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Types of peer assessments in group projects.

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TYPES OF PEER ASSESSMENTS IN GROUP PROJECTS

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INTRODUCTION

The P21 Framework for 21st Century Learning, which was developed by educators, education experts, and business leaders to define and illustrate the skills, knowledge, expertise, and support systems that students need, identifies collaboration as a key educational outcome as it prepares students for the real-world problem solving and enhance their prospects for employment.[1] Therefore, group assessments are becoming a commonplace in higher education, mainly to promote collaborative working environment and peer learning amongst students. In addition, group assessments are considered as an effective assessment strategy to manage large classes as it reduces the marking burden on academics.[2] Despite the benefits, students resent group work particularly when a common group mark is awarded when there is a varying level of inputs from the members of the group.[3,4,5] Especially, non- engaging students could possibly attain good grades without contributing to the group work or with minimal contribution. This problem of "free riders" disadvantages and discourages engaging students.[6,7]

There is a plethora of peer assessment methods used by academics to assess group works. However, there is a dearth of studies which explores why a particular method is preferred and the difference it makes on the final grades of students. Therefore, this paper explores different methods of peer assessments by reviewing recent literature and expands into comparing the final grades derived from two different methods of peer assessments adopted in the same module to study the end results. Finally, the correlation between the final individual grades and the peer marks given was unpacked which allows academics to make an informed decision.

LITERATURE REVIEW

Group Projects

The increasing use of group projects and team-based learning has become the norm in higher education with the pedagogical shift from teacher-centred learning approaches to student-centred learning approaches.[8] Group projects are a catalyst to promote collaboration amongst students as the modern higher education strives to produce graduates with collaborative skills to improve their career prospects.[9] In simple terms, collaboration can be defined as 'the act of working with another person or group of people to create or produce something.[10] In the educational context, this can be translated into, working in teams to produce an output that meets the assessment requirements and demonstrates the achievement of the learning outcomes of a given module. Group projects are also proven to increase the productivity of academics by attending to students in groups rather than individually and through reduced marking burden.[11] Despite the perceived benefits of collaboration, literature reports

learners resisting group works and collaborative exercises due to the problem of free riders, those who do not contribute equally but receive the same grade as others.[12,13,14] Scholars advocate that peer assessments can alleviate the problem of "free riders" and help reap the benefits of collaborative group projects.[15,16,17]

Peer Assessments

Literature on peer assessments can be traced back to early 1990s. Latest developments in peer assessments are essentially a modification to the fundamental techniques proposed by Falchikov,[18] Goldfinch and Raeside,[19] Stanier,[20] and Topping.[21,22] This suggests that these are seminal texts in the area and the methods proposed are still valid or in use in the same or different shape or form. Therefore, it is imperative that the historic literature and the development in the area is appraised.

Topping[23] defines peer assessment as,

"an arrangement in which individuals consider the amount, level, value, worth, quality, or success of the products or outcomes of learning of peers of similar status".

Accordingly, peer assessments can be used to assess the product of the group work or the process of the group work.[24,25] Either way, peer assessments and group work can lead to student empowerment.[26] Students take ownership of their learning and become active participants in the learning process when they play the role of assessors. Peer assessments improve the quality of group assessments by positively influencing the attitudes of students and rewarding engaging students.[27] Stanier tested the attitudes of students engaging in a peer assessment integrated group work over the course of a multi-disciplinary module and noted that the attitudes of the students changed positively over the period of the module. [28] The study also reported that the students seemed to enjoy the group work while showing improved team effectiveness and a reduction of clashes.[29]

A summary of the methods reported in the literature in the recent past (2009-2019) is presented in Table 1.

Study	**Computation Method**
Carson and Glasor[30]	Hybrid (Multiplier/Distribution)
Jin[31]	Multiplier
Weaver and Esposto[32]	Multiplier
Nepal[33]	Multiplier
Spatar et al.[34]	Multiplier
Planas-Lladó et al.[35]	Distribution

Table 1. Summary of the peer assessment methods reported in the literature

Literature in the past decade primarily reported of two methods and the third one is a combination of the two methods. This is an adaptation of the method reported in Conway et al.'s study.[36] Especially, addition and subtraction methods have become unpopular in the recent past. The reason for addition/subtraction method going out of fashion is could be attributable to the aim of the peer assessment. As discussed before, the two key aims of peer assessments are: (1) Assessing the group working/collaborative skills of the students (the process), or (2) Differentiating the final grade based on the individual's contribution to the final outcome (the product). Accordingly, addition/subtraction method is mainly used when the aim is to assess the collaborative skills of the student (or the process). Academics are moving away from assessing the process and moving towards assessing the product. Hence, varying forms of multiplier methods seem to be a preferable peer assessment method amongst academics. Therefore, distribution method and multiplier methods are compared.

