working experience, are generally found to be more favourable towards the Architectural profession, than they had been at stage 2. Major requirements to instil integration at this stage are considered to be a semi-structured concentration on the design professionals role as a team player, and an ability to display a degree of mental efficiency, and be orderly in their manner of work.

- *Extent to which the existing experimental project encouraged empathy for other disciplines amongst intermediate stage Architectural Students is summarised as follows:* This intermediate stage project brought an improvement in how the Quantity Surveying profession is perceived. Whilst improvement in attitude towards another discipline did compound the non-design profession as a co-operative pragmatist, the project did improve the professions overall standing in the eyes of the intermediate stage Architectural student. The QS profession was seen as well versed in their subject area, yet aware of their professional limitations. Leadership and contribution attitude scale scores were largely unaffected by the project. Overall this project can be seen to have compounded originally held stereotypical attitudes without addressing the major, potentially detrimental, negatively held attitudes.

- *Extent to which the existing experimental project encouraged empathy for other disciplines amongst intermediate stage Quantity Surveying Students is summarised as follows*: Overall this project improved attitudes displayed towards the design profession. Increased favourability occurred in 6 out of 8 attitude scale factor constructs. In particular attitudes held towards the degree of mental efficiency, displayed by the Architect, were substantially improved. Attitudes towards the design (Architectural) profession as isolationist were not addressed by this intermediate stage project. Attitudes held towards Architecture as having an unwillingness for *co-operative idea development* was significantly compounded at a stage when the profession of Architecture was already regarded as preferring to work in isolation. The project compounded attitudes concerning the Architects ability to provide information to the design team. The structure of this project encouraged design disciplines to take the lead and non-design disciplines to adopt the role of specialist support, however Quantity Surveying students appeared to reject this structure and the project reversed favourable attitudes towards Architectural leadership qualities.

7.5.3 Final stage project

- *Major requirement(s) to instil integrative ethos amongst final stage Quantity Surveying Students:* Final stage Quantity Surveying students are found to retain many negative attitudes described at the initial and intermediate stages above. In particular the profession of Architecture is regarded unfavourably as: a profession that seldom seeks advice and dislikes working within a team, has low levels of mental efficiency, and, frequently makes errors in their work. Attitudes displayed by final stage Quantity Surveying students, reflect an overall down-turn in mean rank scoring. Attitudes towards the level of prestige attributable to the design profession, and their ability to lead the design team are substantially less favourable than attitudes displayed by students at the initial stages

- *Major requirement(s) to instil integrative ethos amongst final stage Architectural Students:* In this final stage the non-design discipline is regarded as, accurate, mentally efficient, a good team player; and, as willing to seek help for problems outwith their own remit. However the non-design profession is held very much, by the final stage Architectural students, to be a support to their own professional input.

- *Extent to which existing experimental project instilled integrative ethos amongst final stage Quantity Surveying Students:* After participation in the final stage programme, almost all measurable attitudes, held towards the profession of

Architecture, were found to be less favourable. Attitudes towards the design specialist in terms of, team working, willingness to seek advice, and, willingness to act on others ideas, were all measured as less favourable after the project. In addition established positive attitudes were reversed. The Architect was now deemed to be unstimulating, and unsuited to creative idea generation. Negative attitudes towards the unsuitability of the Architect to lead were again compounded. This final stage project was unable to address the negative attitudes which had developed over the duration of the non-design students course.

- *Extent to which existing experimental project instilled integrative ethos amongst Final stage Architectural Students:* After the project non-design profession communication skills were regarded, for the first time, as inadequate. Perceived levels of mental efficiency also decreased. Whilst Architectural student attitudes towards a Quantity Surveying requirement for specialist teaching is found to improve, reflecting the specialist role demanded by the project task structure, all other positive attitudes towards the non-design oriented profession were found to diminish. Overall final stage Architectural student questionnaire replies reflected an attitude that non-design building professions are not integrated equal design team members; they are merely support to the Architectural input.

7.5.4 Overview

Analysis of the three experimental educational initiatives to instil empathy clearly show that it is possible to modify attitudes towards other professions. However findings reveal that the structure and staging of inter-disciplinary training programmes must be carefully addressed before success, in terms of multi-disciplinary empathy, can be achieved.

Section 8, below, provides recommendations for the structure and staging of inter-disciplinary projects, to facilitate a successful integration of vocational courses in construction and design.

Notes and References

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[695] C1 common learning skills unit, course documentation, UCE Birmingham.
[696] C1 common learning skills unit, course documentation, UCE Birmingham.
[697] IPP unit, course documentation, UCE Birmingham.
[698] Sanson, R., Senior Lecturer in Surveying, UCE Birmingham
[699] Kirwan, J, Head of School of Architecture, UCE Birmingham

CHAPTER 8

DISCUSSION: EFFECTIVE INTER-DISCIPLINARY EDUCATION

CHAPTER 8

DISCUSSION: EFFECTIVE INTERDISCIPLINARY EDUCATION

8.1 Recommendations for change: the identification of training needs

The graphical representation of an initiative for inter-disciplinary education discussed earlier is again shown in Figure 8.1. This section extends the analyses of the three activity sets for vocational education previously discussed and progresses towards an examination of a more formalised management at the end of the model. This more formalised stage (to direct educators towards optimum integrative techniques for particular student bodies) is represented graphically in the model as follows:

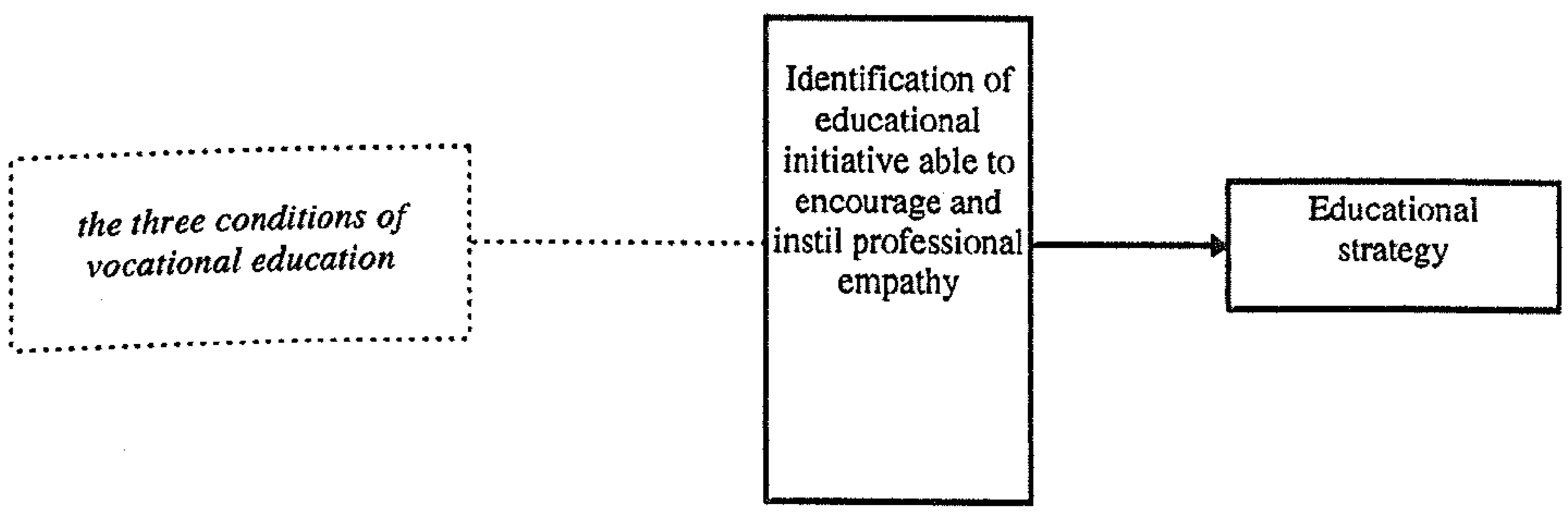

Figure 8.2
Towards an examination of a more formalised process to improve inter-disciplinary training initiatives

Previous sections have already presented vocational schools of the built environment with the information required to progress beyond the necessary activities described as *the three conditions of vocational education.* It is pertinent at this stage however to restate previous arguments in terms of the need for vocational education to (i) recognise the other specialist requirements of a complex construction industry, (ii) take acount opf existing levels of industrial experience, and (iii) accommodate the different stages of a vocational course.


Graduation
Maintain an effective product in an increasingly complex building industry
Produce specialist professionals suited to the dynamic requirements of a technologically complex building industry
Educate to a specific specialist knowledge base, validated by professional institution
Educate to participate in a multi-disciplinary building design team
Educate in an expert field, with due regard given to the other specialist requirements of a complex construction industry
Provide multi-disciplinary education able to take account of existing levels of building industry experience
Provide multi-disciplinary education able to accommodate particular stage of vocational education
Provide specialist education for a functionalised multi-disciplinary industry
Ascertain the traditionally held positions and roles of professions in the design process
Know the nature of the various professional cultures that exist within the building design team
determine affinity towards other disciplines
Ascertain attitude held towards disparate professional peers
Address potentially detrimental variables of disparate professional culture
Take appropriate action to facilitate an optimum educational process able to instil an ethos of integration
Assess the influence of experience of the building industry on professional relationships
Quantify existing levels of industrial experience
Determine the level of experience gained by participation in particular professional educational structures
Compare differences in affinity towards other disciplines with differences in experience
Address potentially detrimental negative attitudes displayed towards peers as a result of experience
Marry level of industrial experience with course structure in an optimum educational initiative to improve inter-disciplinary integration.
Ascertain influence on professional relations of specific stages of vocational education
Determine variables able to allow course comparisons of peer relations over time
Measure attitude change and development, arising from progression through disparate vocational courses
Identify attitudes detrimental to peer relations that are peculiar to specific stages of vocational education
Develop and maintain multi-disciplinary participation over different stages of vocational education, by implementation of educational initiatives able to instil an ethos of integration
Identification of educational initiative able to encourage and instil professional empathy
Review/ Feedback
Identify areas of professional conflict
Project content and structure
Encourage positive peer assessment
Duration
Programme
Educational strategy
Implementation
Resources
Team size
Team Selection
Group Composition
Tutor input
Review / Feedback
Graduation
INTENTION
Realise the potential of multi-disciplinary industry
Utilise educational means
Determine key variables of successful specialist integration
Manage scarce educational resources / Implement programmes
RESPONSIBILITY
Client groups
Professional institutions / Course validators / Higher Ed. Insts.
Research
Vocational Schools / Research
INDICATORS
Industrial / Governmental Reports
Specialist demand / Vocational employment
Research findings
Programme performance appraisal and results

Fig. 8.1

The following three tables outline the findings able to direct educationalists towards the next stage of the normative model and provide the foundation to the *educational strategy* to achieve effective specialist interaction.

The first column of Table 8.1 below identifies activities to allow students to empathise the specialist roles in building design. The second column of the table comments on the current situation in vocational courses. The third column details changes to improve the existing situation based on findings and arguments detailed in previous sections. The final column of the table allows cross reference to be made the relevant section.

Activity Information	*Comments concerning current situation*	*Changes to improve the existing situation*	*Refs.*
Provide specialist knowledge of the construction industry	Vocational courses provided by Higher Educational Institutions, validated by various professional bodies to meet market demands of a fractionalised building design process.	Not Applicable	5.5.1
Highlight, within existing vocational courses, the increasingly complex nature of the dynamic construction industry by acquainting students with the existence of other disciplines.	Subjective, stereotypical views held by tutors, are able to identify fairly accurately, disciplines with disparate professional objectives. However, recognition of differences is seldom used productively. Indeed tutors are generally perceived by their students to display a high degree of professional bias against other disciplines.	Provide tutors with the empirical evidence that participation within a particular specialist *course of study* in Higher Educational Institutions, is the major significant influence in multi-disciplinary design team dissonance. Further illustrate that group dissonance is detrimental to the design process. Educators must seek to highlight for vocational students, those disciplines that, although appearing to display a disparate professional outlook, are beneficial to the contemporary building design process.	6.2.1
Determine the existing level of affinity held towards disparate building design team discipline(s).	Such information is currently of a highly subjective nature. Little empirical data is used in an educational context.	A definite split into *design orientated disciplines* on the one hand and *non-design orientated disciplines* on the other is found to exist. Higher educational courses that adhere to either of these two broad activities influence greatly differences in student attitudes. Clearly if Education Establishments wish to instil in students due regard for the disparate specialist requirements of the building industry, courses are advised to promote a view that their own professional objectives can compliment disciplines, which adhere to a *contrary* categorisation, in the realisation of a complex project brief. Great care must be taken however, since some disciplines can be argued to straddle both design and non-design activities. An unqualified decision that seeks, in good faith, to relate specific professional objectives to a disparate point of view must choose wisely. Courses may simply compound existing professional outlooks if a discipline, which has an inherently similar point of view, is chosen for comparison. One such example is the discipline of Building Surveying, which following close examination, is found to see itself as a design profession with non-design points of interest. Although this discipline shares much of its curricula with non-design Quantity Surveying courses, and has relatively little interaction with Architectural courses, evidence suggests that attempting to integrate the disciplines of Architecture and Building Surveying is unlikely to benefit either course. Building Surveying students, who can be said to have design aspirations, are argued to be better suited to cross-disciplinary practice simulations with non-design oriented courses such as Quantity Surveying, even though these courses already share many core subjects.	3. 6.2.3 6.4.2

Table 8.1 Educate in a particular specialist area of the construction industry, with due regard given to the other specialist requirements of the complex industry

In general terms, previous findings argued that progression through an *isolated* academic course of study saw a rise in antipathy towards other disciplines. Results were also presented which showed that, whilst longer terms of industrial exposure produced relatively unfavourable attitudes towards professional colleagues, short term (6 to 12 months) sandwich period exposure to the building design team had a positive affect on attitudes towards other disciplines. Educational initiatives which seek to encourage integration must therefore acknowledge existing degree(s) of industrial experience. In particular educational establishments must recognise whether integrative initiatives are to take place *before or after sandwich period employment* in full-time courses. They must be aware of the different variables of integration to allow educational initiatives to suit the amount of industrial experience at particular stages of *part-time courses*. Educational establishments must also recognise the additional preparation required for Continuing Professional Development (CPD) programmes which seek to instil efficient integration amongst time-served specialist professionals, who may already exhibit a high degree of cynicism about their fellow professional.

The Table 8.2 summarises these findings. The four columns of the table describe, activities to address levels of student experience, the current situation in tertiary education; proposed changes, and, cross-reference sections.

Activity Information	Comments concerning current situation	Rationale to improve existing situation	Refs.
Ascertain existing levels of student experience	The structural considerations for vocational courses are based on part-time and full-time modes of study. Little account is taken of empirical data which measures existing levels of industrial experience.	Evidence indicates that exposure to the traditional building design team in practice influences significantly student attitudes towards professional relationships. Evidence also indicates that the duration or degree of exposure is a major influencing factor. Findings further indicate that different professional disciplines within the building design team display different attitudes towards peer groups, as a result of different durations of industrial practice experience. If Higher Educational Institutions seek to educate vocational students to participate in multi-disciplinary teams, they are advised to take full account of the influences of existing levels of industrial practice experience held by students.	6.4.2.2. 6.4.3
Tailor particular educational initiatives to acknowledge the different levels of student experience.	Current educational initiatives concentrate on levels of theoretical specialist knowledge	Findings indicate that at the initial stages of professional education, students who are older and more experienced in the construction industry display less affinity to professional colleagues than students with little or no industrial experience. When students participate in full-time vocational courses, with no recourse to *real world* practice environments, research findings clearly show that affinity towards professional peers decreases over time. That is peer group affinity levels decrease from the initial stages to the final stages. Interestingly however findings also indicate that when students undertake a limited amount of sandwich period industrial experience, which is related to their particular discipline, this reverses the trend towards peer group antipathy over time. This should be borne in the staging and content of educational initiatives	6.3.2 6.4.3

Table 8.2
Educate to participate in a multi-disciplinary team, with due regard given to student's existing levels of industrial experience of the building design process.

Findings described previously indicate that particular stages of vocational education influence, to different degrees, student affinities towards their future design team professional colleagues.

Vocational education must accommodate the idiosyncrasies peculiar to particular stages of disparate vocational courses. Table 8.3 presented below summarises, in the first column, activities to allow education to recognise the influence of stage on student attitudes. The second column comments on current practice. The third column outlines a rationale to improve the existing situation, whilst the final column of the table below allows cross reference to be made to the relevant section.

Activity Information	*Comments concerning current situation*	*Rationale to improve existing situation*	*Refs.*
Ascertain the influence of the specific stages of the vocational educational process on peer relations.	Debate is found to exist concerning the best stage to implement cross-disciplinary projects. Opposing factions adopt either the view that disciplines require to come together as early as possible to combat professional cultural differences, or alternatively argue that students must be highly proficient in their own specialism, preferably having studied to post-graduate stage, before attempting to integrate with other students at masters stage.	If *no* action is taken to address inter-disciplinary relations during professional education, post-graduate students enter industry with adverse attitudes towards their design team colleagues. Attitudes held by post graduate students are then compounded by degrees of cynicism found to arise after long term exposure to an industrial environment; this affects detrimentally the building design process.	5.2 6.3.2
Implement integrative programmes at particular stages of vocational education.	Subjective opinion dictates to a large extent the staging, during tertiary training, of inter-disciplinary programmes in professional education.	Evidence suggests that different stages of professional education require different integrative initiatives if educational programmes are to address successfully the specific problems that arise at different times in vocational courses. Findings indicate that educational initiatives, with specific structures and formats, implemented incorrectly, not only fail to achieve their objectives, they compound the very problem they set out to improve. Different stages have different needs. Educational initiatives that seek to instil an ethos of integration must be tailored to suit particular educational stages. Detailed suggestions are made in the *training needs* section below.	7.3 7.5

Table 8.3
Educate to participate in a multi-disciplinary team, with due regard given to the idiosyncrasies peculiar to particular stages of disparate vocational courses

The remainder of this section now discusses recommendations for educators to improve the educational processes of multi-disciplinary initiatives for the integration of disparate vocational courses in specialist areas of the built environment. An *educational strategy* is presented that acknowledges both the contextual variables of the proposed *programme*, and the structural variables of the available *resources*. This linkage is described graphically below.

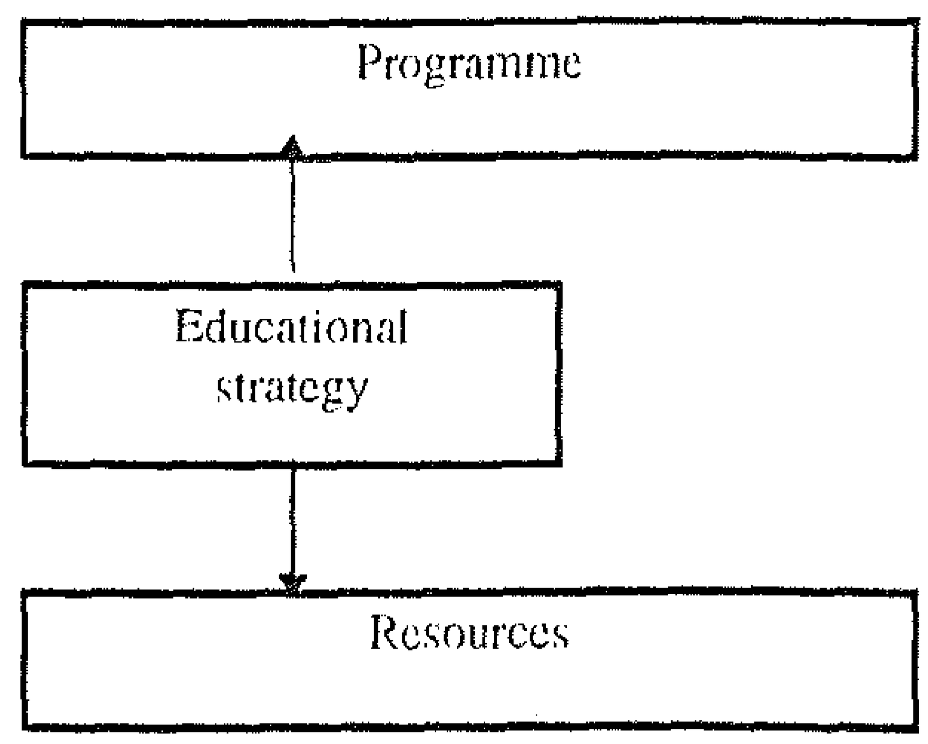

Figure 8.3
An educational strategy to acknowledge both the contextual variables of the proposed programme, and the structural variables of the available resources.

Recommendations for change, based upon *programme* content, and *resources* available to the Higher Educational Institutions are described alongside the present state of inter-disciplinary education in the section below. Tables describe recommended incremental improvements for (i) the initial stages, (ii) the intermediate stages, and the (iii) final stages of vocational education. These tables represent an optimum multi-disciplinary integrative programme for *design orientated* (Architectural) students paired with *non-design orientated* (Quantity Surveying) students.

8.1.1 Contemporary group-work: programme and resource variables

Earlier a contemporary approach to group-work and team building was presented. This discussion highlighted several important programme and resource variables for training schemes seeking to facilitate an integration of specialist interests.

