Innovative interdisciplinary pedagogical approaches to enhance students' learning experiences and to benefit them in their future development.

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Innovative interdisciplinary pedagogical approaches to enhance students' learning experiences and to benefit them in their future development.

Enhancing students' learning experiences

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Lay Summary

Most universities have siloed departments and discipline specific degrees which make it hard to foster innovation, interdisciplinarity and entrepreneurship. At a Scottish University the Innovation Award, using Design Thinking (DT) pedagogy, benefits students in personal development, skills' enhancement, and collaboration. Findings uncovered enhanced engagement with learning, reflective skills, and development of self-confidence.

Abstract Purpose – This study adds to the existing body of knowledge on the benefits to learners of using an interdisciplinary design thinking (DT) pedagogical approach taking the form of a micro credential with an extra curricula workshop.

Design/methodology/approach – The interpretivist research examined opinion via nine semi-structured interviews with learners who had participated in a workshop. The interviews focussed on demographic information, learning strategies, workshop interdisciplinary benefits and being taught via DT. The recorded interviews and transcriptions were analysed via NVivo and content analysis.

Findings – The results are themed into development opportunities, future learning, making meaning and sense and practical application of knowledge and skills reflection for the students. The DT pedagogy worked well for the students who confirmed university learning should be this way, adding to the debate on

embedding engaging interdisciplinary methods to embed entrepreneurship and innovation in the curriculum.

Originality/value – The research is original as the use of DT has added value to the students' development and mindset. Developing graduates this way benefits the local and national economy, as the reach of graduates' transferability makes them fit for the future.

Keywords Innovation, Pedagogy, Development, Interdisciplinarity, Wicked problems, Employability

Paper type Research paper.

Background

Background Universities are rapidly becoming entrepreneurial eco systems fuelled by the need to aid local and national economic development (Pugh *et al.*, 2019). Universities don't always practise what they preach, adopting siloed teaching business models as the financial structure does not permit flexibility for interdisciplinarity and innovation (Glen *et al*., 2015). Flexible methods of teaching and learning, such as design thinking (DT) methodology can enhance such needs.

DT's pedagogic value is realised through collaboration, research, ideation and rapid prototyping activities providing a bedrock for metacognitive skills development (Pratomo, *et al.,* 2021). Creativity, and development of a range of thinking styles, combined with affective skills such as curiosity and interests can drive results in innovative action, including problem solving and opportunity identification (Che noh *et al*., 2021). DT helps students ideate, cope with ambiguity and manage uncertainty as activities are fast paced, developing cognitive flexibility and may be crucial in the world of work (Brown, 2009).

DT has encompassed a range of models such as, the Stanford's d. school model and Glen, *et al.'s* (2015) six phase model. The stages in each model are similar with investigation and discovery to description of the issue, through ideation and brainstorming to solutions that best meets end-user's needs. Finally, rapid

prototyping, involves incremental modifications driven by end-user feedback. In practice, Pratomo *et al*., (2021) found that creativity and entrepreneurial alertness were enhanced in vocational students using Stanford d, whereas Cummings and Yur-Austin (2022) identified creativity, engagement and ownership increased in project-based learning.

A Scottish University partnering with the Scottish Institute for Enterprise (SIE) delivered the Scottish Innovation Student Award (SISA), rebranding it as their own, when the SIE ceased. This three-tiered, micro credential has a DT interdisciplinary workshop for level two. By working with local business on a "wicked problem" the students encounter "real world" problems emulating the workplace. Being interdisciplinary makes the level two participants recognise the benefits to themselves and to their future prospects by enhancing their skills giving them confidence to co-collaborate outwith and across their disciplines.

Breaking barriers via DT prepares this university's graduates for the fourth industrial revolution. Future proofing aids in the emergence of new employment opportunities (Davidson and Bremner, 2020) and considers the top ten skills required for 2025 (World Economic Forum, 2022, WEF), where critical thinking and problem solving are important. In considering the QAA (2018) framework the award has created entrepreneurial mindsets as successful students have developed Sustainable Fashion Scotland and a vertical wind farm.

The aim of this research is to examine the learners benefits of undertaking the level two DT Innovation Award workshop, adopting a qualitative investigation. Topics include the future of work and skills, teaching and learning practices, the Innovation Award, the research question, findings and their discussion and contribution before drawing conclusions.

Literature review

The future of work and skills

Much debate exists about the "future of work" and how fast transformation is occurring. WEF (2022) highlights the skill sets needed for 2025 with analytical thinking and innovation at the top. Scotland's plans include developing a skilled workforce with entrepreneurial people, who are culturally aware (Scottish

Government, 2023), yet universities maintain silos due to financial constraints. Flatter, more flexible collaborative approaches with interdisciplinarity at the core of teaching and learning have been highlighted for change (Lyall *et al.,* 2015). Universities must be flexible if they are to provide authentic learning experiences to develop future graduates (Becerra, 2023). New models of degree delivery are appearing such as that of Marymont University and Taicang, an entrepreneurial college in China (Perrin, 2022).

Graduate skills must incorporate several competencies (Charles and Nicoll, 2023; Skills Development Scotland, 2023) and employability is more challenging. Post-Brexit, the UK pool of labour has altered and graduates will not have a career for life (Futurelearn, 2023) having to be adaptable, transferring their skill sets. Consequently, skills and competencies must be emphasised to increase students' resilience, adaptability and problem solving within the collaborative spheres they may be required to work in. Curricula developments must consider riskier teaching pedagogies (Lyall *et al*., 2015) to meet these needs.

Teaching and learning practices
New teaching and learning pedagogies have evolved from rote learning to scaffolding (Vygotsky, 1978), inquiry-based learning and "flipped classrooms" (Jenkins *et al.,* 2017). The developments in information and communication technology (ICT) have complimented in person teaching (Weller, 2007) to introduce online learning spaces. As Al-Ansi *et al.,* (2019) note Internet access has driven this, giving us online and blended learning with Means et al., (2013) debating that newer methods are more effective than learning in-person. Wu (2015) suggests student grades are better via online, but students lose social interaction. Educational concepts have been extended by "ICT" implementation (Al-Ansi, 2022a, b), with self-determination theory (SDT) (Deci *et al.,* 2004) motivations for learning, social constructivism theory (SCT) (Yildirim, 2014) and successful intelligence theory (SIT) (Sternberg and Rainbow Project Collaborators, 2006) examined in STEM (Science, Technology, Engineering, and Mathematics). The pandemic accelerated ICTs use in teaching, however the attempt to build in "social learning" evidenced some challenges. Xuexin's PADA Presentation, Assimilation, Discussion and Assessment (PADA) method (Al-Ansi, 2022a, b) has been identified as a positive social learning influence. However, many students

have highlighted the need for in-person teaching but ICT is a requirement as are metacognitive skills, social learning and collaboration for the future world of work. Social learning in particular develops creative entrepreneurial graduates (Anderson and Air, 2022) as it extends observational and concrete experience developing creativity (Kolb, 1984).

Despite the evolution of teaching and the social interaction need the fundamentals of teaching remain the same. It uses techniques which disseminate knowledge, develop skills and attitudes required to aid the economy and society (Blessinger, 2023). Authentic teaching methods are now at the core of many universities teaching strategies and are constructivist approaches "to learning that holds that people actively construct or make their own knowledge and that reality is determined by the experiences of the learner" (Elliott *et al.,* 2000, p. 256). However, the revolutionary changes enabled by the pandemic (Al-Ansi *et al.,* 2021) have not always furthered the pedagogical approaches towards interdisciplinarity involving DT (Glen *et al.,* 2015).