It was argued that if educators firstly *identify areas of perceived conflict*, subsequent task development and training programmes are much more likely to address and eradicate such conflicts[700]. It was also argued that the *content and structure* of the training situation must reflect accurately (building design) practice norms and seek to develop the potential of skill diversity as an asset to the group, by improving the capacity for project completion[701]. In addition perceived *team member contribution obtained by peer assessment*, was highlighted as an important aspect of educational integration initiatives[702]. The *duration* of educational initiatives, which seek to bring disparate specialists together in preparation for performance in an industry which is technically diverse, was also argued to be an important variable in training programmes[703]. These four aspects of the *programme* for an educational strategy to instil professional empathy are presented graphically below:

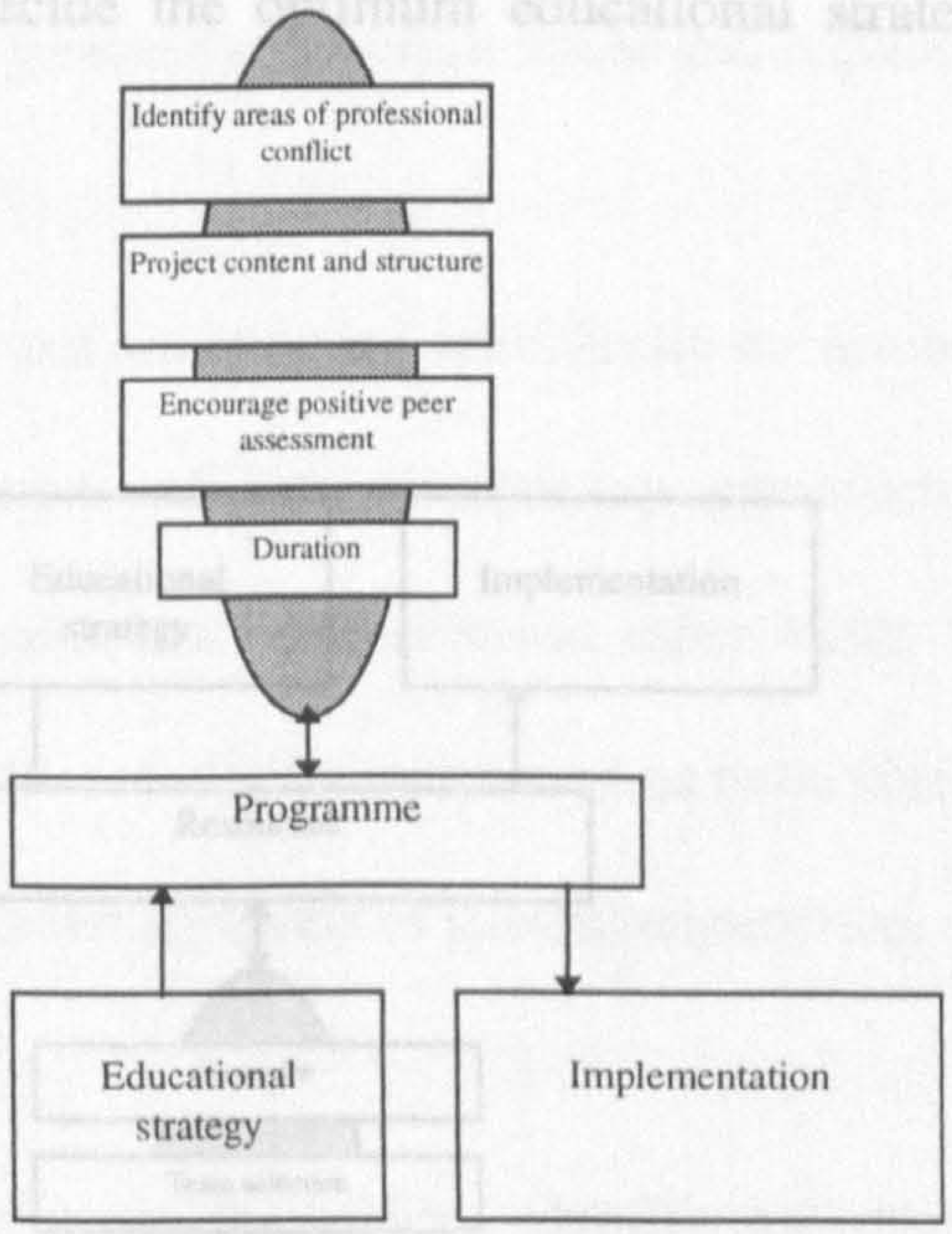

Figure 8.4
Four aspects of a programme for an educational strategy to instil professional empathy

In addition to the multi-disciplinary educational initiative *programme* variables above, a number of important factors were found to stem from how educational institutions used and allocated the *resources* made available to them. It was found that the *size of team(s)* participating in a training scheme was a key variable in affecting the project learning outcomes of educational team building initiatives[704,705,706]. Similarly, allowing a degree of participation in *team selection* by the students themselves was also argued to influence the achievement of training scheme objectives[707,708]. Notwithstanding this aspect of team selection, previous discussion also argued that *group composition* was an important factor, where similar ability and same-interest groupings were found to be unsuited to technically diverse fields[709,710]. Another major variable identified in which was as affecting the success of educational initiatives concerned *tutor input*. Tutors involved in training schemes were argued to constitute a major influence on what happens in the group[711,712]. These four areas, are argued to be the key variables which educators must tackle in the allocation of *resources* in their educational strategy. These resource variables, represented in the model as stemming from the need to decide the optimum educational strategy, are presented graphically as follows:

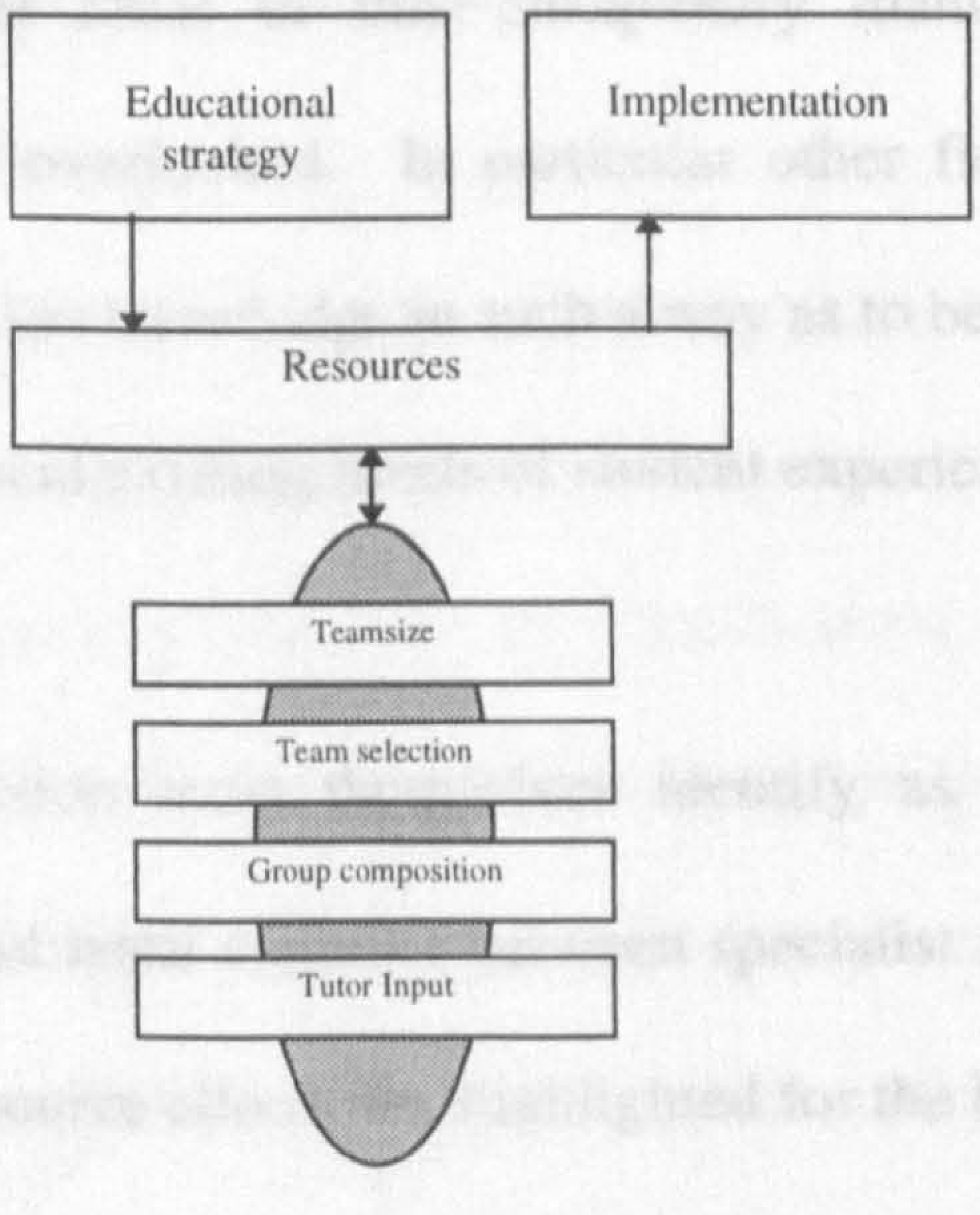

Figure 8.5
Four aspects of the resources for an educational strategy to instil professional empathy.

These key programme and resource variables in inter-disciplinary training schemes provide the foundations for the following recommendations section. Recommendations, based upon the eight aspects of educational strategy relating to programme and resources, are presented below to facilitate educators to produce their own optimum educational initiative for the effective integration of specialist professional interests.

8.1.2 Identifying the optimum educational initiative for integration

The following section sets out conditions to facilitate educators to provide an optimum programme of inter-disciplinary interaction for different building design team disciplines. The discussion which follows identifies the training needs of particular disciplines at specific stages of their professional education, and makes recommendations for the best use of scarce educational resources, programme structure, content and implementation.

Whilst recommendations focus on, and are intended specifically for use by, the construction professions, relevance to other areas of inter-disciplinary manufacturing and service provision activity must not be overlooked. In particular other fields will recognise the importance of presenting specialist knowledge in such a way as to be able to take account of other areas of related expertise and existing levels of student experience.

Industries other than construction must themselves identify as important, educational initiatives able to encourage and instil empathy between specialist areas. The variables of educational programme and resource allocation, highlighted for the building design process, are equally useful to other industries. The key variables for an optimum educational initiative for construction, cover a wide range of fractionalised activity. All eight variables identified are of importance, (i) the need to identify areas of inter-specialist conflict, (ii) project content and structure, (iii) the need to encourage positive peer assessment, (iv) project duration decisions, (v) optimum team size for training schemes, (vi) team selection procedures, (vii) group composition, and, (viii) the level of tutor input, are all important considerations in the search for an optimum training programme of specialist interaction in most fields.

The sections below concern education for construction professionals. Discussion presents an activity breakdown of inter-disciplinary programme(s) and available resources, the situation as it exists at present, and incremental changes to improve the situation. This discussion acknowledges that attitudes detrimental to peer relations are peculiar to specific stages of vocational education. Inter-disciplinary programmes to promote professional integration amongst *design orientated* (Architectural) students paired with *non-design orientated* (Quantity Surveying) students are described for students at the, (i) initial stage (ii) intermediate stage, and the, (iii) final stage of undergraduate education.

8.1.2.1 The initial stages of professional courses

The following discussion examines the requirements for multi-disciplinary educational initiatives at the initial stage of a professional course in construction in terms of the following programme and resource variables: (i) the identification of specific areas of perceived conflict; (ii) the need to verify multi-disciplinary programme content and structure; (iii) tutor input; (iv) attempts to encourage peer assessment in a positive way; (v and vi) team selection and team composition; (vii) duration; and (viii) team size.

Little consideration is given to the **identification of areas of conflict** between the design and non-design disciplines at the initial stages of vocational education. This is ill-advised since *after* this initial period of vocational education, attitudes held towards design team colleagues drop significantly, that is, attitudes about peers become significantly less favourable. It is vital therefore to identify and address the different elements of these negative trends before they have chance to take root.

To allow educators to do this, findings described in detail in previous sections, are presented which identify the specific areas of conflict to be addressed at this initial stage of the educational process. These are summarised as follows:- Non-design building professionals are perceived, by stage 1 design orientated students, to make only limited contribution to the project, provide information of only limited use, and display an unsuitability for project leadership. Non-design building professionals are also regarded as unable to stimulate, having a low quality of training and as undeserving of professional prestige. Attitudes held that the non-design professional as merely a mentally proficient support discipline, are retained throughout the rest of the design students academic course of studies.

Design professionals on the other hand are perceived, by stage 1 non-design course students, to be unable to communicate with laymen, and are unable to recognise professional limitations. They are also regarded as having a self-interested outlook, rejecting team working, and having an inefficient, unorganised approach to work. Design professionals are regarded as having a major contribution to building projects, by disparate students at all stages of academic life. However their perceived input is found to diminish amongst students at the later stages of education.

It is argued that these aspects affect detrimentally professional relationships. It is recommended that educators address, in multi-disciplinary initiatives at the initial stages of vocational courses, these specific aspects of attitude held toward colleagues from a different discipline.

Educators, in addressing the specific areas of conflict above, must also seek to **verify multi-disciplinary programme content and structure** for stage 1 students, whose specialist knowledge at this stage is nominal. Knowledge of the disparate disciplines who make up the multi-disciplinary design team is gained from populist media sources. Stereotypical notions, of the role and professional objectives of particular design team specialists, dominate.

In recognition of this lack of a specialist skill base, non-specialist project work might seem the answer. However, extensive group projects of a general management/organisational nature (reflecting necessarily an early unfamiliarity with construction) are found *not* to provide the desired precursor for student appreciation of the need for similar interaction in the building design team. In addition findings indicate that attempts to instil team development and an appreciation of group dynamics via extensive cross-disciplinary group projects at an early stage, are unlikely to succeed in encouraging greater understanding of peer contribution, or greater recognition of common value systems between participants Interestingly however cross-disciplinary attendance at common subject lectures, although found to do little to change stereotypical attitudes towards peer professions, is well received by students who, at the very least, are able to recognise that disparate disciplines share some common knowledge bases.

In effect, large, inter-disciplinary, student led, project work is not recommended at this early stage, since findings suggest that little is to be gained by mixing disparate courses of stage 1 students, to participate in projects which concentrate chiefly on group dynamics. This can be done just as successfully in a multitude of subject-specific tutorials which require a degree of group participation.

However it is recommended that Schools identify, and communicate the fact that there are areas of commonality with neighbouring vocational courses. Studies indicate relatively high proportions of subjects as common across several disparate disciplines. Whilst it must be noted that cross-disciplinary attendance of lectures does little to address the areas of specialist conflict already identified the fact that 70% of all stage 1 students perceive attending lectures alongside other courses as a positive way to integrate professional objectives, cannot be overlooked.

Stage 1 students learn of their own professional knowledge base(s) from experienced tutors; logically then, experienced tutors from disparate disciplines are best placed to begin to introduce new vocational students to the potential of other specialisms in the building design process. 65% of all first year students regard tutor input as a major influence in successful cross-disciplinary initiatives. Multi-disciplinary tutor deployment, within a structured programme of studies, is recommended at this early stage. However tutors must be made fully aware of their responsibilities. Vocational tutors must be able to recognise the need to allow all first year students, through tutor/student interaction, to re-assess any negative attitudes held towards professional peers at this early stage. Clearly multi-disciplinary building design successes do exist. These present themselves as teaching material for case studies of actual project(s) in industry that identify particular professions as able to perform adequately in the areas of perceived conflict identified above. Based upon the findings outlined above a multi-disciplinary programme that incorporates a structured presentation by suitably motivated tutors, of successful real life multi-disciplinary jobs, is argued to better encourage and instil professional empathy, than student led projects that concentrate chiefly on group dynamics.

Findings show that in addition to the 65% of first year students who regard tutors as a major influence in the success of inter-disciplinary project work, 80% of students in the first stages of professional education regard tutors involved in cross-disciplinary education to be biased in favour of a particular profession. Clearly the ***influence of tutors*** at this formative period can be argued to be an important aspect in educational initiatives seeking to improve future design team relations.

It is recommended that tutors acknowledge the potential to influence student attitudes towards peers. All tutors who come into contact with new students require to be involved from the very outset in inter-disciplinary initiatives which seek a greater integration of vocational students, since evidence indicates that the most successful training programmes are initiated, at least to some degree, by those who actually run them. Contact tutors must themselves be empowered to recognise the relevancy of *programme* and *resource* variables in any educational strategy to instil professional empathy. Recognising the importance of the areas described in the *identification of conflict*, is considered essential to the success of a programme of integration at stage 1, however contact tutors must be given the opportunity to have an input into how these aspects are addressed.

Evidence suggests that that the specialist able to get the group *out of trouble* will raise their standing in the eyes of the other members. However opportunities to **encourage peer assessment in a positive** way by group-work, between the different disciplines at the early stages of vocational courses, are limited in the light of low levels of specialist knowledge. In addition student attitudes towards those pursuing a different vocational profession, gained through general group-work activities, are likely to be distorted, since assessments made about a colleague's discipline at this early stage are based largely on factors other than their specialist potential to improve the building design process. Therefore at the early stages of professional education, it is again recommended that the onus of responsibility to encourage positive peer assessment falls to the suitably motivated tutor. Successful mutli-disciplinary projects in the construction industry, presented by tutors as case study material, can begin to present the disparate profession as able to provide the design team with specialist knowledge to combat problems outwith the remit of the other members.

An educational strategy to instil specialist interaction, as well as seeking to raise the standing of specialist members, must consider the **group composition** of its student participants. In particular findings suggest that little is to be gained by selecting *inter-disciplinary* groups to participate in ubiquitous group dynamics exercises at the initial stages of vocational education

The traditional building profession stereotypes which are found to exist among new students, are also found to dictate their level of participation in group-work exercises, whatever the subject area. Even in exercises where there is no mention of construction or the traditional building design team hierarchy, students attempt to adhere to future professional roles which they perceive as being one of leadership for the design students, and one of support for the non-design students. Although disparate professions may well see themselves as either principal contributors or specialist support disciplines, it is ill-advised, in an educational process seeking to instil mutual trust and the potential of professional integration in the building process, to encourage a superior / subordinate relationship.

At this early stage, the selection of inter-disciplinary groupings are of little benefit to the encouragement of specialist integration. It is recommended that new students, who have limited specialist knowledge of their own discipline, are not placed in a position where they are required to either advance or defend their chosen discipline's professional objectives to an inter-disciplinary group.

Having established that this early stage of vocational education is unsuited to *workshops* that seek to promote an integration of existing levels of student specialist knowledge, **programme duration** is subject to the same logistical considerations given to the other areas of a vocational course in construction. Findings indicate that initiatives which do no more than introduce areas of commonality can be spread over 15 weeks, or two semesters, without affecting adversely the success of multi-disciplinary education at this early stage. Equally, in consideration of **student group size** considerations, findings indicate that relatively large groups do not adversely affect student attitudes towards building design team relations, in schemes which aim to provide a degree of subject commonality, recommended here as taking the form of case studies of real multi-disciplinary building project successes. However if an educational strategy *also* seeks to encourage a degree of student input, based upon specialist knowledge, then the adoption of relatively short intensive workshop durations, and relatively small groups sizes of between 4-6 members, are recommended.

Generally the early stages of vocational education should seek to accommodate the opportunity to promote a *commonality* of professional objectives and the potential of a multi-disciplinary approach in building design. This approach is recommended as working best within existing vocational course structures. Implementation should compliment existing subjects covered during the initial semesters of a particular course. The following table restates the recommendations already made for an initial stage educational initiative seeking the effective integration of professional courses dealing with the built environment. The first column of Table 8.4 describes a particular programme or resource variables for the development of a suitable educational strategy. The second column describes how the variable is used at present, the current interpretation of the variable highlighting the situation as it exists. The third column outlines proposed changes and recommendations, and the fourth column allows cross-reference to be made with other sections of the text.

Strategy Variable	*Current Situation*	*Proposed Change*	*Cross Reference*
Identification of areas of conflict	No objective consideration is given to an identification of specific areas of conflict between the design and non-design disciplines at this stage.	It is vital to acknowledge and address specific elements having the potential to affect negatively design team relationships.	4. 5.5.2
Identification of areas of conflict *attitudes expressed by stage 1 design oriented students*	Non-design building professionals are perceived, by stage 1 design orientated students to: make only limited contribution to the project; provide information of only limited use; display an unsuitability for project leadership; unable to stimulate; as having a low quality of training and as undeserving of professional prestige. Attitudes held that the non-design professional as merely a mentally proficient support discipline, are retained throughout the rest of the design students academic course of studies.	The attitudes described opposite must be addressed by inter-disciplinary initiatives at the initial stages of vocational education.	6.4.2.2.2 6.4.3.2
Identification of areas of conflict *attitudes expressed by stage 1 non-design oriented students*	Design professionals are perceived, by stage 1 non-design students, as: unable to communicate with laymen; unable to recognise professional limitations; as having a self-interested outlook; rejecting team working; and having an inefficient, unorganised approach to work. Although design professionals are perceived at the initial stages as having a major contribution to building projects, this is found to diminish in the later stages of education.	The attitudes described opposite must be addressed by inter-disciplinary initiatives at the initial stages of vocational education.	6.4.2.2.1 6.4.3.1
Content / structure: inter-disciplinary project-work	Group projects of a general management/organisational nature (reflecting, by definition, an early unfamiliarity with construction) currently exist. These are found *not* to provide the desired precursor for student appreciation of the need for similar interaction in the building design team.	Experienced, suitably motivated (see below), tutors are best placed to begin to introduce new vocational students to the potential of other specialisms in the building design process. Structured case study analyses of successful multi-disciplinary projects in industry present a vehicle to identify particular professions as able to perform adequately in areas of conflict identified above.	2. 4.
Content / Structure: inter-disciplinary common subject areas	Cross-disciplinary attendance at common subject lectures exists. Although this is found to do little to instil professional empathy, it is well received by students who, at the very least, are able to recognise that disparate disciplines share some common knowledge bases.	Whilst departments may wish to identify areas of commonality with neighbouring schools in core subject areas, it must be noted that cross-disciplinary attendance of lectures themselves will do little to address the areas of specialist conflict identified above.	7.2.2

Table 8.4
Recommendations table for inter-disciplinary initiatives at the initial stages

Tutor input	A degree of professional bias, picked up from tutors, is found to manifest itself in student attitudes towards design team peers.	Contact tutors must themselves be empowered to recognise the relevancy of *programme* and *resource* variables in any educational strategy to instil professional empathy. Recognising the importance of the areas described in the *identification of conflict* above is considered essential to the success of a programme of integration at stage 1, however contact tutors must be given the opportunity to have an input into how these aspects are addressed.	4. 7.2.2
Encourage positive peer assessment	Student attitudes towards those pursuing a different vocational profession, obtained through current educational activities, are likely to be distorted; since assessments made about a colleague's discipline at this early stage are based largely on factors other than their specialist potential to improve the building design process.	At the early stages of professional education, it is again recommended that the onus of responsibility to encourage positive peer assessment falls to the suitably motivated tutor. Successful mutli-disciplinary projects in the construction industry, presented by tutors as case study material, can begin to present the disparate profession as able to provide the design team with specialist knowledge to combat problems outwith the remit of the other members.	4. 6.3.2
Team selection / group composition	During participation in inter-disciplinary group-work exercises, even in exercises where there is *no* mention of construction or traditional building design team hierarchies, students attempt to adhere to future professional roles which they perceive as being one of leadership for the design students, and one of support for the non-design students.	Findings suggest that little is to be gained by selecting *inter-disciplinary* groups, who have limited specialist knowledge of their own discipline, to participate in ubiquitous group exercises. At this early stage the selection of inter-disciplinary groupings, for anything other than tutor led common-subject discourse, is argued as unable to further an integrative ethos.	7.2.3
Duration	Findings indicate that initiatives which do no more than introduce areas of commonality can be spread over 15 weeks, or two semesters, without affecting adversely the success of multi-disciplinary education at this early stage.	Inter-disciplinary programmes at the early stages, which develop the variables identified above, are recommended to work best within existing vocational course structures. Implementation should complement existing subjects covered during the initial semesters of a particular course.	4. 7.2.3
Team size	Findings indicate that relatively large groups do not affect adversely student attitudes towards building design team relations, in schemes which aim to provide a degree of subject commonality among different courses in the initial stages of vocational education.	Participating numbers of students in an educational scheme that develops the variables identified above, may reflect existing sum totals of students in other taught subjects of a particular course.	4. 7.2.2

Table 8.4

Recommendations table for inter-disciplinary initiatives at the initial stages.

8.1.2.2 The intermediate stages of professional courses

The following discussion below concentrates on developing an educational initiative to suit students at the *intermediate* stage of their course. Recommendations for a more effective integration of disciplines, at the intermediate stages of tertiary education, are again based on influential programme and resource strategy variables.

Higher Educational Institutions that seek to integrate disparate building design team disciplines at this intermediate stage of professional education, display an inherent recognition that courses require to overcome professional conflict brought about by isolated curricula. However a detailed, objective, **identification of the variables which make up** these **areas of professional conflict** is seldom, if ever, conducted. Evidence suggests that intermediate stage student attitudes towards design team peers have grown more apathetic and more unfavourable after participation in the initial semesters of vocational courses. It is vital therefore that educators identify and address the particular aspects that contribute to inter-disciplinary conflict at this intermediate stage of professional education.

Previous sections have detailed specific areas of conflict that have the potential to affect detrimentally building design team relationships. It is recommended that an intermediate stage initiative that seeks an effective integration of courses should address the following areas:-

Educators must acknowledge that the design professional is perceived, by intermediate stage students involved in non-design construction courses, to display an enmity to team-working and to project an isolationist specialised outlook. The design profession is also perceived to have a disorganised mental approach, and a disorderly working manner.

Whilst there is recognition, by intermediate stage students, that designers are very important to the building process, they are seen more and more as indifferent to the other specialist design team members. Equally educators must address attitudes, held by design orientated students at the intermediate stage, that non-design building professionals produce information of very limited use, and contribute little to the project. The non-design profession is also perceived as unable to generate ideas, as unsuitable for project leadership, and as having a low quality of training.

This intermediate stage is well placed to encourage student interaction and the integration of specialist skills gained through vocational education. Evidence suggests that programmes of integration carried out at this stage are able to improve the overall outlook of students towards design team peers. However unless projects highlight directly the important areas of professional conflict above, initiatives are found to simply compound existing positive attitudes about a profession, rather than addressing the potentially detrimental negative attitudes concerning design team peers.

In terms of the **structure and content of intermediate educational programmes**, findings suggest that projects which either specify directly, or encourage indirectly, traditional role play professional relationships are unlikely to address the areas of professional conflict perceived to exist by intermediate stage students. Unless instructed to do otherwise, students adopt a hierarchical hand-me-down system of information generation, which does not instil specialist interaction. This simply emphasises further the disparate nature of the specialists who make up the building design team. Although intermediate stage students are well placed to integrate their own specialist knowledge bases, programmes of integration must beware of simply introducing professional distancing into the middle stages of vocational construction education.

It is recommended that students at this intermediate stage, take part in inter-disciplinary projects which allow them to demonstrate their particular specialist skills to disparate colleagues. However educators seeking a programme to facilitate effective interaction through group work must structure intermediate stage projects carefully. Findings indicate that, even in what appear to be egalitarian (construction orientated) projects, 72% of intermediate stage design students see their input as more important than other disciplines, whilst only 26% of non-design intermediate stage students regard themselves as more important than peers in the completion of the group exercise.

Educational initiatives must instil confidence in specialist contribution and a holistic inter-disciplinary approach. It is recommended therefore that educators ensure that no one discipline holds the prime position in achieving objectives. It is advised that both design and non-design disciplines be encouraged (via a carefully structured workshop brief) to explore the aspects outlined in the *identification of areas of conflict* described above, to achieve successful project completion. Findings suggest projects in which the content is devised by tutors who come into direct contact with participating students, to be the most successful in achieving educational objectives. Clearly tutor input at the development stage of project work is very important.

Further recommendations concerning the structure and content of multi-disciplinary initiatives, emphasise the identification of common subject areas. Repeating opinions expressed at the initial stages, 75% of all intermediate stage students regard attending lectures alongside other courses as a way to achieve an integration of building professional objectives. It is noted that there is little evidence to suggest that commonality aids effective integration, however Schools able to overcome logistical problems, might attempt some degree of inter-disciplinary lecture attendance. At the very least, subject commonality across vocational courses may allow students to acknowledge one another in a neutral environment.

Tutor input remains an important variable in any educational initiative that seeks to instil an effective integration of disciplines at the intermediate stage. Tutors are perceived to be even more biased by intermediate stage students than initial stage students. Almost 90% of all intermediate students regard tutors involved in inter-disciplinary education to be biased in favour of one particular profession. It is recommended that tutors be made fully aware of the intermediate stage attitudes which affect detrimentally the building design team process. Inter-disciplinary initiatives should be structured to allow educational staff the opportunity to promote the building design team as attaining success through a multi-disciplinary approach.

Although students perceive tutors to be biased, they also perceive tutors as having only limited effect on successful inter-disciplinary project completion. This displays confidence in the students own ability to integrate specialist knowledge in particular group-work situations. This is to be encouraged. Tutors, involved in intermediate stage educational programmes of integration, are advised to concentrate their efforts into the development of a project structure able to address adverse attitudes. Tutor input during the workshop is apt to be construed as seeking to influence the project outcome in favour of a particular professional objective. Students therefore must be made clear of project task requirements at the outset, and be given the freedom to work towards project objectives as an independent inter-disciplinary group.

Tutor input at the evaluation stage is also very important, both to provide sufficient student feedback, and to assess the programme of integration in terms of ability to address the areas of conflict identified at the outset. Measuring post project student attitude towards other professions is recommended (utilising methods such as those described in section 5) to allow tutors to measure empirically a projects ability to instil empathy among different disciplines.

At present several Higher Educational Institutions do implement programmes of integration. However an inherent goal of all such programmes, that of encouraging confidence in another disciplines abilities, is seldom addressed directly. Projects currently encourage students to **view positively** disparate **professional input** to the building design process in an *ad hoc* way rather than as part of any considered approach. Findings indicate that team members able to get a group out of trouble raise the standing of particular individuals in the eyes of their group. The structure of projects should therefore incorporate situations which allow particular specialist disciplines to get the group out of trouble. Scenarios must be consistent with the areas of conflict identified for intermediate students. For example tutors can effect a change to the brief at the mid-point of progress through an inter-disciplinary project. Individuals may then display specialist knowledge to allow the group to overcome the unexpected problem. This will raise the standing of a particular profession and encourage confidence in specialist input.

Findings indicate that past performance in the students own specialist course does not dictate inter-disciplinary performance within a group. Average placed students can perform better than expected in the inter-disciplinary group projects; whereas students who have a proven track-record can perform indifferently in the inter-disciplinary group[713]. Findings show that in general, mixed ability and mixed personality **group compositions** excel. It is recommended therefore that intermediate educational inter-disciplinary projects promote the interaction of mixed (ability) groupings.

In an intermediate stage multi-disciplinary group project, for courses dealing with the creation and maintenance of the built environment, a prime objective is to bring together disciplines with different professional objectives. Care must be taken to ensure that this condition is satisfied. Disciplines brought together in good faith, with what may *appear* to be disparate professional objectives, may find themselves in direct competition for specific tasks. Architectural and Building Surveying students for example, rather than seeking to integrate their particular skills in a multi-disciplinary project, compete directly for design input if project objectives are ambiguous[714]

It is recommended that such groupings include design and alternatively non-design oriented construction students. If groupings include more than one discipline that adheres to the same broad categorisation, then that project specification should be structured to differentiate/allocate non-specialist team roles to avoid direct specialist competition in the completion of group objectives.

Instances exist where it is the students themselves who make *ad-hoc* inter-disciplinary contacts, to fulfil particular course requirements. Cross-disciplinary contacts, which occur as a result of unstructured, personal initiatives, are to be applauded. Indeed findings indicate that allowing participation in **team selection** by the participants themselves aids successful project performance. However, Schools and Departments who would oversee this type of networking, must not neglect their direct responsibility to structure formal interaction between disparate courses, to promote the potential of integrated effort to *all* students.

Clearly the inter-disciplinary programme and resource variable of **team selection** is related to the deliberate act of bringing different disciplines together. A degree of control is recommended during team selection processes, to ensure that reciprocating course tutors direct students to choose the most suitable discipline to allow integration of different professional objectives. Given that student choice is found to improve group success, it is recommended that intermediate inter-disciplinary projects attempt to marry tutor control over team selection with a degree of student choice. Individuals should be impelled to choose compatible disparate specialists to allow completion of a complex problem.

For example students from different courses can be asked to identify independently an interest in one of several areas (offered by tutors) of the creation and maintenance of the built environment. The full nature of the complex project is consequently disclosed. Students identify independently all potential problems which may occur in the development of their particular area of interest. Students are then informed that respective responses have led to their alignment with other like-minded individuals in other courses. Such a pre-cursor to professional networking, motivated by a degree of personal gain, allows students to: participate in team selection, identify individuals able to *get them out of trouble* in areas outwith their own professional remit, and ultimately be more receptive to cross-disciplinary work groups.

Team size must also be considered during group selection procedures. Findings indicate that projects seeking to integrate vocational students involved in different aspects of the creation and maintenance of the built environment, are affected adversely by large teams with many members. Smaller groups of between 4 and 6 members are found to cause few adverse affects. It is recommended therefore that inter-disciplinary project work-groups should contain between 4 and 6 members.

A final consideration in the inter-disciplinary project at the intermediate stage of vocational education is **project duration**. Findings suggest that this stage of vocational education, where students are able to integrate technically diverse specialist knowledge bases, is affected adversely by projects that programme participation over a prolonged multiple-week duration. On the other hand, short intensive projects of up to 5 days do not to affect adversely student attitudes towards design team relationships. It is recommended that educational projects seeking integration at this intermediate stage be intensive and concise.

This discussion has made recommendations for intermediate stage inter-disciplinary initiatives based on programme and resource variables concerning, the need to identify areas of inter-disciplinary conflict, project content and structure, the level of tutor input, the need to encourage positive peer assessment, group composition, team selection procedures, optimum team size for training schemes, and, project duration decisions. These recommendations are summarised in the first column of Table 8.5 in terms of, column 2 which describes the situation as it exists at present, column 3 which details proposed changes, and, column 4 which allows cross-references to be made to the relevant findings sections.

Strategy Variable	*Current Situation*	*Proposed Change*	*Cross Reference*
Identification of areas of conflict	Evidence suggests that intermediate stage student attitudes towards design team peers have grown more apathetic, more unfavourable after participation in the initial semesters of vocational courses; detailed, objective, identification of the variables which make up these areas of professional conflict are seldom, if ever, considered.	It is vital that educators identify and address the particular aspects that contribute to inter-disciplinary conflict at this intermediate stage of professional education.	6.4.2.1
Identification of areas of conflict: *attitudes expressed by intermediate stage non-design students*	The design professional is perceived, by the non-design student, to display an enmity to team-working; to project an isolationist specialised outlook; to have a disorganised mental approach, and as having a disorderly working manner. The design professional is regarded as important to the building process, but is perceived, at this intermediate stage, as indifferent to the other specialist building design team members.	The attitudes described opposite must be addressed by inter-disciplinary initiatives at the intermediate stage	6.4.2.2.1
Identification of areas of conflict: *attitudes expressed by intermediate stage design students*	The non-design building professional is perceived by intermediate design students as having only limited project contribution; providing information of very limited use; as unable to generate ideas; as unsuitable for project leadership, and as having a low quality of training.	The attitudes described opposite must be addressed by inter-disciplinary initiatives at the intermediate stage	6.4.2.2.2
Verify multi-disciplinary programme content and structure	Evidence suggests that programmes of integration carried out at this stage are able to improve the overall outlook of students towards design team peers. However projects that either specify directly, or encourage indirectly, standard role play professional relationships are unlikely to address the important areas of professional conflict. At present, intermediate stage initiatives are found to compound existing positive attitudes about a profession, rather than addressing the potentially detrimental negative attitudes concerning different design team professions.	It is recommended that students at this intermediate stage, take part in inter-disciplinary projects which allow them to demonstrate their particular specialist skills to colleagues from different courses. However the structure and content of such projects must address the aspects outlined in the *identification of areas of conflict* described above. If logistically possible, a degree of subject commonality across vocational courses is also recommended	6.4.3 7.4.2

Table 8.5 Recommendations for inter-disciplinary initiatives at the intermediate stage

Tutor input	Whilst students perceive tutors to be biased (90% of all intermediate students now regard tutors involved in cross-disciplinary education to be biased in favour of one particular profession), they also perceive tutors as having only limited effect on successful inter-disciplinary project completion. This displays confidence in the students own ability to integrate specialist knowledge in particular group-work situations.	Tutors, in an intermediate stage educational programme of integration, must concentrate efforts into the identification of areas of conflict, and concentrate on developing a project structure able to address these needs. Tutor input *during* the workshop is apt to be construed as seeking to influence the project outcome in favour of a particular professional objective. Students therefore must be made clear of workshop task requirements at the outset, and be given the freedom to work towards project objectives as an independent group.	7.4.2
Encourage positive peer assessment	Whilst several Higher Educational Institutions do implement programmes of integration, an inherent goal of all such programmes, that of encouraging mutual respect and confidence in the different specialist abilities, is seldom addressed directly. Little is done at present to encourage directly students to view positively the disparate professions making up the building design team.	Team members able to get the group *out of trouble* raise the standing of particular individuals in the eyes of their group. It is recommended that project structure incorporate occasion to allow particular specialist disciplines to help the group overcome an unexpected problem.	4.
Group composition	At present group composition decisions for inter-disciplinary integrative projects are largely arbitrary. Findings indicate that past performance in the students own specialist course does not dictate inter-disciplinary performance within a group.	Findings show that in general, mixed ability and mixed personality group compositions excel. It is recommended therefore that intermediate educational inter-disciplinary projects promote the interaction of mixed (ability) groupings. It is recommended that groupings include design and alternatively non-design oriented construction students. If groupings include more than one discipline that adheres to the same broad categorisation, it is recommended that project specification be structured to differentiate/allocate non-specialist team roles to avoid direct specialist competition in the completion of group objectives	4. 6.2.3
Team selection	At present team selection decisions for integrative projects are largely arbitrary. Instances exist where the students themselves make ad-hoc inter-disciplinary contacts. These cross-disciplinary contacts, which occur as a result of unstructured, personal initiatives, are to be applauded. However, Schools and Departments who would oversee this type of networking, must not neglect their direct responsibility to structure formal interaction between different courses, to promote the potential of integrated effort to all students.	Given that student choice is found to improve group work, it is recommended that intermediate inter-disciplinary projects attempt to marry tutor control over team selection (to facilitate students to choose the most suitable discipline to allow integration of different professional objectives) with a degree of student choice over team selection. It is recommended that projects provide a pre-cursor to professional networking, allowing students, motivated by a degree of personal gain, to: participate in team selection, identify individuals able to *get them out of trouble* in areas outwith their own professional remit, and ultimately be more receptive to cross-disciplinary work groups.	4. 6.2.3

Table 8.5
Recommendations for inter-disciplinary initiatives at the intermediate stage

Duration	Findings suggest that this stage of vocational education, which allows students to integrate technically diverse specialist knowledge bases, is affected adversely by projects that programme participation over a prolonged multiple-week duration. Short intensive projects on the other hand are not found affect adversely student attitudes towards design team relationships.	It is recommended that student interaction, during educational initiatives at the intermediate stage of vocational education, occur over a short intensive timescale.	7.4.3
Team size	Findings indicate that projects seeking to integrate vocational students involved in different aspects of the creation and maintenance of the built environment, are affected adversely by large teams with many members. Smaller groups are found to cause no adverse affects.	It is recommended that inter-disciplinary project work-groups contain between 4 and 6 members from disparate courses.	4. 7.4.3

Table 8.5
Recommendations for inter-disciplinary initiatives at the intermediate stage

8.1.2.3 The final stages of professional courses

The Following discussion below examines the requirements for multi-disciplinary educational initiatives at the final stages of a professional course in construction. To describe the recommended approach the following programme and resource variables are used, the identification of specific areas of perceived conflict, the need to verify multi-disciplinary programme content and structure, tutor input, attempts to encourage peer assessment in a positive way, team composition, team selection, duration, and, team size.

Evidence suggests that final stage students from both design and non-design oriented courses share a mutual disrespect for one another. Attitudes displayed towards respective design team professional peers are lower, less favourable, at this final stage of vocational education, than in both the initial years of vocational education, and also the year(s) preceding this final stage. Students graduating from the vocational courses offered by Higher Educational Institutions, are less disposed towards future design team colleagues as a result of participation in the tertiary educational system. Clearly this is an undesirable situation. Educational establishments must look initially at the **areas of professional conflict**, perceived to exist by final stage students, to redress disaffinity toward inter-professional relations.

Specific areas of professional conflict, perceived to exist by students at the final stages of vocational education, are detailed extensively in previous sections of this thesis. Generally, attitudes displayed towards the non-design profession(s) in the final stages, differ little from those displayed at the initial stages of vocational education. Non-design professions are still regarded as mentally proficient, yet unsuited to lead the building design team, and unsuited to manage the project. They are still perceived very much as a support discipline.

Design oriented disciplines, on the other hand, are still perceived to prefer to work alone, and as unwilling to seek advice in the pursuit of problems outwith their professional remit. In addition, final stage non-design students now regard design disciplines as less able to lead the building team than in preceding years. Previous acceptance of a traditional design team hierarchy is put into question by final stage vocational students.

It is recommended that a final stage multi-disciplinary project should facilitate students to recognise that an increasingly complex construction industry requires professionals able to integrate their specialist skill, in different organisational hierarchies, without prejudice.

Decisions concerning the **content and structure** of an inter-disciplinary project at this stage, must be made carefully. Many Educational institutions advocate that the final stage of professional education is the best time to implement multi-disciplinary training programmes. However, findings suggest that the final stage of education gains little from inter-disciplinary group projects, if no precedent has been set for such interaction in preceding years. Disparate courses brought together in this final stage to encourage student interaction and the integration of specialist skill, are found not to synthesise professional objectives. Rather it is found that attitudes, displayed towards professional peers after participation in building design practice simulations, decrease significantly. That is attitudes become significantly less favourable towards design team colleagues as a result of educational initiatives to integrate disciplines.

Unless directed to do otherwise, final stage students are found to become preoccupied with the need to develop highly technical solutions which, rather than encouraging specialist co-operation, engage vocational students in more and more complex areas of their own particular field. This effectively fractionalises their group-work to the extent that final submissions become disjointed and contradictory. A prime motive for inter-disciplinary projects, that of allowing students to integrate professional objectives, becomes lost. Even the introduction of a series of management/teamwork lectures and seminars, at the primary stages of the inter-disciplinary programme to combat group fractionalisation, is found to be ineffectual. Clearly projects at the final stage must be structured carefully to avoid technical fractionalisation. It is suggested that tutors make variations incrementally to the final stage project brief, to ensure that group members come together regularly to (re)assess process and product, and integrate in an organisationally dynamic way.

At present **tutors** are perceived, by their students, to lack interest in multi-disciplinary projects at the final stages. In addition students display misgivings about existing assessment techniques, believing that tutors concentrate on superficial presentation, rather than content. Student participation in final stage inter-disciplinary projects is argued to be affected detrimentally by confusion over programme objectives. It is recommended that tutors, of inter-disciplinary projects at the final stage, emphasise that programme objects are not achieved by a technologically complex *fragmented* solution, and a flashy submission; rather tutors must ensure that inter-disciplinary programmes instil in students the potential of specialist integration.

Specialist knowledge is at an apex in the final stages of tertiary education and students must be encouraged to integrate this specialist expertise to realise their collective potential in an increasingly complex industry. A structure that allows incrementally project-brief *variations*, is argued to both regain student confidence in tutor involvement, and also allow project progress to be monitored by staff. The programme brief, as well as necessary post-project assessment and student feedback, must caution against a fragmented approach and concentrate instead on a teams ability to cope with inter-disciplinary problems.