Clarity of DT has still to gain consensus, as debates between "manufacturing systems" and "humanist style" approaches require interpretation. Liedtka's (2014) human-centred innovation process emphasises observation, collaboration, fast learning, visualisation of ideas, rapid concept prototyping and concurrent business analyses. Thoring *et al.* (2014) highlighted that DT coupled with cultural differences, transdisciplinary in approach, develop the intracultural competencies in employees and, therefore, the same applies in education. Fjuk and Kvale (2018) emphasised the need for empathy and teamwork as vestiges in the ideation of the problems solution. Latterly, Hantsiuk *et al*. (2021) stressed cultural collaboration in DT, taking students out of their comfort zone in teamwork, develops intracultural competencies, suggesting a need for disruptive teaching to create more entrepreneurial mindsets. As universities are a panacea for enterprise fulfilling strategies, Staniec and Pilawa (2020) noted the success of DT supporting the need for embedding it in extra curricula student activities. Little research has uncovered the benefits of DT as a pedagogical approach; therefore, a case exists to identify what benefits students get from an interdisciplinary experience, particularly as the Entrepreneurial Campus report has just been published by Tuffee and Little (2023).

The Innovation Award

A Scottish University has innovation as one of its core strategies and values. As the top modern university in Scotland for graduate prospects (Guardian, 2023) and graduate employability (HESA, 2022) it seeks to have authentic degrees, developing graduates' transferable skills. One way of increasing the skills diversity is through the extra curricula Innovation Award. The award acts as an activity to enhance the student experience and to recognise meta skills (SDS, 2023), the university's employability framework, the European Entrepreneurship Competence Framework (Bacigalupo *et al.,* 2016) and the QAA (2018) framework in order to ensure economic and social consideration. The DT workshop acts to bring about change in student mindsets, to be more entrepreneurial in their personal approach towards the dynamic future of work. Figure 1 outlines the 3 levels.
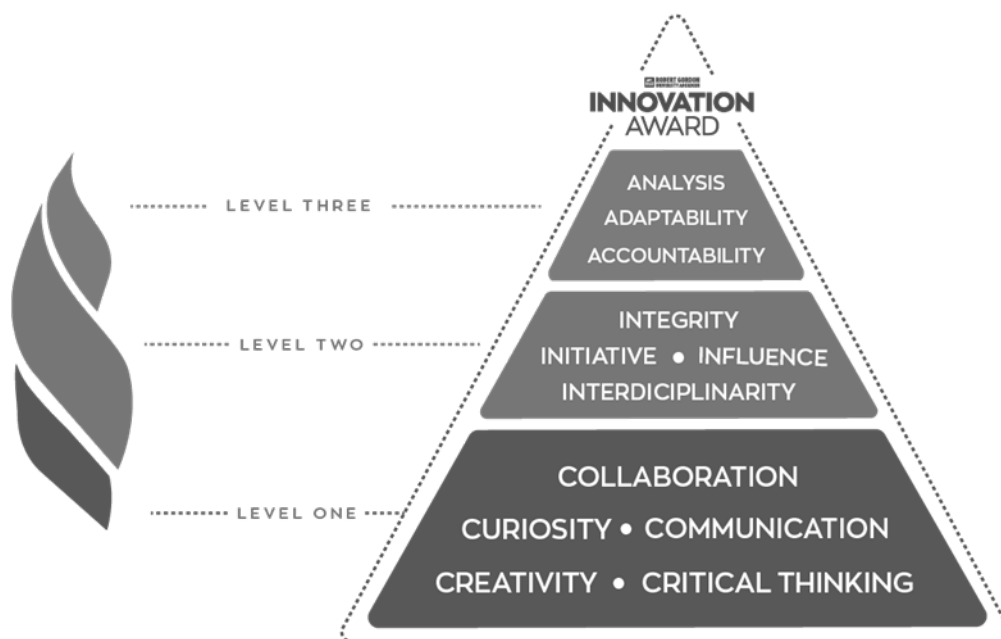

Figure I. Reproduced with permission the Robert Gordon University Innovation Award structure and incorporated skills. (sources) Created by Robert Gordon University.