Final stage student attitude, held towards different building disciplines, is found to be unfavourable. As a result there is a need to **encourage positively opinion of the different professions** involved in the design process. Unfortunately the inter-disciplinary projects which exist at present, have been unable to remedy the situation. Existing inter-disciplinary initiatives are found to reduce affinity towards other professions even more. This result has serious connotations for an educational process preparing undergraduate professionals to take their place in an integrated industry. Little emphasis is placed upon the importance of identifying clearly areas of professional enmity. As a result inter-disciplinary programme structures at present instil neither confidence nor mutual respect among disparate disciplines. To raise the standing of individual team members, a specialist member must be seen to get the team out of trouble. This is particularly important at this final stage, when attitudes towards peers have slumped. Projects must allow students to display to the team the potential of their own particular specialist skill(s). It is recommended that projects are structured to ensure that students continually (re)assess task allocation; tutors require to monitor group progress to ensure that no one group member is under-utilised nor alternatively overloaded.

Group composition in final stage inter-disciplinary projects is a major concern. Student groupings are found to experience indecision and confusion if teams are composed of too numerous and too wide ranging disciplines. Confusion can be fuelled by degrees of student ignorance about the perceived role(s) of the other disciplines. In other words there appears, to the students, to be unequal abilities to progress the project, and different notions of what the final report should actually look like. A final stage inter-disciplinary project seeking to integrate disparate courses should avoid attempting too much too late.

Team size considerations are of note at this stage. Findings indicate that large groupings of (up to a dozen) students from different disciplines adversely affect integration. Smaller groupings (of between 4 and 6) are found to contribute towards improvements in attitudes displayed towards peers. Final stage inter-disciplinary projects should promote small teams. It is also recommended that **group composition** at the final stage should avoid bringing too many design team disciplines together, if no precedent exists for course integration in previous years. Rather than attempt a final stage *catch-all* of a large spread of disciplines, educators should concentrate on bringing together disciplines that are known to conflict in professional outlook. A design orientated course paired with a non-design orientated course is recommended. Participation, by the students themselves, in the **team selection** process is also recommended to aid the success of group-work exercises.

Findings suggest that inter-disciplinary projects for the integration of building design vocational courses, which involve participation over a relatively short, intensive period, produce less adversarial attitudes towards peers than longer prolonged **project durations**. This finding is in line with evidence that suggests that the programmes which seek to develop participation in technically diverse areas, benefit from intensive short periods of interaction. It is recommended then that student interaction, in final stage inter-disciplinary projects, be carried out over a short, relatively intensive, period of time.

Each of the recommendations made for the final stage inter-disciplinary initiative are restated in Table 8.6. The important programme and resource variables discussed above, make up the several rows of the Table. These are further described within columns which outline: the situation as it exists at present; proposed changes; and, cross-references to the relevant findings sections.

Strategy Variable	*Current Situation*	*Proposed Change*	*Cross Reference*
Identify areas of conflict	Attitudes displayed by vocational students towards other design team professions are less favourable, at this final stage of tertiary education, than in both the initial years of the vocational course and the year(s) preceding this final stage.	Educational establishments must look closely at the major areas of professional conflict to attempt to redress in this final stage, the main variables of disaffinity towards inter-professional relations.	6.4.2.1
Identify areas of conflict: *attitudes expressed by final stage non-design orientated students*	Design disciplines are perceived, by final stage non-design orientated disciplines to: prefer to work alone; and, as unwilling to seek advice in the pursuit of problems outwith their professional remit. Final stage non-design students now regard design disciplines as less able to lead the building team than in preceding years.	Previous acceptance of a traditional design team hierarchy is put into question by final stage vocational students. Multi-disciplinary projects should facilitate students to recognise that an increasingly complex construction industry requires professionals able to integrate their specialist skill, in different organisational hierarchies, without prejudice.	6.4.2.2.1
Identify areas of conflict: *design student attitudes*	The non-design profession is held, by design orientated students, as merely a support discipline: mentally proficient yet unsuited to lead the building design team, and unsuited to manage a project.	Inter-disciplinary educational projects should facilitate recognition that the increasingly complex construction industry calls for professional integration in any number of organisational hierarchies.	6.4.2.2.2
Verify multi-disciplinary programme content and structure	Final stage students are preoccupied with the need to develop highly technical solutions. Rather than encouraging specialist co-operation, vocational students become engaged in more and more complex areas of their own particular field. Inter-disciplinary output is often disjointed and contradictory Management/teamwork lectures and seminars at the primary stages of the inter-disciplinary programme, fail to combat group fractionalisation.	Projects at the final stage must be structured carefully to avoid excessive technical fractionalisation. It is recommended that tutors make variations incrementally to the final stage project brief, to ensure that group members come together regularly to (re)assess process and product, and integrate in an organisationally dynamic way.	3 7.3.1
Tutor input	Tutors are perceived, by their students, to lack interest in multi-disciplinary projects at the final stages. In addition students display misgivings about existing assessment techniques, believing that tutors concentrate on superficial presentation, rather than content.	It is recommended that tutors, of inter-disciplinary projects at the final stage, emphasise that programme objectives are not achieved by a technologically complex *fragmented* solution, and a flashy submission; rather tutors must ensure that inter-disciplinary programmes instil in students the potential of specialist integration.	7.3.2

Table 8.6
Recommendations table for final stage educational initiatives

Encourage positive peer assessment	Final stage student attitude, held towards different building disciplines, is found to be unfavourable. Existing inter-disciplinary initiatives are found not to encourage affinity towards other professions. Inter-disciplinary programme structures at present instil neither mutual respect nor confidence in another professions specialist input.	To raise the standing of individual team members, a specialist member must be seen to get the team out of trouble. This is particularly important at this final stage, when attitudes towards peers have slumped. Projects must allow students to display to the team the potential of their own particular specialist skill(s). It is recommended that projects are structured to ensure that students assess continually task allocation; tutors require to monitor group progress to ensure that no one group member is under-utilised or alternatively overloaded.	3 4 7.3.3
Group composition	Final stage student groupings experience indecision and confusion if teams are composed of too numerous and too wide ranging disciplines. Resentments are fuelled by, what appears to the students as, unequal abilities and different notions of what the final report should actually look like. Clearly final stage inter-disciplinary projects seeking to integrate different courses should avoid attempting too much too late.	If precedent does not exist for course integration in previous years, group composition at the final stage should avoid seeking to bring too many design team disciplines together. It is recommended that group composition concentrate on a pairing of design orientated courses with non-design orientated disciplines. Addressing the specific variables of professional conflict, identified above, for this pairing is argued to address inefficient integration.	6.2.3 7.3.2
Team selection	Little attention is currently given to team selection. At present project co-ordinators select teams made up of final stage students from available vocational courses.	Where possible allowing participants to be active in team selection processes is found to aid the success of group-work exercises. It is recommended that co-ordinators ensure that individuals at this final stage are either directed, or encouraged by specific project briefs, to combine with a discipline which adheres to either a design or alternatively non-design orientation.	4
Duration	Findings suggest that inter-disciplinary projects for the integration of building design vocational courses, which involve participation over a relatively short intensive period, produce less adversarial attitudes towards peers than longer prolonged project durations.	It is recommended that programmes which seek to develop participation in technically diverse areas, will benefit from intensive, short periods of interaction	4 7.3.1 7.4.1
Team size	Findings indicate that large groupings affect adversely affinity to integrate with disparate specialists. Smaller groupings contribute towards improvements in attitudes displayed towards different professions.	It is recommended that inter-disciplinary project teams include 4-6 members.	4 7.3.1 7.4.1

Table 8.6
Recommendations table for final stage educational initiatives

Recommendations have now been presented and discussed which would help to improve incrementally inter-disciplinary educational initiatives for disparate design and non-design orientated construction disciplines at:

(i) The initial stages of tertiary vocational education;

(ii) The intermediate stages; and

(iii) The final stages of tertiary vocational education.

8.1.3 Overview

The recommendations presented and summarised in the Tables in Chapter 8 are part of the justification of an initiative able to facilitate educators to provide successful educational projects that act as a pre-cursor for the optimum integration of disparate specialists in the processes of building design. The recommendations detail the variables of structure and staging necessary to facilitate a successful integration of vocational courses dealing with the creation and maintenance of the built environment.

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CHAPTER 9

CONCLUSIONS: COMMUNICATION IN THE BUILDING DESIGN TEAM

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CHAPTER 9

CONCLUSIONS: COMMUNICATION IN THE BUILDING DESIGN TEAM

9.1 Problems created by the communication difficulties of disparate disciplines

The general area of concern for this research project was the extent to which fractionalisation of the technologically complex construction industry brings problems to the building design process. The project investigated communication difficulties between different professional disciplines, and their capacity to affect detrimentally building design team operation. Stemming from a central concern that problems exist in integrating the different professionals involved in the creation and maintenance of the built environment, this project examined professional education for the construction industry as the foundation for inter-professional relations.

To investigate the postulated link between inefficiencies in professional interaction and education for the construction industry a working hypothesis was developed which contained the following three propositions:-

Proposition (i)	There are problems in the building design team created by difficulties of communication between different professional disciplines.
Proposition (ii)	Communication difficulties are primarily a function of cultural differences instilled by vocational education.
Proposition (iii)	Communication gaps require educational initiatives able to bridge cultural differences instilled by vocational traditions in the educational process.

The study relating to proposition (i), *there are problems in the building design team created by difficulties of communication between different professional disciplines*, examined whether the necessary fractionalisation of the technologically complex construction industry brings problems. Research activities investigating this proposition examined the degree of empathy that experts in particular fields of the building design process display toward one another. The level of professional dissonance among the members of the building design team was examined as a factor of (in)efficient design process and (a less than optimum) product.

The study relating to proposition (ii), *communication difficulties are primarily a function of cultural differences instilled by vocational education,* examined the degree to which problems, consequently found to exist in the building design team, were to do with tertiary education. Research activities investigating this proposition examined how different professional traditions, instilled by both the professional institutions and the Higher Educational Institutions, affected (detrimentally) the multi-disciplinary design process demanded by today's dynamic building industry.

Finally, the study concerned with proposition (iii), *communication gaps require educational initiatives able to bridge cultural differences instilled by vocational traditions in the educational process,* investigated the need for educational initiatives to encourage empathy among different building design team professionals. Research to investigate this proposition examined the potential for a new model, able to facilitate educators to provide educational initiatives that act as a pre-cursor for an optimum integration of disparate specialisms in the process of building design.

9.2 The role of inter-disciplinary education in addressing communication difficulties

9.2.1 Building design team yet to fulfil multi-disciplinary potential

Data gathered to examine this proposition (i) found that in the light of a growing international trend to fractionalise professional input, uncertainty has arisen world-wide on how best to prepare future design team specialists to succeed in changing legislative and economic environments[715]. Indeed various reports express a high degree of dissatisfaction with the process of the building design team. These reports represent an impressive body of opinion which believes that the construction process in the UK has yet to achieve an optimum level of production[716]. Government and industry are currently appealing for an improvement in communication across disparate professional interfaces, as the way towards a more efficient and effective construction industry.

9.2.2 Inter-professional conflict predominates performance

The principal barrier to project team performance in the construction industry was found to be inter-professional conflict resulting from professional power struggles[717]. The need to address the perceptions and cognitions of participating specialists, to reduce conflict in the multi-disciplinary design process and improve output, was clear[718]. Results from the analysis of the case studies found that, in general, students from courses with disparate professional objectives displayed high levels of mutual disrespect toward one another. Techniques developed to measure success in inter-disciplinary workshop participation, found that students, instructed to work with peers from other courses, generally displayed an enmity towards other disciplines. Students from disparate disciplines, brought together in practice simulations, were found to be disinclined to interact with one another. Indeed as a result of participation in some of the existing inter-disciplinary tertiary educational workshops, this aversion towards other professions was intensified. Findings support proposition (i).

It is worth noting that, whilst inter-professional conflict is the strongest reported barrier to project team performance, it is not the only factor involved. Discussion also highlighted variables such as contractual conditions, and project organisational structure as contributing to inter-disciplinary performance. It is recognised that many innovative designs, resulting from efficient and effective project team performances, may simply go unreported. The influence of inter-disciplinary building design partnerships and practices on the efficiency of the industry, has yet to be measured. This limitation to the data set is acknowledged and indeed suggests an opportunity for future research into the extent to which the mixed disciplinary firm, which can be argued as treating the symptoms of the problem of inter-disciplinary integration, can aid attempts to find the cure. Notwithstanding limitations however, the data presented throughout this text does indeed support proposition (i) *that there are problems in the building design team created by difficulties of communication between different professional disciplines.*

9.2.3 Vocational traditions aid dissonance

Data gathered to investigate proposition (ii) found that a major cause of specialist dissonance in the UK construction industry was an academic adherence to vocational tradition, which often detracts from the much needed multi-disciplinary approach demanded of today's built environment design team[719]. Much Governmental and industrial literature recommends acceptance that a greater inter-disciplinary approach to professional education is necessary, to improve communication across building design team interfaces, without losing the expertise of individual professions[720].

The methods taught to different disciplines, can lead to the lack of understanding between differing approaches and conflict within the building design team[721]. Differences, resulting from different patterns of thinking, can lead to a reduction in respect for, or lack of trust in professional colleagues; subsequently building design process suffers[722]. Communication between individuals, who adopt heterogeneous (professional) attitudes towards the realisation of a project, is often found to be largely confrontational[723]. Much literature voices opinion that mutuality is attained when there are no inequalities built into cultural structures, and where structures are allowed to come about through the mutual approval of each member[724].

9.2.4 Enmity increases after initial stages of professional education

It is found that barriers encountered by co-operative teams, testify to the fact that the effort to integrate disciplines for applied purposes may come too late; much literature argues that integration should be developed during the tertiary educational stage[725]. Generally, students become *less* co-operative in the later years of their academic careers when the pressure to succeed, and an increased emphasis on individual attainment, engenders a competitive, non co-operative, attitude[726]. Case study analysis found that students are less empathetic towards different professional objectives in the later stages of their academic careers than in the early stages.

Case study analyses revealed that the particular vocational course of study undertaken by the individual was the key contributor to design team attitude difference. Adherence to either *design* or alternatively *non-design* vocational education influenced greatly group differences. In addition mutual enmity was found to increase after the initial stages of vocational education. It was found that attitudes displayed towards disparate professions become significantly less favourable, less sympathetic, as the student progressed through their full-time course of study. Final stage students were found to display little inter-professional affinity; indeed inter-disciplinary project work, conducted at the final stages to encourage inter-disciplinary integration, resulted instead in increased cross-disciplinary enmity.

The research conducted verifies the fact that vocational education does instil professional cultural differences amongst building design team members. This in turn influences greatly difficulties experienced by disparate members in the communication and integration of their particular specialism. Given the evidence presented throughout this text, proposition (ii), which states that *communication difficulties are primarily a function of cultural differences instilled by vocational education,* is accepted.

9.2.5 Education influences professional traits

Findings presented to investigate proposition (iii) indicate that educational curricula for specific construction disciplines influence professional trait and personality variables[727]. There is recognition of the potential for some form of educational process to address the professional mind-set and to encourage empathy with the issues faced by disparate building disciplines[728].

The need for integrative project-work in contemporary construction education has roots in early traditional and modern educational philosophies, which sought to allow assessment of the individuals place in a multi-disciplinary decision making process, through experience[729,730]. Data presented to investigate this third proposition argued that, if change is sought to better the efficiency and effectiveness of the building design team organisation, a process able to combat detrimental traditional cultural assumptions is required during the formative years of professional development[731,732].

9.2.6 Structured initiatives can address professional enmity

It is found that problems in organisational communication, and differences in dealing with people are largely a matter of values and attitudes. Results and findings presented by this project found that attitudes held towards other disciplines involved in the design process were modified by training programmes[733 734]. Findings indicated that attitudes towards building design team colleagues did improve as a result of experimental training programmes. Research revealed that whilst some existing case study multi-disciplinary practice simulations were found to be less than ideal, addressing particular constituent parts of these integrated projects allows educators to address professional enmity displayed by students towards their design team colleagues. A detailed breakdown of all measurements taken for case study inter-disciplinary practice simulations, allowed the development of a system able to facilitate educational initiatives that act as the precursor for optimum integration and communication in the design process.

The development of an educational model able to improve incrementally the educational process to allow building design disciplines to recognise and integrate effectively with their disparate peers, supports the third proposition that: - *communication gaps require educational initiatives able to bridge cultural differences instilled by vocational traditions in the educational process.*

9.2.7 Limitations

Evidence presented above supports the third proposition, however it is worth noting certain potentially limiting variables at this point. Research conducted to investigate this proposition concentrated upon case studies taken from a Higher Education Institutional sample which had already made tentative steps toward cross-disciplinary project work. The methodology developed by this project measured student attitudes at various stages of isolated vocational courses; the measured sample had no official contact with other disciplines. However, the sample of students used in this study were not completely isolated from other vocational disciplines; different courses shared the physical resources provided by their University. The full extent to which student attitude is influenced by non-academic contact with other disciplines is not known. Future research might seek to assess the influence of *completely* isolated educational environments. Equally the extent to which student attitude is influenced by an academic environment which, whilst keeping vocational courses apart, is theoretically sympathetic to cross-disciplinary education, is not known. Again future research may seek to assess the influence of Educational Institutions which are theoretically committed to traditional, vocationally separate, curricula. Investigation of hypothesis proposition (iii) concerned case study analyses in which specialist academic staff were highly motivated. Notwithstanding the recommendations of good practice for tutor input made by the educational model presented, future research might seek to assess in much greater detail, the full extent to which a tutors (lack of) motivation is able to influence dependent student attitudes.

The model presented earlier is a longitudinal educational process able to improve cumulatively inter-disciplinary communication during tertiary education, and act as the pre-cursor for effective communication in industry. The effect of complete implementation of the model over the students academic life, from the initial stage to the final stage several years later, is not known. Future research might seek to measure the influence of full longitudinal implementation of the normative model, from the initial stages of entering vocational education, through graduation, to professional practice in the construction industry.

9.3 An educational model to address communication difficulties

9.3.1 Statement of research findings

The critical review of the literature and the empirical studies conducted in this research reveals that there are problems among the members of the building design team as a result of professional dissonance and communication difficulties. These communication difficulties are found to result from tertiary education. Tertiary education can address communication difficulties between different building disciplines by the implementation of structured educational initiatives.

This statement of research findings supports the three propositions made at various points throughout this text. The development of a normative model, a simplified system of variables giving educators the conditions for achieving the objective of effective inter-disciplinary interaction, allows the work undertaken by this project to address the larger issue of specialist interaction in the multi-disciplinary construction industry. The educational model developed by this research project represents a pre-cursor for an integrated building design team, an efficient design process and an effective building design product.

9.3.2 Model staging, programme and resource allocation

The model developed and presented allows educators to make best use of scarce educational resources to implement a training initiative suited to their needs. The model describes variables deemed necessary for an educational initiative which incorporates particular building design and alternatively non-design students at specific stages of their respective courses. Educators receive recommendations concerning the appropriate programme and resource variables for a particular educational strategy at either the initial, intermediate or final stage of a vocational course. Educators are advised which specific aspects of professional conflict must be tackled, advised on content and structure, given recommendations on how to encourage positive peer assessment, as well as given advice on programme duration, team size, inter-disciplinary team composition and the role of the tutor. If educators comply with these recommendations, educational initiatives seeking to improve inter-disciplinary integration will be successful. Findings indicate that experimental training initiatives did successfully change student attitudes towards different professionals. The model makes different recommendations for different stages of vocational training, since each stage has specific inter-disciplinary needs. Optimum application of the model involves the students at the outset of tertiary education and continues to the completion of their studies.

9.3.3 Model applicability to other fractionalised fields of endeavour

Whilst this project has concentrated on the communication processes and potential for improving the integration of UK disparate building design team specialists, the work presented has a broader application. With the onset of a harmonisation of the European construction industry, and ever closer international building markets, the need to facilitate professionals to integrate specialist skill in changing and challenging environments is vital. International educational exchange schemes such as ERASMUS may well stimulate trends towards a more inter-disciplinary approach to vocational building courses. A model based upon the concepts presented here might aid internationally disparate building courses to integrate different educational objectives. It may well be that established professional institutions, currently promoting Continuing Professional Development schemes and training courses, have need of a model able to recommend an optimum educational programme to address international barriers to effective integration. Although additional research would be required, utilisation of the methodology presented by this project may well aid future analyses of integration in an international context.

In addition to the construction industry, many divergent areas of manufacturing and service provision also express concern about the inefficient integration of specialists[735]. The implications of the findings of this project find broadest application in the fractionalised nature of many other complex fields of endeavour. Special needs education[736], medicine and social work[737], manufacturing industries from motor car production[738] to the space industry[739], hospitality provision[740], as well as leisure provision[741], can all be argued to have need for an educational model able to facilitate expert individuals to integrate effectively within a particular field of interest. It may well be that the model presented by this research project is able to provide a framework to allow educators in other fields to target specific areas of service provision and manufacturing, to improve communication processes, inter-disciplinary interaction, and final product.

9.4 Extending the normative model

9.4.1 Project end point: providing a precursor for effective building design team integration

The work undertaken by this project, culminating in the educational model for vocational courses dealing with the creation and maintenance of the built environment, provides the precursor for effective integration of building design disciplines in industry. The normative model, developed to provide educators with the conditions for achieving the objective of effective inter-disciplinary interaction within a structured educational initiative, represents the end point of this research project.

9.4.2 Opportunities for future research

Whilst an end point is acknowledged, opportunities for future research do exist. To extend the current study, future research may seek to address areas already flagged in the discussion. Principally, an opportunity exists to examine the *cumulative* effect of the constituent educational initiatives recommended by the model for the initial, intermediate and final stages of a course. Future research which measures longitudinally full implementation of the normative model, from the initial stages of entering vocational education, through graduation, to professional practice in the construction industry, is desirable. The full extent to which inter-disciplinary projects staged at the later stages of a vocational course build upon programmes from preceding stages, may well provide information to augment the existing data base, and aid successful utilisation of the developed model. Indeed a longitudinal study may seek to continue analyses of individual student participants to post graduate employment and beyond into their professional careers; this would provide the optimum data base for Continuing Professional Development schemes to facilitate yet further post-graduate and time served professionals to recognise the potential of effective inter-disciplinary integration.

An analysis of attitude development resulting from progression through tertiary education and/or professional practice in the construction industry, to employment within a Higher Educational Institution as vocational tutor for the next generation of building professionals, is also recommended for further research. Future research might seek to address in detail the extent to which tutor motivation and attitude, influence student attitudes in the vocational courses of construction. Whilst the educational model already makes recommendations of good practice for tutor input into a particular educational initiative, future research might be conducted to investigate in greater detail the potential of human error (degree of tutor resistance to the recommendations of good practice) to influence the success of the model and the dependent student attitudes.

Another area for future study goes beyond the national boundary of the UK. Notwithstanding Inter-European party political uncertainties, the advent of an increasingly unified Europe holds scope for future research to expand the work presented in this study. Both the educational exchange scheme ERASMUS, which facilitates international integration of (construction orientated) students during tertiary education, and, European Community moves towards a European Harmonisation of the respective European construction industries, provide suitable opportunities for future research. The methodology presented by this project, to facilitate effective integration between different UK professional disciplines, may well be further utilised in such international contexts. Future research able to expand the current study, to investigate and address attitude differences that are potentially detrimental to performance within an internationally harmonised construction industry as well as an internationally disparate building design team, is desirable.

9.4.3 Future research beyond the construction industry

Future research is recommended to develop the model presented by this research project beyond the confines of design oriented and alternatively non-design oriented disciplines within the construction industry. In an increasingly technological world, the fractionalisation of solutions to complex problems is inevitable. Specialists must integrate effectively if solutions are to be effective. The way towards a more efficient team process, and ultimately a more effective product, is through an educational initiative able to instil inter-disciplinary empathy. Future research, developing the model presented by this project, may facilitate educators to *improve* inter-disciplinary communication processes, inter-disciplinary interaction, and the final product. Future research able to develop the methodology presented here, to provide a framework which will allow educators in other disparate fields to address inter-disciplinary dissonance within their own specific areas of service provision and manufacturing, is recommended.

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APPENDIX

Appendix A item 5.1

Questionnaire development table of pre-internal validity procedure. The table below shows the following:

(i) Column 1 shows the *Internal Item Reference Number*

(ii) Column 2 shows the *Pool of Questionnaire Statements*

(iii) Column 3 shows the *Response Favourability Reference Score*
Item by item internal score where:

Favourable = 5 ...Uncertain = 3 ... Unfavourable = 1;

and where:

S.A. = Strongly Agree
A = Agree
U = Uncertain
D = Disagree
S.D. = Strongly Disagree

(iv) Column 4 shows the *Questionnaire Statement Cross-Reference Source* where:
Stringer:
Stringer, P. (1970) 'The professional self-images of architecture and engineering students', Architectural research and teaching, vol 1, no 2, p25-33;
Faulkner and Day:
Faulkner, A. & Day, A. (1986) 'Images of status and performance in building team occupations' Construction management and economics, no 4, p245-260; &
H & J:
Higgins, G. & Jessop, M. (1965) 'Communications in the building industry: a report of a pilot study' Tavistock publications.

(v) Column 4 also shows the *Early Stage Category Reference (A - K) Statement* where items at this early stage were classified as:

A = aesthetic creative motivation
B = orientation to other people
C = mental habits
D = purpose and responsibility
E = information handling
F = social status
G = level of training received
H = level of education received
I = contribution to building process
J = usefulness of information provided
K = leadership

Item No.	Questionnaire Statement	Response Favourability Reference Score					Statement Cross-Reference Source & Early Stage Category Reference (A - K)										
		Favourable = 5; to, Unfavourable = 1					Stringer					Faulkner & Day				H & J	
		S. A.	A.	U.	D.	S. D.	A	B	C	D	E	G	H	J	K	F	I
1	This professional is held in high regard by the general public	5	4	3	2	2										F	
2	In their work this professional feels responsible to society	5	4	3	2	1				D							
3	This professional seeks out the help and advice of other people when they hit a problem in their own work	5	4	3	2	1		B									
4	This professional makes a serious effort to keep up with the current publications and literature in their own field	5	4	3	2	1					E						
5	After graduating this professional needs little 'hands-on' experience before they are able to perform their job satisfactory	5	4	3	2	1						G					
6	The education of this profession needs to be of a higher standard and greater intensity than the other professions involved in the design team	5	4	3	2	1							H				
7	This professional contributes greatly to the building process and the eventual completion of the project	5	4	3	2	1											I

Item No.	Questionnaire Statement	Response Favourability Reference Score					Statement Cross-Reference Source & Early Stage Category Reference (A - K)										
		Favourable = 5; to, Unfavourable = 1					Stringer					Faulkner & Day				H & J	
		S. A.	A.	U.	D.	S. D.	A	B	C	D	E	G	H	J	K	F	I
8	This profession can readily explain technical matters in their field to laymen	5	4	3	2	1		B									
9	The information provided by this profession is extremely useful to the other professions in the design team during the project	5	4	3	2	1								J			
10	This professionals work is characterised by inventiveness and ingenuity	5	4	3	2	1	A										
11	This professional grasps other peoples ideas quickly, often long before they finish explaining them	5	4	3	2	1		B									
12	This professional is the most suitable candidate to lead the design team	5	4	3	2	1									K		
13	This professional is somewhat distractible; requires optimum conditions for concentration	1	2	3	4	5			C								
14	This profession is held in high regard by other design team members	5	4	3	2	1										F	

Item No.	Questionnaire Statement	Response Favourability Reference Score					Statement Cross-Reference Source & Early Stage Category Reference (A - K)										
		Favourable = 5; to, Unfavourable = 1					Stringer					Faulkner & Day				H & J	
		S. A.	A.	U.	D.	S. D.	A	B	C	D	E	G	H	J	K	F	I
15	This professional reacts quickly to problems: they immediately generate a great number of ideas	5	4	3	2	1	A										
16	The level of training given to a graduate in this professional office is of a lower standard than in other professional disciplines	1	2	3	4	5						G					
17	This professional has an active, efficient and well organised mind	5	4	3	2	1			C								
18	This profession gives freely of their own time and ideas to other peoples projects and tasks	5	4	3	2	1		B									
19	This discipline is aware of their professional limitations: do not attempt what they cannot do	5	4	3	2	1			C								
20	Undergraduate education in this discipline needs to have a general 'all-embracing' approach	1	2	3	4	5							H				
21	This professional is skilled at taking their colleagues ideas and concepts and fashioning them into practical solutions and programmes	5	4	3	2	1		B									

Item No.	Questionnaire Statement	Response Favourability Reference Score					Statement Cross-Reference Source & Early Stage Category Reference (A - K)										
		Favourable = 5; to, Unfavourable = 1					Stringer					Faulkner & Day				H & J	
		S. A.	A.	U.	D.	S. D.	A	B	C	D	E	G	H	J	K	F	I
22	The information provided by this professional is of use mainly in progress reports to the client	1	2	3	4	5								J			
23	This professional has a knack for improvising quick solutions to problems that may restrict progress	5	4	3	2	1	A										
24	This professional is an essential member of the design team and contributor to the building process	5	4	3	2	1											I
25	This professional has a special talent for solving organisational problems	5	4	3	2	1		B									
26	This professionals skills make them a suitable overall project manager	5	4	3	2	1									K		
27	This discipline deserves to be regarded as a prestigious profession	5	4	3	2	1										F	
28	This profession enjoys the freedom of working in an ill-defined field	5	4	3	2	1	A										

Item No.	Questionnaire Statement	Response Favourability Reference Score					Statement Cross-Reference Source & Early Stage Category Reference (A - K)										
		Favourable = 5; to, Unfavourable = 1					Stringer					Faulkner & Day				H & J	
		S. A.	A.	U.	D.	S. D.	A	B	C	D	E	G	H	J	K	F	I
29	This profession prefers to work alone; they are not team players	1	2	3	4	5		B									
30	The graduate has little to learn from the other disciplines involved in the building process; their work is too specialised	5	4	3	2	1						G					
31	This professional is a perfectionist; devotes endless attention to detail	1	2	3	4	5				D							
32	The training of this professional during higher education should be of a highly specialised nature	5	4	3	2	1						G					
33	This profession is neat and orderly in their habits and manner of work.	5	4	3	2	1			C								
34	Without the information generated by this professional, the other professionals could not perform their tasks	5	4	3	2	1								J			
35	This profession is stimulating to other people; seems to catalyse others into more original productive work than would otherwise achieve	5	4	3	2	1		B									

Item No.	Questionnaire Statement	Response Favourability Reference Score					Statement Cross-Reference Source & Early Stage Category Reference (A - K)										
		Favourable = 5; to, Unfavourable = 1					Stringer					Faulkner & Day				H & J	
		S. A.	A.	U.	D.	S. D.	A	B	C	D	E	G	H	J	K	F	I
36	This professional is somewhat deficient in the command of basic sources of literature in their field	5	4	3	2	1					E						
37	In their work this discipline feels responsible chiefly to their own profession	1	2	3	4	5				D							
38	This professional has an exceptionally good memory	5	4	3	2	1			C								
39	This professional frequently makes errors; their work needs to be checked for accuracy	1	2	3	4	5			C								
40	This profession puts their own goals and professional values above all others	1	2	3	4	5				D							
41	This professionals interests in construction lie within a rather narrow range	1	2	3	4	5					E						
42	This profession is relatively uninformed on most subjects other than their own.	1	2	3	4	5					E						

Appendix A item 5.2

Pilot Attitude Scale Questionnaire given to the test group of students:

Attitude Study: Research Questionnaire

This questionnaire is part of a research project which is examining the interaction and communication process of the construction design team.

Your help in completing the following would be gratefully appreciated

Andrew Whyte
Faculty of Design
Robert Gordon University
Aberdeen

Please complete the following concerning your current status:

Course	....		
Year / Stage of studies	....		
Delete as appropriate:			
	male /	female	
	home student /	overseas student	
age:	under 21 yr. old /	21 - 25 yr. old /	over 25 yr. old
construction industry experience:	over 5 yr. / *substantial*	1 - 5 yr. / *limited*	vocational; none *none to date*
parent/guardian occupation:	construction industry /	other	

please turn over...

	The following questions relate to your thoughts on a profession (other than your own chosen discipline) in the construction industry. Please answer the questions below by ticking the box which you think best describes the...	STRONGLY AGREE	AGREE	UNCERTAIN	DISAGREE	STRONGLY DISAGREE
1	This professional is held in high regard by the general public					
2	In their work this professional feels responsible to society					
3	This professional seeks out the help and advice of other people when they hit a problem in their own work					
4	This professional makes a serious effort to keep up with the current publications and literature in their own field					
5	After graduating this professional needs little 'hands-on' experience before they are able to perform their job satisfactory					
6	The education of this profession needs to be of a higher standard and greater intensity than the other professions involved in the construction design team					
7	This professional contributes greatly to the building process and the eventual completion of the project					
8	This profession can readily explain technical matters in their field to laymen					
9	The information provided by this profession is extremely useful to the other professions of the design team during the project process					
10	This professionals work is characterised by inventiveness and ingenuity					
11	This professional grasps other peoples ideas quickly, often long before they finish explaining them					
12	This professional is the most suitable candidate to lead the design team					
13	This professional is somewhat distractible; requires optimum conditions for concentration					
14	This profession is held in high regard by other design team members					
15	This professional reacts quickly to problems: they immediately generate a great number of ideas					
16	The level of training given to a graduate in this professional office is of a lower standard than in other professional disciplines					
17	This professional has an active, efficient and well organised mind					
18	This profession gives freely of their own time and ideas to other peoples projects and tasks					
19	This discipline is aware of their professional limitations: do not attempt what they cannot do					
20	Undergraduate education in this discipline needs to have a general 'all-embracing' approach					

21	This profession is skilled at taking their colleagues ideas and concepts and fashioning them into practical solutions and programmes						
22	The information provided by this professional is of use mainly in progress reports to the client						
23	This professional has a knack for improvising quick solutions to problems that may restrict progress						
24	This professional is an essential member of the design team and contributor to the building process						
25	This professional has a special talent for solving organisational problems						
26	This professionals skills make them a suitable overall project manager						
27	This discipline deserves to be regarded as a prestigious profession						
28	This profession enjoys the freedom of working in an ill-defined field						
29	This profession prefers to work alone; they are not team players						
30	The graduate has little to learn from the other disciplines involved in the building process; their work is too specialised						
31	This professional is a perfectionist; devotes endless attention to detail						
32	The training of this professional during higher education should be of a highly specialised nature						
33	This profession is neat and orderly in their habits and manner of work.						
34	Without the information generated by this professional, the other professionals could not perform their tasks						
35	This profession is stimulating to other people; seems to catalyse others into more original productive work than would otherwise achieve						
36	This professional is somewhat deficient in the command of basic sources of literature in their field						
37	In their work this discipline feels responsible chiefly to their own profession						
38	This professional has an exceptionally good memory						
39	This professional frequently makes errors; their work needs to be checked for accuracy						
40	This profession puts their own goals and professional values above all others						
41	This professionals interests in construction lie within a rather narrow range						
42	This profession is relatively uninformed on most subjects other than their own.						

Appendix A item 5.3

The table below describes Internal Validity, Item by Item Analysis (comparison of the score tallies of High and Low scorers), highlighting the 24 items retained and the 18 items eliminated from.

(i) Column 1 shows the *Internal Item Reference Number*

(ii) Column 2 shows whether or not the item has been validated:
Valid'td = Validated; Y = Yes (item retained); N = No (item eliminated)

(iii) Column 3 shows the Original Pool of 42 Statements

(iv) Column 4 shows an item by item comparison of *High score group item tallies* by *Low score group item tallies.*

Item No.	Vald'td		Statement	Item Comparison by group Tallies	
	Y	N		High Score Group	Low Score Group
1		N	This professional is held in high regard by the general public	10	9
2		N	In their work this professional feels responsible to society	4	3
3	Y		This professional seeks out the help and advice of other people when they hit a problem in their own work	7	4
4	Y		This professional makes a serious effort to keep up with the current publications and literature in their own field	5	4
5		N	After graduating this professional needs little 'hands-on' experience before they are able to perform their job satisfactory	1	2
6		N	The education of this profession needs to be of a higher standard and greater intensity than the other professions involved in the design team	3	3
7	Y		This professional contributes greatly to the building process and the eventual completion of the project	10	10
8	Y		This profession can readily explain technical matters in their field to laymen	6	4
9	Y		The information provided by this profession is extremely useful to the rest of the professionals in the design team during the project	9	10
10		N	This professionals work is characterised by inventiveness and ingenuity	5	6
11	Y		This professional grasps other peoples ideas quickly, often long before they finish explaining them	2	0
12	Y		This professional is the most suitable candidate to lead the design team	8	4
13		N	This professional is somewhat distractible; requires optimum conditions for concentration	2	2
14		N	This profession is held in high regard by other design team members	3	3
15	Y		This profession reacts quickly to problems: they immediately generate a great number of ideas	3	1
16	Y		The level of training given to a graduate in this professional office is of a lower standard than in other disciplines	3	2

Item No.	Vald'td		Statement	Item Comparison by group Tallies	
	Y	N		High Score Gr'p	Low Score Group
17	Y		This professional has an active, efficient and well organised mind	4	1
18	Y		This profession gives freely of their own time and ideas to other peoples projects and tasks	3	1
19	Y		This discipline is aware of their professional limitations: do not attempt what they cannot do	4	2
20	Y		Undergraduate education in this discipline needs to have a general 'all-embracing' approach	2	0
21	Y		This professional is skilled at taking their colleagues ideas and concepts and fashioning them into practical solutions and programmes	8	6
22	Y		The information provided by this professional is of use mainly in progress reports to the client	6	4
23		N	This professional has a knack for improvising quick solutions to problems that may restrict progress	5	5
24		N	This professional is an essential member of the design team and contributor to the building process	10	11
25	Y		This professional has a special talent for solving organisational problems	3	0
26	Y		This professionals skills make them a suitable overall project manager	3	0
27	Y		This discipline deserves to be regarded as a prestigious profession	7	6
28	Y		This profession enjoys the freedom of working in an ill-defined field	0	3
29	Y		This profession prefers to work alone; they are not team players	5	2
30		N	The graduate has little to learn from the other disciplines involved in the building process; their work is too specialised	1	1
31		N	This professional is a perfectionist; devotes endless attention to detail	5	6

Item No.	Vald'td		Statement	Item Comparison by group Tallies	
	Y	N		High Score Gr'p	Low Score Gr'p
32	Y		The training of this professional during higher education should be of a highly specialised nature	4	2
33	Y		This profession is neat and orderly in their habits and manner of work.	2	4
34		N	Without the information generated by this professional, the other professionals could not perform their tasks	11	10
35	Y		This profession is stimulating to other people; seems to catalyse others into more original productive work than would otherwise achieve	2	0
36		N	This professional is somewhat deficient in the command of basic sources of literature in their field	2	1
37	Y		In their work this discipline feels responsible chiefly to their own profession	2	1
38		N	This professional has an exceptionally good memory	0	0
39	Y		This professional frequently makes errors; their work needs to be checked for accuracy	3	0
40		N	This profession puts their own goals and professional values above all others	2	2
41		N	This professionals interests in construction lie within a rather narrow range	2	3
42		N	This profession is relatively uninformed on most subjects other than their own.	4	3

Appendix A item 5.4

Rank correlation reliability data table where:
(i) Column 1 shows the subjects (named respondents given a number for reference) under test.
(ii) Column 2 shows the scores obtained from each respondent in the (re)test.
(iii) Column 3 shows the mean ranking given to each respondent in the retest.
(iv) Column 4, 5 and 6 show original test information corresponding to columns 1, 2 and 3.
(v) Columns 7 and 8 show the difference between the test and re-test mean ranking and the difference squared respectively.

Subject Number	Total Score	Mean Rank in Retest	Subject Number	Total Score	Mean Rank in Original-test	Diff'rnce	Diffr'nce Squared
1	60	1	1	63	2.5	1.5	2.25
2	63	2	2	67	5.5	3.5	12.25
3	64	4	3	63	2.5	1.5	2.25
4	64	4	4	69	9.5	5.5	30.25
5	64	4	5	57	1	3	9
6	65	6	6	64	4	2	4
7	67	7	7	73	11	4	16
8	69	8	8	69	9.5	1.5	2.25
9	71	9.5	9	68	7.5	2	4
10	71	9.5	10	74	12.5	3	9
11	72	11	11	67	5.5	5.5	30.25
12	73	13	12	80	18	5	25
13	73	13	13	75	14	1	1
14	73	13	14	78	16.5	3.5	12.25
15	74	15	15	74	12.5	2.5	6.25
16	74	16	16	68	7.5	8.5	72.25
17	76	17.5	17	78	16.5	1	1
18	76	17.5	18	77	15	2.5	6.25
19	86	19	19	85	19	0	0
						total =	245.5

(ii) Calculation of the co-efficient of rank correlation is given by:
Spearman's formula for rank correlation:

$$\text{rrank} = 1 - \frac{6 * \Sigma \text{ Dsquared}}{\text{N (Nsquared} - 1)}$$

where:
D = difference between ranks of corresponding values of X and Y.
N = number of pairs of values (X, Y) in the data.

Thus from the data set:

$$\text{rrank} = 1 - \frac{6\,(254.5)}{19\,\{(19*19) - 1)\}}$$

$$= 0.7846$$

$$\approx \underline{\mathbf{0.8}}$$

Appendix A item 5.5

The internally validated and reliability tested 24 item attitude scale is shown below

Attitude Study: Research Questionnaire

This questionnaire is part of a research project which is examining the interaction and communication process of the construction design team.

Your help in completing the following would be gratefully appreciated

Andrew Whyte
Faculty of Design
Robert Gordon University
Aberdeen

Please complete the following concerning your current status:

Course ....

Year / Stage of studies ....

Delete as appropriate:

male / female

home student / overseas student

age: under 21 yr. old / 21 - 25 yr. old / over 25 yr. old

construction industry experience: over 5 yr. / *substantial* 1 - 5 yr. / *limited* vocational; none *none to date*

parent/guardian occupation: construction industry / other

please turn over / ...

	The following questions relate to your thoughts on a profession (other than your own chosen discipline) in the construction industry. Please answer the questions below by ticking the box which you think best describes the..	STRONGLY AGREE	AGREE	UNCERTAIN	DISAGREE	STRONGLY DISAGREE
1	This profession seldom seeks out the help and advice of other people when they hit a problem in their own work					
2	This professional contributes greatly to the building process and the eventual completion of the project					
3	This profession can readily explain technical matters in their field to laymen					
4	This profession fails to utilise the basic sources of literature available in their field					
5	This professional grasps other peoples ideas quickly, often long before they finish explaining them					
6	This professional is the most suitable candidate to lead the design team					
7	This professional reacts quickly to problems: they immediately generate a great number of ideas					
8	The level of training given to a graduate in their professional office is of a lower standard than in other professional disciplines					
9	This professional has an active, efficient and well organised mind					
10	This profession gives freely of their own time and ideas to other peoples projects and tasks					
11	Undergraduate education in this discipline needs to have a general 'all-embracing' approach					
12	This discipline is aware of their professional limitations: do not attempt what they cannot do					

Please turn over / ...