The level two workshop delivers the concepts of interdisciplinary collaborative teamwork with the DT pedagogy forming the core. The tasks are conducted in interdisciplinary and intracultural teams, where they consider the "weight of the past" (Sher, 2023) with the future. It facilitates the student solutions to a "wicked

problem" and enhances their exposure to DT service design (Ali *et al.,* 2017). Teams create personas for the business in question, and the ideation process begins with a crazy eights approach elucidating solutions, where eight ideas are posited in eight minutes by each individual within teams. It is hard for students to forget artefacts from the past, an example being a record player, but it's about how these artefacts can evolve, for future benefit. In providing solutions, the teams empathise, define, ideate and prototype via the DT approach to pitch their final idea to a panel. The approach enhances the student's ability to be more entrepreneurial (Baggen *et al.,* 2022), by developing a more open mind set whilst moving between divergent and convergent thinking, analysis and critical thinking. It is during the collaboration in their contextual "safe zone" the teams are challenged and time pressures formulates ideas faster than in traditional project management. Benefits of this style of learning are under researched (Ali *et al.,* 2017).

Research questions

It is clear graduates must develop diverse relevant skills sets which include intracultural awareness and collaborative practices. One research question was posited for this small-scale research being mindful that inductive research can yield many new concepts.

RQ1. What are the benefits of undertaking the Robert Gordon University (RGU) Innovation Award for learners?

Research design and context

An interpretivist inductive approach (Smith *et al.,* 2009) was used to investigate students' general perceptions of learning, their perceptions of the impact the level two workshop had on themselves and the benefits of using DT. The research focussed on participants who had undertaken a workshop online or in person.

Participants

Over 100 students had participated in a workshop, and an email request for participants was administered providing ten purposively self-selected interviewees from their positive response. A semi-structured interview was administered by two experienced researchers, whilst the tenth interview did not transpire due to their

absence. The interview was appropriate for gaining opinions on the subject matter as whether structured or semi-structured they provide a wealth of information (Hanson and Grimmer, 2007). Saturation (Saunders *et al.,* 2018) was achieved with the nine participants. Two facilitators increased the reliability of the research instrument (Easterby-Smith *et al.,* 2011).

Instrumentation and data collection

The interview explored the research question via three themed sections: general questions on students' learning strategies, innovation and mindset questions on the workshop and questions on the benefits of interdisciplinary DT teaching. A settling question was used to ask demographic information as part of twenty-two questions with a final one asking if anyone had anything else to add. A pilot interview with a colleague identified no issues. Interviews were arranged via email and a diary invite followed with a MS Teams link. A participant information consent sheet meeting the university's ethics governance was issued and signed and interviews were recorded and transcribed verbatim. The research was conducted after the participants had experienced the workshop.

Data analysis procedure

Data were analysed using a thematic approach (Braun and Clarke, 2020) where two researchers checked for accuracy on the themes presented. Content analysis was adopted and the NVivo software package assisted in drawing out the main themes of the interviews finding insights in an inductive approach from a deductive standpoint.

Results

Respondent profile

The nine respondents interviewed were aged between 25 and 50 and six participants identified as female, three as male with one of the participants being a distance learning student and the rest being on campus. One was on an honour's tourism degree and the remainder on post graduate studies. The postgraduate participants were on courses relating to engineering, energy, quality, or librarianship. A number of the participants had experienced learning at another university prior to attending this one and had spent time in work. Participants were coded p1-p9 for ease of analysis and discussion. Five benefits to learner themes