	The following questions relate to your thoughts on a profession (other than your own chosen discipline) in the construction industry. Please answer the questions below by ticking the box which you think best describes the..	STRONGLY AGREE	AGREE	UNCERTAIN	DISAGREE	STRONGLY DISAGREE
13	This professional is skilled at taking their colleagues ideas and concepts and fashioning them into practical solutions and programmes					
14	The information provided by this profession is of use mainly in progress reports to the client					
15	This professional has a special talent for solving organisational problems					
16	This professionals skills make them a suitable overall project manager					
17	This professional frequently makes errors; their work needs to be checked for accuracy					
18	This discipline deserves to be regarded as a prestigious profession					
19	This profession enjoys the freedom of working in an ill-defined field					
20	This profession prefers to work alone; they are not team players					
21	The training of this professional during higher education should be of a highly specialised nature					
22	This profession is neat and orderly in their habits and manner of work.					
23	This profession is stimulating to other people; seems to catalyse others into more original productive work than would otherwise achieve					
24	In their work this discipline feels responsible chiefly to their own profession					

Thank you for your help.

Appendix A item 5.6

Replies to a request for information were kindly received from:

University of Cambridge, Department of Architecture, Peter Carolin

University of Central England in Birmingham, Faculty of the Built Environment, Tom Muir, John Kirwan, Brian Rance, Bob Sanson

De Montford University, Leicester, School of the BuiltEnvironment, Department of Architecture,
D. George Henderson.

University of Dundee, Duncan of Jordanstone College of Art, Departments of Architecture & Engineering, James Paul

Edinburgh University, MSc Building, David Cowling

Heriot Watt University, Department of Building Engineering, Hunter Cairns

University of Huddersfield, School of Design Technology, G. Calderbank

Leeds Metropolitan University, Leeds School of the Environment, Barry Fryer, David Whitney

University of Manchester, School of Architecture, Martin Symes

University of Newcastle, Department of Architecture, Rodger Tillotson

University of Plymouth, School of Architecture, Adrian Gale.

The Robert Gordon University, Aberdeen, Faculty of Design, John Donald, Dennis Urquhart

South Bank University, London, Faculty of Design, James Franks

University of Strathclyde, Glasgow, Centre for Building Design Engineering, Lamond Laing.

University of Westminster, School of Architecture and Engineering, Paul E. Regan.

Prof. J. N. Tarn
Liverpool School of
Architecture and Building Engineering
University of Liverpool
Aberdromby Square
Liverpool 7

Andrew Whyte
Faculty of Design
The Robert Gordon University
Garthdee Road
Aberdeen
AB2 2XD

Dear Professor Tarn,

11.08.92

Appeal for information to aid an active research project

I write in connection with an appeal for information to aid an active research project. The project concerns current integrated education for vocational students of the built environment.

Currently I am a research student with the Faculty of Design at the Robert Gordon University in Aberdeen. As part of my plan of work to PhD I am seeking to assess the extent to which perceptual differences contribute to (in)efficient integration in practice. More specifically at this stage of the project I am attempting to assess the value of moves towards more integrated Higher Educational courses, by examining the existence (and development) of professional perceptual bias during tertiary training.

Particular interest exists in establishing whether changes in attitude and perception towards related design, building and engineering peer group disciplines occur as a result of: inter-disciplinary project-work; common core curricula; and/or duration of studies.

Although I understand that you will be very busy in perpetration for the new academic year, any information which you may feel relevant to this project would be gratefully received. Details of the content and structure of any multi-disciplinary projects given to your student body and any existing student and course feedback would similarly be much appreciated.

I believe this project to be ultimately relevant to most course co-ordinators and I offer my services and time to your department to help in the assessment and feedback of existing inter-disciplinary studies. The empirical evidence which I hope to gather should benefit both my own research proposal and allow a clearer picture of how particular project work influences student attitudes.

I look forward to your reply.

Yours sincerely,

Andrew Whyte (Research Student)

Appendix A item 5.7

Telephone contact (and selected face to face contact) was made with those named below:

University of Bath: Day, A.

Cambridge University: Carolin, P.

University of Central England, Birmingham: Muir, T.

Edinburgh University: Gilmour, A.

Heriott Watt University, Edinburgh: Cairns, H.

Leeds Metropolitan University: Fryer, B.

Robert Gordon University, Aberdeen: Donald, J. & Urquhart, D.

University of Strathclyde, Glasgow: Laing, L.

Subsequent correspondence (an example of which is below) was sent to:

University of Central England, Birmingham: Muir, T.

Robert Gordon University, Aberdeen: Donald, J & Urquhart, D.

University of Strathclyde, Glasgow: Laing, L.

Appendix A item 5.7

Telephone contact (and selected face to face contact) was made with those named below:

University of Bath: Day, A.

Cambridge University: Carolin, P.

University of Central England, Birmingham: Muir, T.

Edinburgh University: Gilmour, A.

Heriott Watt University, Edinburgh: Cairns, H.

Leeds Metropolitan University: Fryer, B.

Robert Gordon University, Aberdeen: Donald, J. & Urquhart, D.

University of Strathclyde, Glasgow: Laing, L.

Subsequent correspondence (an example of which is below) was sent to:

University of Central England, Birmingham: Muir, T.

Robert Gordon University, Aberdeen: Donald, J & Urquhart, D.

University of Strathclyde, Glasgow: Laing, L.

Tom Muir
Faculty of the Built Environment
University of Central England
Perry Bar
Birmingham
B42 2SU

Andrew Whyte
Faculty of Design
Robert Gordon University
Garthdee Road
Aberdeen
AB9 2QB

Dear Tom,

01.11.92

Interdisciplinary Education: Research Collaboration.

I write with reference to our recent telephone conversation, during which we discussed the possibility of collaboration between myself and members of your staff to aid an active research project.

I have prepared a Likert type attitudinal Questionnaire (in association with an environmental psychology advisor) which assesses eleven variables relating to an individuals attitude to a peer group. This attitude scale has already been piloted and internally validated. It consists of 24 statements which can be agreed with (or otherwise) and takes less than ten minutes to complete. The questionnaire has been developed to measure attitudes held by students in vocationally isolated courses dealing with the built environment.

To allow an assessment of any change in attitude resulting from an integrated project, the attitude scale questionnaire would require to be given to a participating student body at the early stages of such a scheme and also require post-project implementation. Please find enclosed a draft copy.

I wish to confirm our agreement that I visit Birmingham to administer the attitude scale to your student body. I will telephone at the end of this week to confirm the most suitable time(s). The empirical evidence which I hope to gather should benefit both my own research proposal and allow a clearer picture of how mutli-disciplinary project work influences student attitudes.

I hope to be in touch by telephone very soon,

Yours sincerely,

Andrew Whyte

enc.

Appendix B item 6.1

Multiple regression through the origin

Dependent Variable .. ***TOTALS***
Variable(s) Entered on Step Number 16..YEAR

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	8	3449472.34178	431184.04272
Residual	706	44646.65822	63.23889

F = 6818.33638 Signif F = .0000

Variables IN the Equation
Architects
Building Surveyors
Quantity Surveyors
Domocile
Aberdeen RGU
Birmingham UCE
Strathclyde Univ
Year

Variables NOT in the equation
Age
Experience
Full or Part time study format
Guardian Occupation
Sex
Subject of the Questionnaire

* * * * MULTIPLE REGRESSION THROUGH THE ORIGIN * * * *

Equation Number 1   Dependent Variable..   TOTALS

Variable(s) Entered on Step Number
16..   YEAR

Multiple R	.99359
R Square	.98722
Adjusted R Square	.98708
Standard Error	7.95229

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	8	3449472.34178	431184.04272
Residual	706	44646.65822	63.23889

F =   6818.33638   Signif F = .0000

------------------ Variables in the Equation ------------------

Variable	B	SE B	Beta	T	Sig T
ARCHTEC	-7.071926	.945386	-.060058	-7.480	.0000
BS	-4.494862	1.010913	-.028755	-4.446	.0000
QS	-6.249504	.986814	-.046806	-6.333	.0000
DOMOCL	-6.385509	.936543	-.085811	-6.818	.0000
ABERDN	83.647483	1.410565	.754125	59.301	.0000
BMHAM	81.011706	1.283584	.856973	63.114	.0000
GLASGOW	84.180385	1.736010	.281238	48.491	.0000
YEAR	-.976919	.257004	-.033534	-3.801	.0002

------------- Variables not in the Equation -------------

Variable	Beta In	Partial	Min Toler	T	Sig T
AGE	.009754	.029658	.068295	.788	.4311
EXPRNCE	.012175	.033130	.062012	.880	.3791
FULLORPA	.009441	.023758	.063652	.631	.5282
PRNTOCCP	-.007378	-.054877	.096646	-1.459	.1449
SEX	.006852	.025521	.087285	.678	.4981
SUB.ARCH	.011364	.037629	.065981	1.000	.3177
SUB.OTH	.001213	.008287	.097425	.220	.8259
SUB.QS	-.011685	-.039806	.091935	-1.058	.2905

Appendix B item 6.1 b

As well as *multiple regression* of the data set, a *discriminant function* analysis was also carried out. Discriminant funtional analysis is a less conventional method to assess the extent to which adherence to a specialist discipline is able to predict attitude scoring. The goal of discriminant analysis is to classify cases into one of several mutually exclusive groups, on the basis of an observed set of characteristics. This allows educators to adapt integrative techniques to best suit an identifiable group.

Again the independent variables were coded, input to the data set and examined as potential predictors of attitude scale scoring

The number of functions used in the discriminant analysis represented the eleven independent variables identified above. Variables were ordered by size of correlation within the function. The variables of: *Course* and *University* were found to have the largest absolute correlation with the first and second discriminant function stages. In other words *Course* and *University* were identified as contributing substantially to differences in group scores (**see below**)

The *Canonical Discriminant function* for all of the 726 respondents attitudinal scores, with regard to the eleven independent variables, displayed an initial significance level of 0.0000 (as below)

Discriminant Analysis on groups defined by totals
Direct method: all variables passing the tolerance test are entered.
Minimum tolerance level 0.00100
Canonical Discriminant Functions
Maximum number of functions 11
Minimum cumulative % variance 100.00
Maximum significance of Wilks Lambda 1.0000
Prior probability for each group is 0.01786

Fcn	Eigen-value	Pct of varince	Cum Pct	Cannel Corr	After Fnc	Wilks Lmbda	Chi-square	df	sig
					0	.333923	758.468	605	**.0000**
1	.3051	25.80	25.8	.4835	1	.435808	574.328	540	.1484
2	.1860	15.73	41.53	.3960	2	.516859	456.379	477	.7440
3	.1504	12.72	54.24	.3616	3	.594597	359.497	416	.9789
4	.1233	10.43	64.67	.3313	4	.667918	279.082	357	.9991
5	.0997	8.38	73.05	.3003	5	.734131	213.720	300	1.000
6	.0934	7.90	80.95	.2922	6	.802683	151.988	245	1.000
7	.0664	5.62	86.95	.2496	7	.855993	107.524	192	1.000
8	.0541	4.58	91.14	.2266	8	.902321	71.076	141	1.000
9	.0464	3.93	95.07	.2107	9	.944220	39.689	92	1.000
10	.0378	3.2	98.27	.1909	10	.979947	14.007	45	1.000
11	.0205	1.73	100	.1416					

This denotes that the null hypothesis, *the means of the eleven functions are equal in the population tested*, can be rejected. In other words significant differences in respondent score exist, in terms of one, or all, of the eleven independent variables of: age; construction industry experience; course; curriculum structure undertaken; domicile; parent / guardian occupation; sex; university; stage of study; subject of questionnaire; and, participation, in multi-disciplinary educational initiative.

Function 1 and function 2 are seen to be responsible for 25.8% and 15.73% of score variance. On closer inspection, the first and second of the eleven functions, examined in terms of an analysis of the *Wilks Lambda Chi-square Significance* show a substantial change from 0.0000 to 0.1484, and then from 0.1484 to 0.7440, respectively. This indicates that these initial functions contribute substantially to group difference(s) in attitude scale scoring.

Identification of functions 1 and 2, ... is obtained by examination of functions ordered in the *Structure Matrix*. An analysis of the *Structure Matrix* examines the contribution of each variable *to the discriminant functions*.

	Fnc1	Fnc2	Fnc3	Fnc4	Fnc5	Fnc6	Fnc7	Fnc8	Fnc9	Fc10	Fc11
Course	.553*	.522	-.222	.207	.328	-.021	-.319	-.127	.098	.081	-.292
Univ	.151	-.64*	.-090	-.031	-.207	.392	.081	.-.00	-.382	.449	.079
"	"	"	"*	"	"	"	"	"	"	"	"
"	"	"	"	"*	"	"	"	"	"	"	"

* denotes largest absolute correlation between each variable and any discriminant function

The remaining variable/function correlations are found to be statistically insignificant. Although of limited use, they can be identified in decreasing order of contribution, as: domicile; full/part time study; pre or post educational initiative response; sex; parental occupation & industry experience; age; year of study; discipline being described.

	Func 1	Func 2	Func 3	Func 4	Func 5	Func 6
COURSE	.55336*	.52218	-.22216	.20772	.32881	[illegible]
UNIV	.15140	-.64023*	-.09025	-.03125	-.20735	[illegible]
DOMOCL	.40818	-.17797	.76751*	-.13583	.16301	.07504
FULLORPA	-.13163	-.02426	-.09273	.52150*	.23167	-.38041
PRE____PO	-.54896	-.12005	.13945	.17893	.68170*	.07211
SEX	.01019	.23906	.13751	.27628	-.22365	[illegible]*
PRNTOCCP	.09883	-.11522	.12041	.05723	-.03859	[illegible]
EXPRNCE	.28248	.16252	-.20951	-.29546	.10315	[illegible]
AGE	-.02780	-.13301	-.06180	-.32296	.41881	[illegible]
YEAR	-.32933	.29822	.25193	-.40909	.19916	[illegible]
SUBJECT	-.05840	.23354	-.08168	.00395	-.08920	[illegible]

	Func 7	Func 8	Func 9	Func 10	Func 11
COURSE	-.31930	-.12741	.09870	.08154	-.29231
UNIV	.08171	-.00389	-.38216	.44959	.07927
DOMOCL	.32460	-.21299	.06659	-.05306	.06337
FULLORPA	.47442	.30299	[illegible]	.11966	-.05440
PRE____PO	-.20054	-.18899	[illegible]	-.22616	.12153
SEX	.28642	-.05560	[illegible]	-.17253	-.30534
PRNTOCCP	-.43769	.78772*	[illegible]	.05792	[illegible]
EXPRNCE	.15339	.53009*	[illegible]	-.22295	[illegible]
AGE	.12501	-.25397	[illegible]*	[illegible]	.02092
YEAR	-.05518	-.08983	[illegible]	[illegible]*	[illegible]
SUBJECT	.26250	.12814	[illegible]	[illegible]	[illegible]*

* denotes largest absolute correlation between each variable and any discriminant function.

Appendix B item 6.2

Kruskal-Wallis 1 - Way Anova: attitude score totals by University.

mean rank	cases	univ
277.39	258	UCE
291.88	39	Strathclyde
252.72	237	RGU
	534	total

corrected for ties:

Chi-Square	D.F.	Significance
4.2148	2	**.1216** (Where value $\leq$ .05 *is* significant)

Appendix B item 6.3

Mann-Whitney U - Wilcoxon Sum W Test: attitude score by University

mean rank	cases	univ
259.10	258	UCE
235.92	237	RGU
	495	total

corrected for ties

Z	2-tailed P
-.1.8033	**.0713** (Where value $\leq$ .05 *is* significant)

Appendix B item 6.4

Kruskal - Wallis 1 way Anova: attitude scores by course of studies

mean rank	cases	course
234.34	192	Arch
256.41	130	QS
274.47	88	BS
317.69	26	Land Arch
348.88	45	Est Mngr
290.00	34	Envrn Plnr
409.13	4	Int Dsgn
327.27	15	BDE
	534	total

corrected for ties

Chi-Square	D.F.	Significance
31.3317	7	**.0001** (Where value $\leq$ .05 *is* significant)

Appendix B item 6.5

Kruskal - Wallis 1 way Anova: attitude scores by course of studies

mean rank	cases	course
193.63	192	Arch
210.02	130	QS
224.72	88	BS

corrected for ties

Chi-Square	D.F.	Significance
4.4320	7	**.1086** (Where value ≤ .05 *is* significant)

Appendix B item 6.6

Analysis of the canonical discriminant function of the 410 cases from the courses of Architecture, Building Surveying and Quantity Surveying reveals a score difference of 0.1110. This indicates that a null hypothesis, which states that the means of ten independent variables are equal, cannot be rejected. This indicates population similarities amongst this three discipline grouping.

Discriminant Analysis on vocationally isolated groups defined by totals
Direct method: all variables passing the tolerance test are entered.

Minimum tolerance level	0.00100
Canonical Discriminant Functions	
Maximum number of functions	10
Minimum cumulative % variance	100.00
Maximum significance of Wilks Lambda	1.0000
Prior probability for each group is	0.02128

Fcn	Eigen-value	Pct of varince	Cum Pct	Cannel Corr	After Fnc	Wilks Lmbda	Chi-square	df	sig
					0	.270605	497.349	460	**.1110**
1	.3592	25.14	25.15	.5141	1	.367800	380.582	405	.8030
2	.2060	14.42	39.17	.4133	2	.443564	309.313	352	.9509
3	.1810	12.67	52.25	.3915	3	.523862	246.003	301	.9910
4	.1608	11.26	63.50	.3722	4	.608092	189.271	252	.9988
5	.1315	9.20	72.71	.3409	5	.688034	142.275	205	.9997
6	.1114	7.80	80.51	.3166	6	.764668	102.093	160	.9999
7	.0948	6.64	87.15	.2943	7	.837196	67.614	117	.9999
8	.0840	5.88	93.03	.2743	8	.907548	36.912	76	1.000
9	.0619	4.33	97.36	.2414	9	.963692	14.072	37	1.000
10	.0377	2.64	100.00	.1905					

It is recognised that the significance level expressed in the Canonical Discriminant Function indicates population similarity. However, it is worthy to note that closer examination of the significance rating column, after the first of the ten functions is removed, reveals a substantial change in significance level from 0.1110 to 0.8030.
The Structure Matrix below again indicates that the largest variable / initial discriminant function correlation to be the variable 'Course'. 'Course' pursued by the respondent, is again implicated as an influential variable in contribution to group differences in attitude scale scoring.

Structure Matrix examines the contribution of each variable to the discriminant functions.

	Fnc1	Fnc2	Fnc3	Fnc4	Fnc5	Fnc6	Fnc7	Fnc8	Fnc9	Fc10
Course	.2908	.6205*	-.196	-.153	-.078	.067	.146	-.021	-.399	.524
Sex/	-.288	.230	.749*	.221	.212	-.199	-.280	-.291	-.303	.055
domicile	.389	-.282	.571*	-.562	-.562	.050	-.054	.324	-.970	.062
Univ	"	"	"	"*	"	"	"	"	"	"

* denotes largest absolute correlation between each variable and any discriminant function

Structure matrix:

Pooled within-groups correlations between discriminating variables
and canonical discriminant functions
(Variables ordered by size of correlation within function)

	Func 1	Func 2	Func 3	Func 4	Func 5	Func 6
COURSE	.29086	.62059*	-.19695	-.15389	-.0782[illegible]	[illegible]
SEX	-.28875	.23054	.74948*	.22154	.21204	-.19992
DOMOCL	.38915	-.28277	.57134*	-.56235	-.63638	.0507[illegible]
UNIV	.19020	-.00071	.26216	.62368*	-.40966	[illegible]
PRNTOCCP	.16518	-.07377	-.19970	.40345	.68542*	.3627[illegible]
AGE	.31089	-.23278	-.04293	.02285	.14069	-.7[illegible]*
FULLORPA	-.07273	-.11830	.05448	.06354	.30959	[illegible]
EXPRNCE	.10061	.46071	-.00017	.20014	.09796	.0443[illegible]
SUBJECT	-.29009	.11424	.04885	-.02666	.44927	-.148[illegible]
YEAR	-.36290	-.15391	-.15982	-.04310	.04154	-.20471

	Func 7	Func 8	Func 9	Func 10
COURSE	.14636	-.02121	-.39986	.52477
SEX	-.28054	-.29158	-.03038	.05578
DOMOCL	-.05476	.32494	-.09785	.06221
UNIV	-.26828	.32851	-.14483	-.10424
PRNTOCCP	-.36507	-.09208	-.13740	-.05075
AGE	.18587	.14045	-.28000	.42632
FULLORPA	.68148*	-.10054	.33967	.53014
EXPRNCE	-.53551	.17043	.60643*	-.20602
SUBJECT	.22196	.48105	-.06399	-.62537*
YEAR	-.40013	.49489	-.32560	.51240*

* denotes largest absolute correlation between each variable and any discriminant function.