were identified from the analysis being development opportunities, future learning, making meaning and sense, practical application of knowledge and skills reflection. The discussion begins with their thoughts on learning strategies to set the context of the participants' knowledge (see Figure 2)
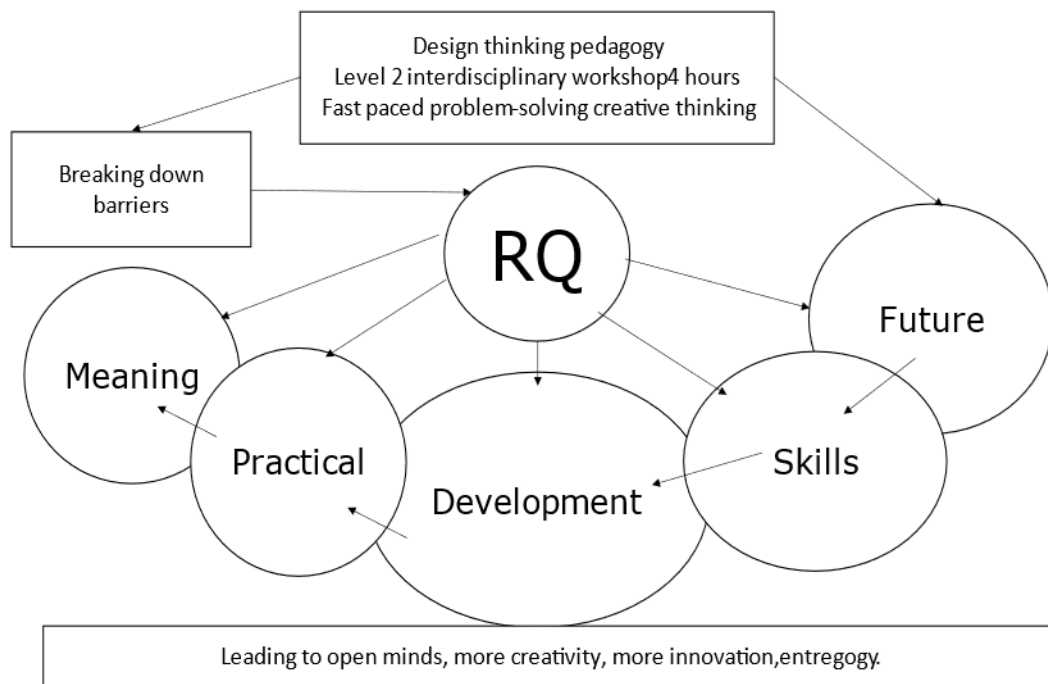

Figure 2. Research theme outcomes Source (S) Author's own work.

Learning strategies

The interview began by asking questions on the participants' learning strategies. A number cited the type of learning they experienced at their present university as being transparent, practical and those who had been online at some point noted the time aspect and being able to "fit their learning in". In terms of their strategies a majority spoke about using professional student support services and about using reading content. Mention was made of structuring their week to fit in what time the learning would take place. When asked how they preferred to learn the participants noted "getting them engaged", "being in person", "learning from others", "researching and reading", "applying models" and "practical learning", identifying a range of tactics. No participant mentioned DT learning strategies but highlighted sometimes their classes were not as engaging as they could be.

Theme one: development opportunities

Theme one from the analysis considers development opportunities and participant responses alluding to the learning development as opportunities from the workshop. In response to the question what did you learn that you think will be of value in the future p1 noted "going outside one's comfort zone rather than staying among people who you know are likely to improve anything that one puts out" and highlighted getting "concrete feedback from the potential customers" (i.e. the business itself). P2 supported these points by noting "it opened my mind to possibilities" and for them the transformation was large "it's enormous, it helps me that whole innovation thing that whole that day". It also developed learners' confidence, p2 added that they had learnt to deep dive, which is a key mindset point and p2 emphasised they had nothing to lose. In response to a question on who took leadership p4 highlighted a development opportunity stating "yeah, I wish that I maybe like volunteered to do" recognising that a learning opportunity had been created. A number of the participants suggested that DT is needed in more classes to engender these development opportunities as p7 noted a key aspect for them was listening within the workshop teams "just doing this thing and listening to other people can really help to learn skills". P9 highlighted that being from a library discipline they often don't look for a solution, so for them this was revolutionary. A final point noted by many was that the skills developed quickly in this session would easily transfer into the workplace as would the DT approach.

Theme two: future learning

Theme two emanated from questions about the workshop, what they enjoyed, their team's idea, what the workshop enhanced, providing a deeper dive into the DT method. Initially responses evidenced benefits of being in an interdisciplinary team as many noted it was good to hear all the team contributions and to debate in the decision making, ensuring it was more effective. One opposing point of view was given by p9 mentioning the confusion some had in getting to grips with the workshop and p2 stated you have to "grab the opportunity". The pace and timing of the workshop was mentioned as a positive factor with the crazy eights exercise complimented and some participants stated they will use this in their workplace. Many added the staff, communication, brainstorming and learning styles within the workshop were the highlights with a suggestion that all "learning should be

this way in the future" (p 8). In particular a general feeling was that if universities wish to have more innovation and entrepreneurial thinking this DT method of teaching delivery is the way forward. "This method of teaching is gonna be really important" p8, they continued "so the so the end result from that is just a better output product all through the process". The findings highlight learners have quickly identified the take aways and that the workshop has prompted their expectations of future learning.