Appendix B item 6.7

Mann-Whitney U - Wilcoxon Sum W Test: attitude score by Course

mean rank	cases	course
156.48	192	Arch
168.92	130	QS
	322	total

corrected for ties

Z	2-tailed P
-1.1773	**.2391** (Where value ≤ .05 *is* significant)

Appendix B item 6.8

Mann-Whitney U - Wilcoxon Sum W Test: attitude score by Course

mean rank	cases	course
133.65	192	Arch
155.45	88	BS
	280	total

corrected for ties

Z	2-tailed P
-2.0936	**.0363** (Where value ≤ .05 *is* significant)

Appendix B item 6.9

Mann-Whitney U - Wilcoxon Sum W Test: attitude score by Course

mean rank	cases	course
106.61	130	QS
113.77	88	BS
	218	total

corrected for ties

Z	2-tailed P
-.8237	**.4101** (Where value ≤ .05 *is* significant)

Appendix B item 6.10

Mann-Whitney U - Wilcoxon Sum W Test: BS attitude score by Subject of Questionnaire response

mean rank	cases	Subject
51.13	31	Arch
40.05	56	QS
	87	total

corrected for ties

Z	2-tailed P
647	**.0498** (Where value ≤ .05 *is* significant)

Appendix 6 item 6.11

Mann-Whitney U - Wilcoxon Sum W Test: Full-time attitude score by Course

mean rank	cases	Course
25.39	33	Arch
24.19	16	QS
	49	total

corrected for ties

Z	2-tailed P
~	**.7811** (Where value ≤ .05 *is* significant)

Appendix B item 6.12

Mann-Whitney U - Wilcoxon Sum W Test: Part-time attitude score by Course

mean rank	cases	Course
6.90	10	Arch
13.44	9	QS
	19	total

corrected for ties

Z	2-tailed P
~	**. 0108** (Where value ≤ .05 *is* significant)

Appendix B item 6.13

Mann-Whitney U - Wilcoxon Sum W Test: QS attitude score by full or part-time

mean rank	cases	format
12.31	16	Full-time
14.22	9	Part-time
	25	total

corrected for ties

Z	2-tailed P
-.6248	**. 5321** (Where value ≤ .05 *is* significant)

Appendix B item 6.14

Mann-Whitney U - Wilcoxon Sum W Test: Arch attitude score by full or part-time

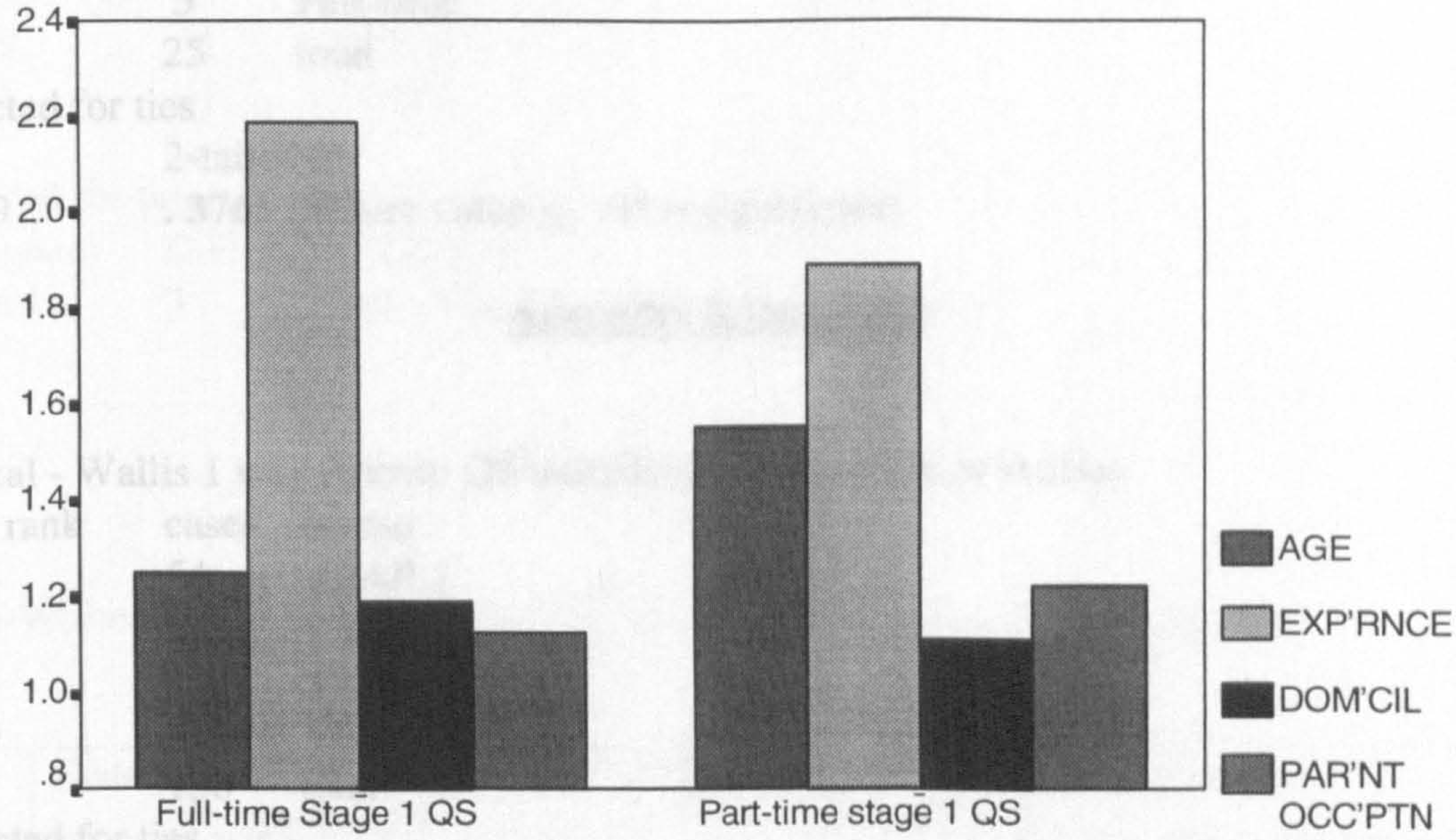
mean rank	cases	format
24.62	33	Full-time
13.35	10	Part-time
	43	total

corrected for ties

Z	2-tailed P
-2.4930	**. 0127** (Where value ≤ .05 *is* significant)

Appendix B item 6.15

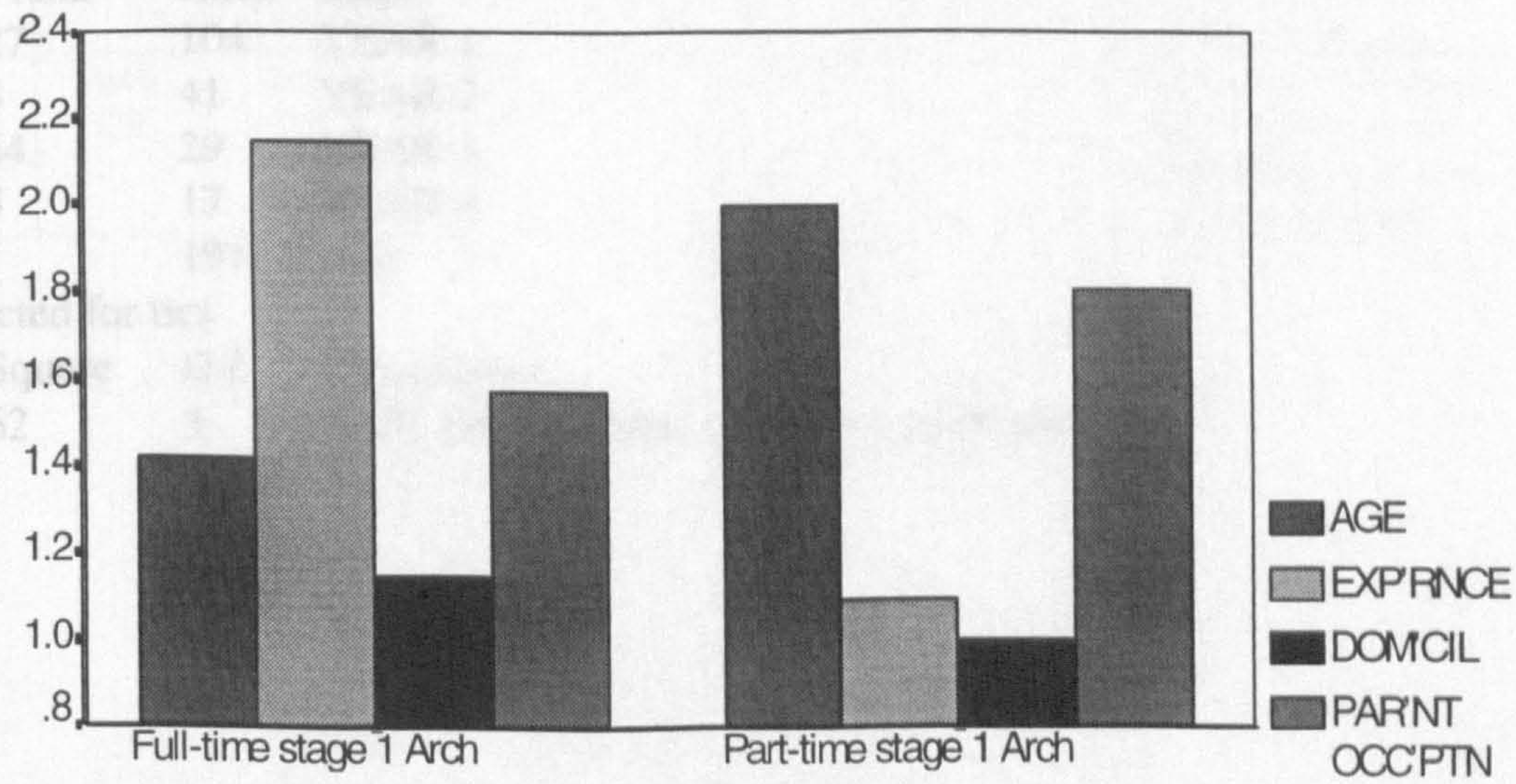
Stage 1 Quantity Surveying part-time and full-time respondents were found to exhibit similar levels of *(construction) industrial experience*, similar *ages*, similar *parental backgrounds* and similar *domiciles*



Full *v* Part- time students (mean totals)

Appendix B item 6.16

Stage 1 Architectural part-time and full-time respondents were found to display noticeably different levels of *industrial experience* and differences in *age*.



Full v Part-time students (mean totals)

Appendix B item 6.17

Mann-Whitney U - Wilcoxon Sum W Test: QS stage 4 attitude score by full or part-time

mean rank	cases	format
12.35	20	Full-time
15.60	5	Part-time
	25	total

corrected for ties

Z	2-tailed P
-.8849	**.3762** (Where value ≤ .05 *is* significant)

Appendix B item 6.18

Kruskal - Wallis 1 way Anova: QS attitude scores by stage of studies

mean rank	cases	course
75.86	54	YEAR 1
58.77	24	YEAR 2
64.93	27	YEAR 3
50.20	25	YEAR 4
	130	total

corrected for ties

Chi-Square	D.F.	Significance
8.9978	3	**.0293** (Where value ≤ .05 *is* significant)

Appendix B item 6.19

Kruskal - Wallis 1 way Anova: Arch attitude scores by stage of studies

mean rank	cases	Stage
101.27	104	YEAR 1
77.34	41	YEAR 2
101.64	29	YEAR 3
99.15	17	YEAR 4
	191	total

corrected for ties

Chi-Square	D.F.	Significance
5.9862	3	**.1123** (Where value ≤ .05 *is* significant)

Appendix B item 6.20

Kruskal - Wallis 1 way Anova: Arch & QS attitude scores by stage of studies

mean rank	cases	Stage
174.62	158	YEAR 1
135.18	65	YEAR 2
166.19	56	YEAR 3
142.81	42	YEAR 4
	321	total

corrected for ties

Chi-Square	D.F.	Significance
10.2394	3	**.0166** (Where value $\leq$ .05 *is* significant)

Appendix B item 6.21

Mann-Whitney U - Wilcoxon Sum W Test: Arch & QS attitude scores by stage

Stage	Course	Mean Rank	Cases	Significance, where value $\leq$ 0.05 *is* significant	Comments
1	Arch QS	74.19 91.30	105 54	0.0263	QS more favourable towards design colleague
2	Arch QS	31.42 35.42	41 24	0.4299	No significant difference; QS slightly more favourable towards design colleague
3	Arch QS	28.18 27.81	28 27	0.9328	No significant difference; Arch very slightly more favourable towards non-design colleague
4	Arch QS	24.77 20.04	18 25	0.2269	No significant difference; Arch slightly more favourable towards non-design colleague

Appendix B item 6.22

Attitude constructs, held by the Quantity Surveying respondents towards the profession of Architecture; factor analysis grouped similarly scored items together.

Varimax rotation 1 for extraction 1 in analysis 1 - Kaiser Normalisation
Varimax converged in 21 iterations
Abridged Rotated Factor Matrix:

Similarly Scored Item Groupings	**Factor 1**	**Factor 2**	**Factor 3**	**Factor 4**	**Factor 5**	**Factor 6**	**Factor 7**	**Factor 7**
Grouping 1	Six Three Sixteen Two							
Grouping 2		Svnteen Twenty- -three Twenty Ten Eghteen						
Grouping 3			Four Twenty- -two Nine Eleven Fifteen					
Grouping 4				Fourtn Ninetn				
Grouping 5					Seven Thirteen			
Grouping 6						Twenty- -four One		
Grouping 7							Twelve Five	
Grouping 8								Twenty- -one Eight

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ATTEMPTED PRE QS FACT ANALYSIS ONLY

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Analysis number 1   Listwise deletion of cases with missing values

Extraction   1 for analysis   1, Principal Components Analysis (PC)

Initial Statistics:

Variable	Communality	*	Factor	Eigenvalue	Pct of Var	Cum Pct
		*				
ONE	1.00000	*	1	4.60887	19.2	19.2
TWO	1.00000	*	2	1.98675	8.3	27.5
THREE	1.00000	*	3	1.49316	6.2	33.7
FOUR	1.00000	*	4	1.44640	6.0	39.7
FIVE	1.00000	*	5	1.37369	5.7	45.5
SIX	1.00000	*	6	1.27838	5.3	50.8
SEVEN	1.00000	*	7	1.07892	4.5	55.3
EIGHT	1.00000	*	8	1.06518	4.4	59.7
NINE	1.00000	*	9	.97061	4.0	63.8
TEN	1.00000	*	10	.93446	3.9	67.7
ELEVEN	1.00000	*	11	.87439	3.6	71.3
TWELVE	1.00000	*	12	.84136	3.5	74.8
THIRTEEN	1.00000	*	13	.72959	3.0	77.8
FOURTEEN	1.00000	*	14	.70793	2.9	80.8
FIFTEEN	1.00000	*	15	.66677	2.8	83.6
SIXTEEN	1.00000	*	16	.63064	2.6	86.2
SEVENTEE	1.00000	*	17	.60050	2.5	88.7
EIGHTEEN	1.00000	*	18	.52481	2.2	90.9
NINETEEN	1.00000	*	19	.45694	1.9	92.8
TWENTY	1.00000	*	20	.42779	1.8	94.6
TWENTYON	1.00000	*	21	.39076	1.6	96.2
TTWO	1.00000	*	22	[illegible]	1.5	97.7
TTHREE	1.00000	*	23	.32384	1.4	[illegible]
TFOUR	1.00000	*	24	[illegible]	1.0	100.0

PC   extracted   8 factors.

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VARIMAX   rotation   1 for extraction   1 in analysis   1 - Kaiser Normalization.

VARIMAX   converged in   21 iterations.

Rotated Factor Matrix:

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
SIX	.77165	[illegible]	[illegible]	-.04702	[illegible]
THREE	.71955	[illegible]	[illegible]	[illegible]	[illegible]
SIXTEEN	.60073	[illegible]	[illegible]	.29459	[illegible]
TWO	.60073	[illegible]	[illegible]	[illegible]	[illegible]
SEVENTEE	.08224	[illegible]	[illegible]	[illegible]	[illegible]
TTHREE	-.07696	[illegible]	[illegible]	[illegible]	[illegible]
TWENTY	.07429	[illegible]	[illegible]	[illegible]	[illegible]
TEN	.16413	[illegible]	[illegible]	[illegible]	[illegible]
EIGHTEEN	.25261	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	.00649	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	.06091	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

FOURTEEN	.10595	~~10025~~	~~07889~~	-.74336	-.04723
NINETEEN	.03392	-.11435	.04508	.64414	-.01013
SEVEN	-.03424	.21828	-.00491	-.00226	.75748
THIRTEEN	~~.31536~~	~~.03431~~	.33273	~~02179~~	.42793
TFOUR	.11046	.04063	-.07711	-.03296	-.09333
ONE	.05091	.07604	.12157	.08791	.29282
TWELVE	.08100	.09404	-.06998	-.00261	.05972
FIVE	.15540	.11101	.23514	.28603	.11147
TWENTYON	-.09088	-.01454	-.00033	.08670	.14759
EIGHT	.28408	.11943	.36036	-.00686	.34969

	Factor 6	Factor 7	Factor 8
SIX	-.03205	.10928	.13962

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	Factor 6	Factor 7	Factor 8
THREE	.10210	.03901	-.19964
SIXTEEN	.06367	.00382	-.14698
TWO	.15644	.12331	.15038
SEVENTEE	-.07454	.09779	-.04555
TTHREE	.03375	.21170	.03012
TWENTY	.28960	.09370	-.09478
TEN	.22436	-.20077	.18711
EIGHTEEN	-.20628	.12474	.19418
FOUR	.02991	-.02400	.19016
TTWO	-.30046	.17613	-.16927
NINE	.07269	-.08390	-.10336
ELEVEN	.32753	.38749	-.02966
FIFTEEN	.27771	-.04575	-.22373
FOURTEEN	-.02582	-.21453	.104[illegible]7
NINETEEN	-.07556	-.10520	.36855
SEVEN	.05978	.07347	[illegible]
THIRTEEN	.31410	.25705	.28[illegible]
TFOUR	.77158	.11052	[illegible]
ONE	.62949	-.02052	-.13[illegible]44
TWELVE	00209	.75156	.067[illegible]
FIVE	13427	.56518	-.01[illegible]
TWENTYON	01530	08767	[illegible]8627
EIGHT	.16368	-.24279	.3812[illegible]

Factor Transformation Matrix:

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Factor 1	.53939	.45096	[illegible]	.30758	[illegible]
Factor 2	-.61961	.40036	[illegible]	.44955	[illegible]
Factor 3	.13877	-.06120	[illegible]	.46039	[illegible]
Factor 4	-.24340	-.11932	[illegible]	.26309	[illegible]
Factor 5	-.09483	-.42535	[illegible]	.00520	[illegible]
Factor 6	.29249	.19847	[illegible]	.40771	[illegible]
Factor 7	.38279	-.39429	[illegible]	.48838	[illegible]
Factor 8	.07467	.44266	[illegible]	[illegible]	[illegible]

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Factor 2	-.00452	.18260	.10318
Factor 3	.69648	.08189	-.50572
Factor 4	.44647	.40579	.38586
Factor 5	.40822	-.40422	.48225
Factor 6	-.00965	-.54537	.27409
Factor 7	-.26072	.53556	.30543
Factor 8	.10373	.07013	.42034

Appendix B item 6.23

Attitude constructs, held by the Architectural respondents towards the profession of Quantity Surveying; factor analysis grouped similarly scored items together.

Varimax rotation 1 for extraction 1 in analysis 1 - Kaiser Normalisation
Varimax converged in 13 iterations
Abridged Rotated Factor Matrix:

Similarly Scored Item Groupings	**Factor 1**	**Factor 2**	**Factor 3**	**Factor 4**	**Factor 5**	**Factor 6**	**Factor 7**	**Factor 7**
Grouping 1	Sixteen Six Fifteen Twenty- -three Two Eightn							
Grouping 2		Twenty- -two Eight Seventn Nine						
Grouping 3			Ten Five Seven Thirteen					
Grouping 4				Twenty One Four Ninetn				
Grouping 5					Fourtn			
Grouping 6						Eleven		
Grouping 7							Twenty- -four Twelve	
Grouping 8								Twenty- -one

ATTEMPTED: PRE ARCH FACT ANALYSIS ONLY

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Analysis number 1   Listwise deletion of cases with missing values

Extraction 1 for analysis 1, Principal Components Analysis (PC)

Initial Statistics:

Variable	Communality	*	Factor	Eigenvalue	Pct of Var	Cum Pct
		*				
ONE	1.00000	*	1	4.10104	17.1	17.1
TWO	1.00000	*	2	2.43857	10.2	27.2
THREE	1.00000	*	3	1.43622	6.0	33.2
FOUR	1.00000	*	4	1.38507	5.8	39.0
FIVE	1.00000	*	5	1.33250	5.6	44.6
SIX	1.00000	*	6	1.16664	4.9	49.4
SEVEN	1.00000	*	7	1.10785	4.6	54.0
EIGHT	1.00000	*	8	1.01756	4.2	58.[illegible]
NINE	1.00000	*	9	.99199	4.1	62.4
TEN	1.00000	*	10	.92571	3.9	66.[illegible]
ELEVEN	1.00000	*	11	.86274	3.6	69.9
TWELVE	1.00000	*	12	.82104	3.4	[illegible]
THIRTEEN	1.00000	*	13	.77370	3.2	76.[illegible]
FOURTEEN	1.00000	*	14	.72314	3.0	79.5
FIFTEEN	1.00000	*	15	.65622	2.7	82.[illegible]
SIXTEEN	1.00000	*	16	.61315	2.6	84.8
SEVENTEE	1.00000	*	17	.56410	2.4	87.2
EIGHTEEN	1.00000	*	18	.54217	2.3	89.4
NINETEEN	1.00000	*	19	.51961	2.2	91.6
TWENTY	1.00000	*	20	.50141	2.1	93.[illegible]
TWENTYON	1.00000	*	21	.45463	1.9	[illegible]
TTWO	1.00000	*	22	.40147	1.7	97.2
TTHREE	1.00000	*	23	.36565	1.5	[illegible]
TFOUR	1.00000	*	24	.29780	1.2	[illegible]

PC extracted 8 factors.

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VARIMAX rotation 1 for extraction 1 in analysis 1 - Kaiser Normalization.

VARIMAX converged in [illegible] iterations.