Theme three: *making meaning and sense*

In order to ascertain if students could understand what they were being put through in the workshop the analysis highlighted the learners' issues in making sense and meaning from it. Interview questions considered elements of the workshop they enjoyed, creative thinking development and how this kind of thinking would help them develop in the workplace. It was clear some participants struggled with the initial demands from the workshop. Much of what they noted in the development of "creative thinking" centred on the speed at which the session ran. This emulates thinking on your feet to an extent and demonstrates when you add the pressure of time people get on with the tasks. The ideating phase of DT using the crazy eights task was highlighted as the area which really moved the participants on. P4 stated "I'm never gonna think of eight things, but then at the end of it, you're like ohh I did manage". Concurrently p2 noted "At first, we did not have a structure. We are going to do this first. But we knew what the charity business wanted and so we kept ticking off. Have we done this? We are meant to get a persona ... Yes. The persona is meant to have an age, done". At other times participants perceived that time was provided to debate and develop a solution, so they had recognised the differences in timings. Additionally, they noticed how they had learnt to be more creative with acceptance of other team members' points of view and as there were no preconceptions all learners started from the same place. Pressure existed in keeping on track with the tasks as p8 stressed "but it's about its about diving in too quickly and not assessing the landscape. .... And I found we went off on a couple of tangents and had to regroup". The realisation was there, they recognised moving fast was needed, but sticking to time is relevant.

Theme four: practical application of knowledge

One of the positives about learning and development for educational practitioners is realising that learners are putting into practice what they have learnt. The use of DT coupled with interdisciplinarity permitted the learners to recognise what they have achieved as often, in normal in class lectures and tutorials, there is limited time to reflect, and many students focus on the assessment rather than the learning. It was clear from the participants that some had developed a sense of how their previous knowledge could be practically applied, during this workshop. P2 highlighted their finance background and how this helped with saying this plan you are proposing costs far too much. Others related their practical application through their personal experience as one participant's grandfather was in a care home so the task Enhancing students' learning experiences relating to this was real and they were able to empathise and more importantly look outside their own oil industry (p 4). The future use of learning from the workshop was also highlighted by many as it added knowledge to the course they were on (p 1) it was good to learn from others and they would recall that going forward into the workplace (all). In terms of the future, they could see the transferability of practical application and creativity, for the next level of the Innovation Award, future research symposiums, creativity in public speaking (p 2), creating a start-up idea for which the workshop acted as a "green flag" (p 3, 4, 5) and getting more from authentic learning than just sitting in class (all). P5 summed this up by saying "I'm trying to apply that for the practical existing problem sort of helped you to just like learn to apply knowledge instead of just like keeping it theoretical". This evidences that the DT method and tasks in question had worked well and quickly.

Theme five: skills reflection

As noted, skills are a valuable asset in anyone's employability arsenal and even more so as the world of work is changing. Often students are not aware of the skill sets they are developing but this DT pedagogy workshop has changed that. All participants were able to articulate their skills used and developed in the workshop and their transferability. P2 highlighted that having a range of skills or disciplines in the workshop teams was great as it emulated what the workplace needs. P5 added that skills could be reflected upon more as strengths and weaknesses and they could see how these feed into their course and the future.

P2 noted more of the functional skills such as presentation, communication, delivery of task and leadership skills being developed and p5 added in brainstorming, confidence and poor time management. Others observed collaboration was good as "they were on the same side" (p9) suggesting that as it was competitive and not assessment based it pulled the team together. As time was a factor there was less time to argue but more need to reach consensus quickly, some of them hinted. A couple noted they don't get these skills development opportunities on their courses, but most were clear on the diversity the workshop had brought.

Discussion and conclusion

Discussion of study findings

This study contributes to literature on the use of DT as a teaching and learning method. It provides evidence as to how an interdisciplinarity DT workshop benefits students, bringing them out of their comfort zone, making them self-aware of skills, learning more and generally feeling more entrepreneurial.

Firstly, as discovered the participants clearly benefitted from the workshop via the DT method. Some found it benefitted them in a "human style" adding to Liedtka's (2014) research. Here the participants recognised the time pressure, noting the benefits of collaborating to get a solution, by listening to others and in recognising they had rapidly prototyped. There was little forthcoming on the cultural debate, although participants noted working with people from other disciplines helped garner ideas, cultural awareness was not at the forefront of their minds, hence Thoring, *et al.'s* (2014) and Hantsuik, *et al.'s* (2021) research is not extended. Culture cannot be discounted though as noted by the participants, they had been taken out of their comfort zone so discovering more on this is required. The findings add to Fjuk and Kvale's (2018) research as participants had recognised self-awareness and implied that teamwork was a catalyst, similar to their ideation findings.

Secondly, the participants recognised several things from engaging in the workshop. They evidenced their learning had been enhanced via DT extending Lyall *et al.'s*, (2015) debate on the interdisciplinarity aspect as a requirement to assist in change. This suggests this approach is needed more in curricula in a way

which is fast paced to get results supporting Tuffee and Little's (2023) recommendations. Despite learners highlighting initial confusion once they got the idea of what was happening the learning took place quickly followed by results. There was consensus round the fact that creative thinking was enhanced by the crazy eights' task registering closely with the WEFs (2022) future predictions for skills. It also supports the work of Baggen *et al.,* (2022), suggesting this method enhances the entrepreneurialism in students, which links in with the Government's policy for economic transformation (Scottish Government, 2023; Tuffee and Little, 2023). The particular point made by one participant stating universities have to get behind this, clearly outlines the need for universities to consider new learning styles to evolve into "fitter universities" such as those emphasised by Becerra (2023) and Perrin (2022).

Finally, participating in the DT workshop has made the students recognise the skills they have and the ones they are developing. A variety of skills were noted by the learners, both functional such as communication and theoretical such as creative thinking. As this learner awareness only seems to emanate upon quick reflection, the recognition of these skills may be lost in lectures. This method adds to the pedagogical debate on what works well adding to Blessinger's (2023) point that learning methods need to aid the economy, society and here it is happening to an extent helping with entrepreneurialism.

Implications for practice

Undoubtedly this research has identified that learners benefit from the DT method in the context of a real situation providing solutions for a business. This suggests that universities need to consider more interdisciplinary modules, with cultural exchange and DT delivery. Curricula needs to be more work based, defining the skills developed and entrepreneurship activities need to be embedded into curriculum if the graduate pool is to be ready for the future of work. Degrees should be seen as more "buildable" by learners who take what they need to towards the end of the degree to shape their skills sets for their career choice.

Limitations of the study

A possible limitation is the time frame for the study. With a longer time span participants could be contacted in the future to investigate further how this

workshop helped their employability and mindset. Did their mindset become more open for example and did the workshop development of skills transfer into their job roles. While the findings are not generalisable they do contribute to the debate on the benefits of varied pedagogies, in particular, DT. Learners have noted DT's effectiveness in engaging them in learning where they feel empowered to ideate, create and innovate. They feel their skills sets have been enhanced more quickly, are more recognisable to them and their confidence has grown as they sense they have control of their degree. They have recognised that interdisciplinary collaboration has added value to them in embodying the activities and providing a solution. The compressed time has added to the success of DT from the learner's perspective highlighting this as a useful degree method. This is in contrast to ICT pedagogies, as here creativity has occurred through social interaction and learning within the workshop's competitive environment.

Recommendations for further research

Further research could examine cross disciplines via a structured survey with pretested items with participants to identify trends, before and after a workshop to identify whether change had occurred. Intracultural awareness could be investigated further as a development within the context. Enhancing students' learning experiences.

Conclusions

In conclusion, the findings have valuable implications for academic developers. Interdisciplinary intracultural modules should be a prerequisite across all university degree programmes. This example identifies best practice for dissemination, where the DT approach to delivery is a must. This will enhance learners' experiences and make graduates fit for the future.

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