Rotated Factor Matrix:

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
SIXTEEN	.72578	[illegible]	[illegible]	.12890	[illegible]
SIX	.67895	[illegible]	.12288	-.06480	[illegible]
FIFTEEN	.63785	[illegible]	.20645	.12567	[illegible]
TTHREE	.60262	[illegible]	.21875	-.08995	[illegible]
TWO	.58191	[illegible]	-.02627	-.10474	[illegible]
EIGHTEEN	.52645	[illegible]	.11450	-.13764	[illegible]
TTWO	[illegible]	[illegible]	.2167[illegible]	.08458	[illegible]
EIGHT	[illegible]	[illegible]	-.11781	.0845[illegible]	[illegible]
SEVENTEE	[illegible]	[illegible]	[illegible]	.231[illegible]	[illegible]
NINE	.28[illegible]	[illegible]	.28[illegible]	.124[illegible]	[illegible]
TEN	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
FIVE	.24[illegible]	[illegible]	[illegible]	.27[illegible]	[illegible]
SEVEN	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
THIRTEEN	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]				

FOUR	.11732	.24679	-.00931	.54524	-.07938
NINETEEN	~~.12263~~	~~.31003~~	~~.15875~~	-.51424	.06482
FOURTEEN	~~-.04087~~	~~-.07217~~	~~-.02953~~	~~.04740~~	.83961
ELEVEN	-.08276	-.01087	-.01503	-.06550	-.08401
THREE	.04360	.24932	.46293	-.07347	.02346
TFOUR	.19539	.08316	-.11276	.06950	.20233
TWELVE	-.11764	.01303	.45486	-.00149	-.36517
TWENTYON	.07914	.02670	.01659	-.03114	-.04889

	Factor 6	Factor 7	Factor 8
SIXTEEN	.18300	-.02628	.11764

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	Factor 6	Factor 7	Factor 8
SIX	-.21593	.03811	.12277
FIFTEEN	-.03290	-.15222	-.05365
TTHREE	.00516	.22199	-.11197
TWO	-.27997	.10126	.11735
EIGHTEEN	.06627	.10797	.02291
TTWO	.04339	-.06542	-.00802
EIGHT	-.19244	.12732	.09986
SEVENTEE	.05922	-.06155	-.33242
NINE	-.01740	.13105	.20521
TEN	-.02211	-.00269	.06668
FIVE	-.05044	.02580	.01208
SEVEN	.04079	-.23953	-.14670
THIRTEEN	.01878	.09098	.24167
TWENTY	-.01518	.23949	.23740
ONE	.31668	.10119	-.19771
FOUR	-.14324	-.23051	-.00572
NINETEEN	.07829	.03153	.26588
FOURTEEN	-.11031	.06155	-.10042
ELEVEN	.82434	.03261	.01151
THREE	.50354	.01932	-.12896
TFOUR	.05951	.7527	.07178
TWELVE	-.08665	.58350	-.14370
WENTYON	.03459	-.12095	[illegible]5155

Factor Transformation Matrix:

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Factor 1	.71984	.42793	.49640	.13147	.08247
Factor 2	-.45925	.64925	.00526	.54552	-.04057
Factor 3	.23210	.05736	.58122	.24839	.69638
Factor 4	-.18875	-.31211	.32755	.01988	.43816
Factor 5	.15466	.34575	.14659	.42282	-.17262
Factor 6	-.16545	-.34085	.34688	.52315	.18862
Factor 7	-.32576	.18781	.23507	-.20843	[illegible]
Factor 8	-.15497	[illegible]	.33373	-.35655	[illegible]

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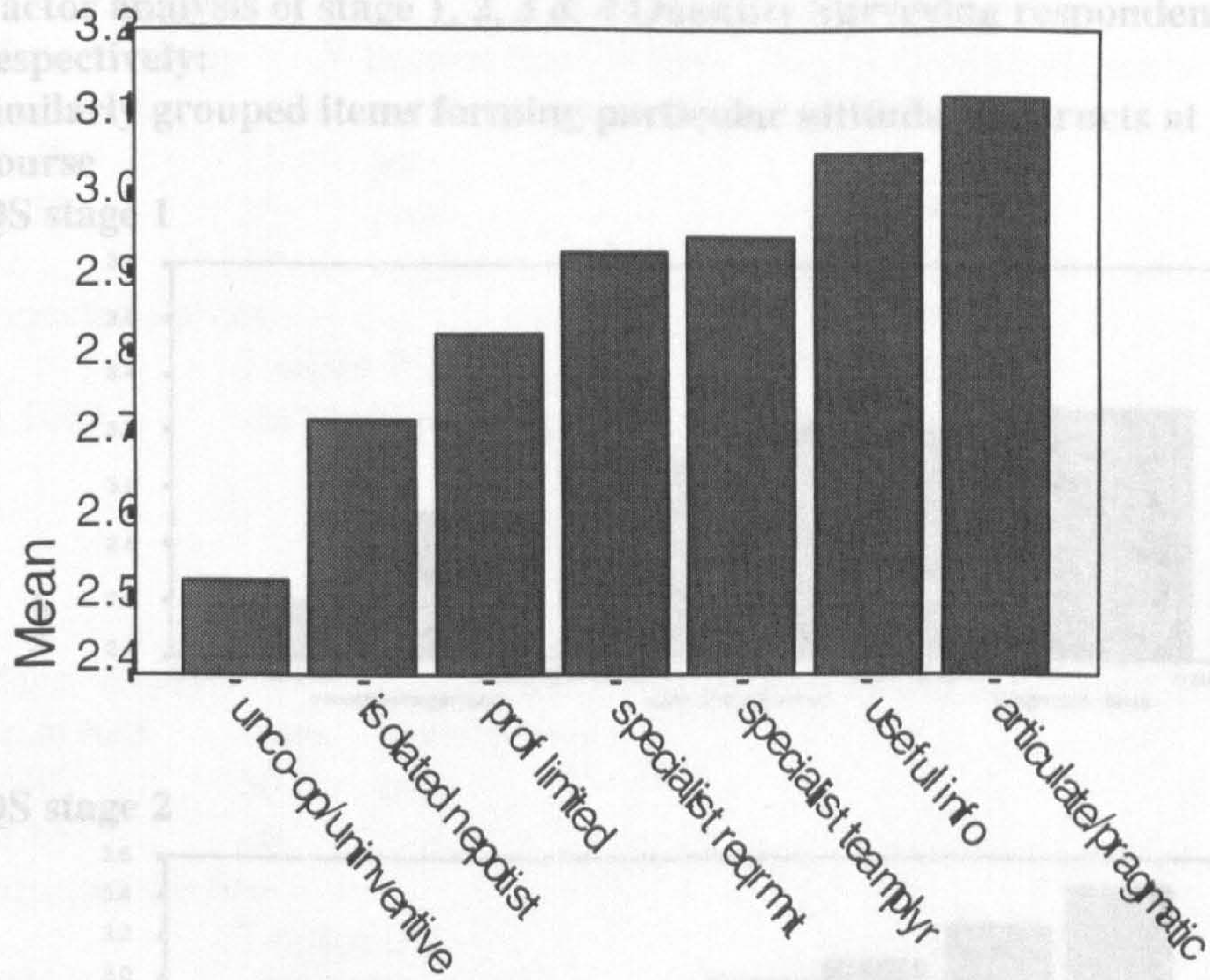
	Factor 6	Factor 7	Factor 8
Factor 1	-.1229[illegible]	[illegible]	.55641
Factor 2	[illegible]20[illegible]	[illegible]	.24351
Factor 3	[illegible]	[illegible]	[illegible]

Factor 5	.76108	.21769	-.00726
Factor 6	-.29311	-.49555	.31357
Factor 7	.14330	.35814	.77841
Factor 8	.47088	-.43906	-.22888

Appendix B item 6.24

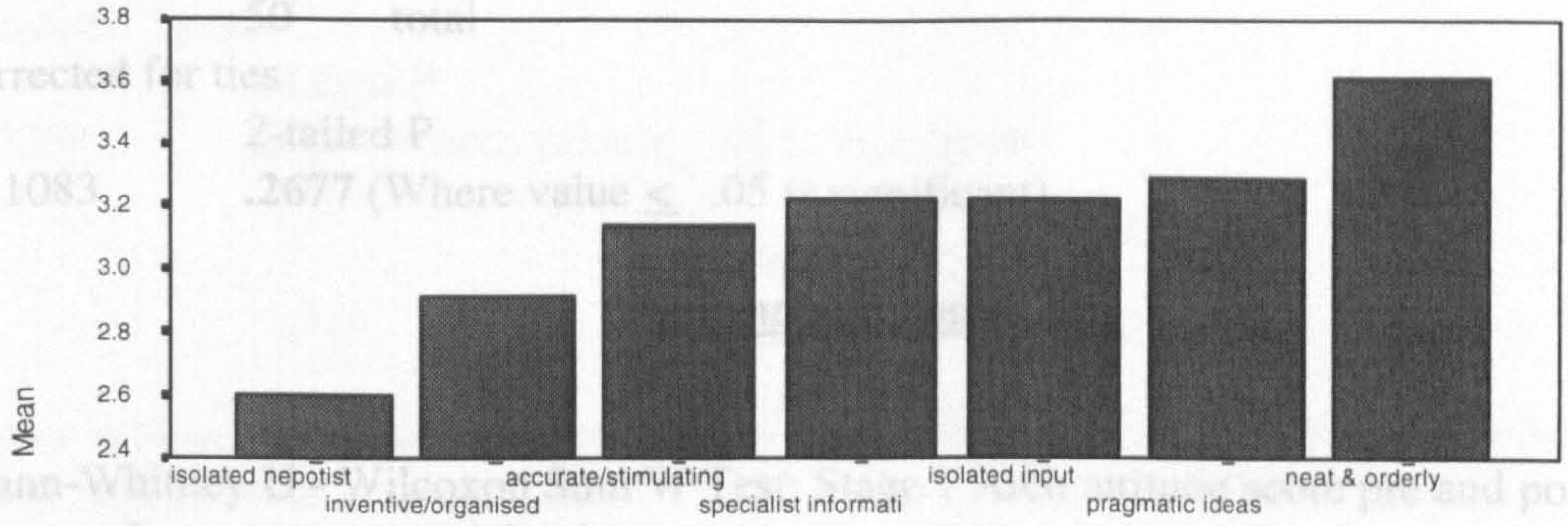


Factor analysis of stage 3 Architectural respondent replies: similarly grouped items forming 8 attitude constructs

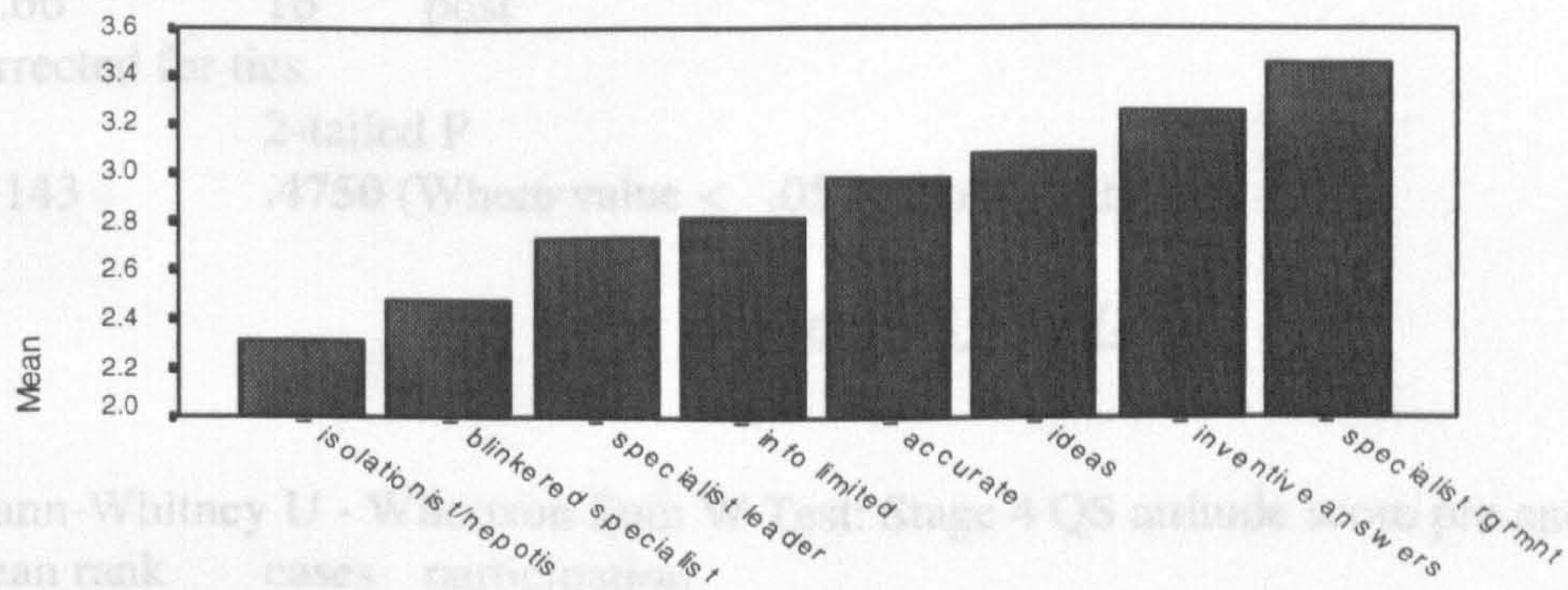
Appendix B item 6.25

Factor analysis of stage 1, 2, 3 & 4 Quantity Surveying respondent replies respectively:
similarly grouped items forming particular attitude constructs at specific stages of the course

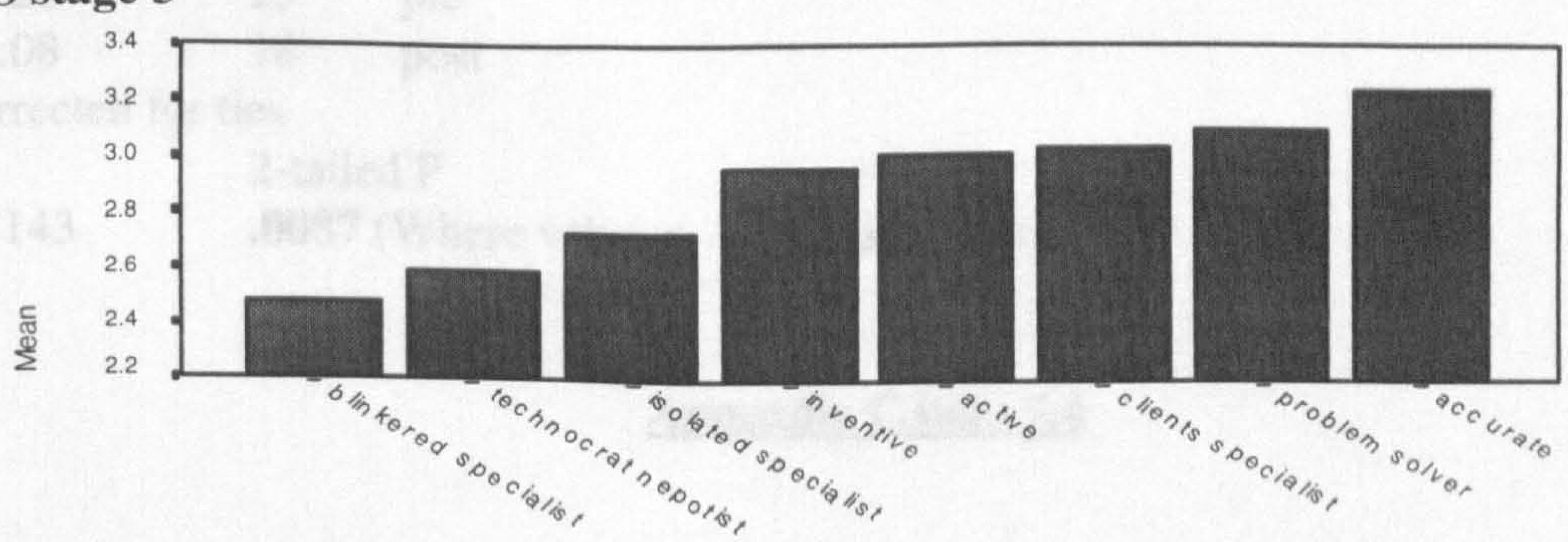
QS stage 1



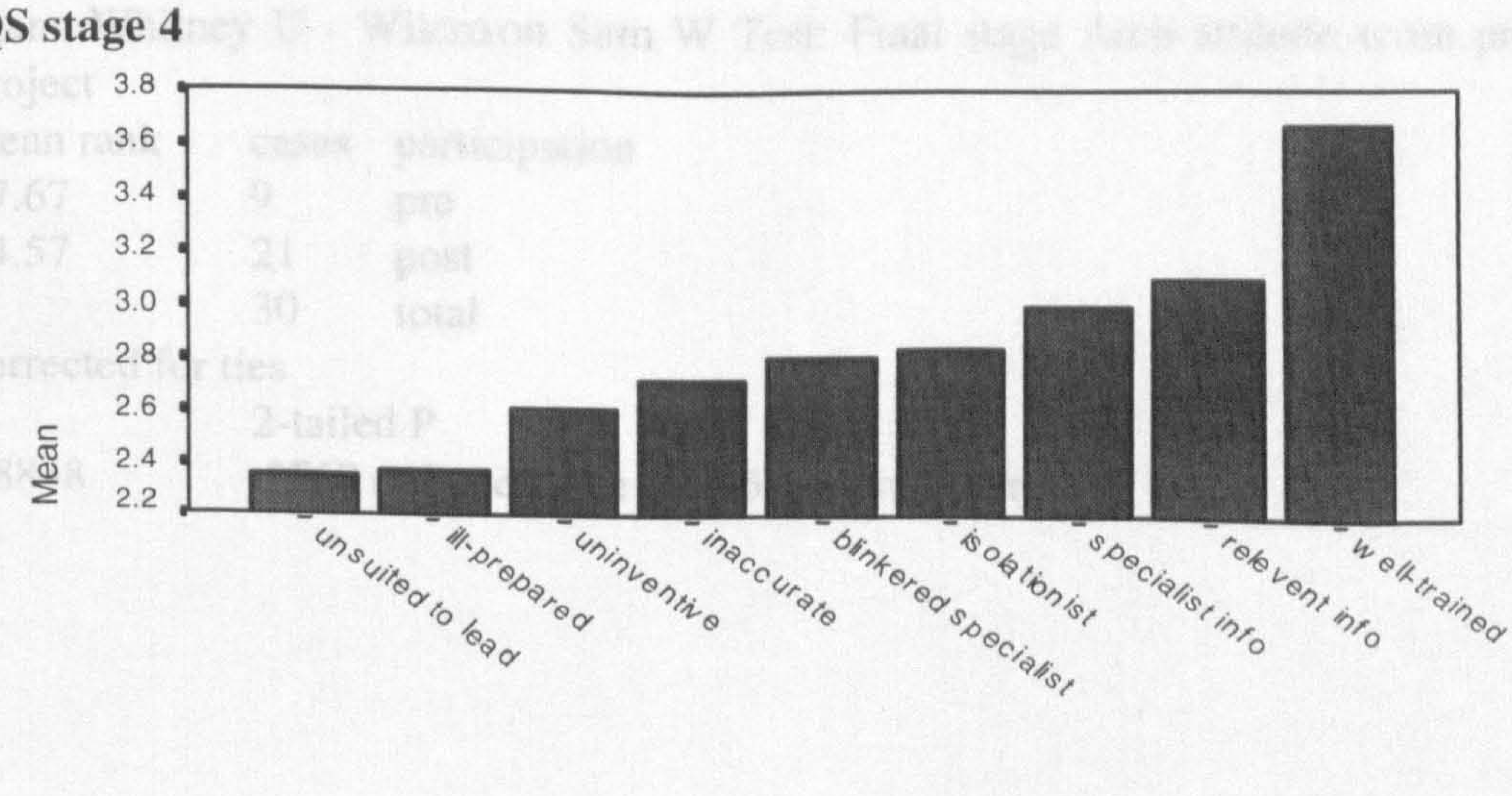
QS stage 2



QS stage 3



QS stage 4



Appendix C item 7.1

Mann-Whitney U - Wilcoxon Sum W Test: Stage 1 QS attitude score pre and post project

mean rank	cases	participation
26.48	25	pre
24.52	25	post
	50	total

corrected for ties

Z	2-tailed P
-1.1083	**.2677** (Where value ≤ .05 *is* significant)

Appendix C item 7.2

Mann-Whitney U - Wilcoxon Sum W Test: Stage 1 Arch attitude score pre and post project

mean rank	cases	participation
14.85	10	pre
12.66	16	post

corrected for ties

Z	2-tailed P
-.7143	**.4750** (Where value ≤ .05 *is* significant)

Appendix C item 7.3

Mann-Whitney U - Wilcoxon Sum W Test: Stage 4 QS attitude score pre and post project

mean rank	cases	participation
26.26	25	pre
16.08	18	post

corrected for ties

Z	2-tailed P
-.7143	**.0087** (Where value ≤ .05 *is* significant)

Appendix C item 7.4

Mann-Whitney U - Wilcoxon Sum W Test: Final stage Arch attitude score pre and post project

mean rank	cases	participation
17.67	9	pre
14.57	21	post
	30	total

corrected for ties

Z	2-tailed P
-.8838	**.3768** (Where value ≤ .05 *is* significant)

Appendix C item 7.5

Mann-Whitney U - Wilcoxon Sum W Test: Stage 3 QS attitude score pre and post project

mean rank	cases	participation
28.39	27	pre
24.46	25	post
	52	total

corrected for ties

Z	2-tailed P
-.9369	**.3488** (Where value ≤ .05 *is* significant)

Appendix C item 7.6

Mann-Whitney U - Wilcoxon Sum W Test: Stage 3 QS attitude score pre and post project

mean rank	cases	participation
24.21	28	pre
30.12	25	post
	53	total

corrected for ties

Z	2-tailed P
-1.3919	**.1640** (Where value ≤ .05 *is* significant)