Table 2 summarises the pros and cons of the two methods reported in the literature. Accordingly, both methods mainly aid the assessment of the final product. Nevertheless, the assessment of the process (or the collaborative skills of the student) can be factored in the PA by including collaboration as one of the assessment criteria. Problems of distribution method can be overcome by employing a carefully developed questionnaire or a PA form to guide the students in distributing the marks reasonably and objectively and providing a formula to distribute the marks. On the other hand, the multiplier methods are objective, however, they need to be straightforward, transparent, and interpretable. The hybrid method proposed by Carson and Glasor[37] aimed at overcoming the reported weaknesses to some extent by combining both methods. Yet, lack of a guide to distribute the marks needs to be addressed in Carson and Glasor's method.

Peer Assessment Methods	**Pros**	**Cons**	**Applicability**
Distribution Method	Straight-forward Simple and easy to understand by the students Students agree on the mark distribution as a group	Distribution is arbitrary/ no guide Difficulty in reaching consensus Complexity increases with larger groups Verification and validation can be difficult	Assess the product
Multiplier Method	Use of PA forms Students are aware of the marking criteria beforehand Independent assessment Objective computation	Can be complicated Some formulae are difficult to interpret Less transparent with complex computational methods	Assess the product

Table 2. Comparison of the existing methods of peer assessments in group projects

In summary, peer assessments are essentially a useful tool to minimise the effect of "free-riders" in group projects which are a catalyst to promote collaboration in the learning process. Of the various peer assessments methods practiced within the higher education setting, the functionality and impact of each method on the final grades vary. Therefore, it is important that academics thoroughly understand the pros and cons of the method being adopted and how it influences individual grades quantitatively. However, the recent literature suggests academics are more inclined towards product-based methods like multiplier and distribution methods compared to process-based methods like addition/deduction methods. Therefore, this paper uncovers this mystery by presenting an evaluation of the final grades derived from a process based and product-based peer assessment methods to study their impact on the overall spread of grades (standard deviation) and correlation between the peer mark and final mark to aid the selection process..

METHOD

The study involves primary data collection and analysis of two peer assessment methods to explore the impact of process based and product-based peer assessments on the final grades of students. Addition/deduction method of peer assessment is mainly used to assess the process of group working skills while multiplier method and distribution method are used to assess the product of group working

skills. Of the two product-based methods, multiplier method of peer assessment was used due to the availability of primary data that was obtained from a Quantity Surveying module. Student grades including peer mark and group marks of 27 students on this module was collected. In total, there were 8 groups of 3 to 4 students. Group mark was awarded by the tutor for the work submitted in groups and the peer mark was awarded by members of the group to one another. Peer marking process was guided through a pre-developed proforma and was conducted anonymously via an e-learning platform. The collected data was processed using addition method and multiplier method to derive the final marks. The formulae used to calculate individual marks for addition and multiplier methods are as follows:

Addition Method:

Individual Mark = Group Mark x 80% + Peer Mark x 20% (1)

Multiplier Method:

Individual Mark = Group Mark x (Average Individual Peer Mark/Average Group Peer Mark) (2)

The marks were presented graphically (for example, G1S1 implies Student 1 of Group 1) and the standard deviation of the peer marks vs. final individual marks were analysed along with correlation coefficient to study data patterns. Correlation coefficient is a metric that measures the linear correlation between two variables, hence, helpful to study the outcome of the two peer assessment methods chosen.

Correlation coefficient can take range from -1.00 to +1.00. The sign of the correlation coefficient indicates the direction of the relationship (positive or negative) while the value indicates the strength of the relationship between two variables. Cohen suggest 0.1 represents a small effect, 0.3 represents a medium effect and 0.5 or more represents a large effect[38] while Evans argues values between 0 and 0.19 to be “very weak”, 0.20 to 0.39 to be “weak”, 0.40 to 0.59 to be “moderate”, 0.60 to 0.79 to be “strong” and 0.80 to 1.0 to be “very strong”. [39] Even though these benchmarks are useful, Field[40] suggests that it is important to interpret the correlation in the context of the research.

FINDINGS

Data Analysis

Addition Method

Individual marks derived from the addition method are presented in Figure 3. Group mark and peer marks were also plotted in the graph for ease of comparison. As illustrated in the graph, the final individual grades are always higher than the group grade when the peer mark is above the group grade and vice versa. However, the correlation between peer mark and individual mark is less than 0.1 (0.09). In addition, the standard deviation of the peer mark was 16 while the standard deviation of the individual mark was 11.

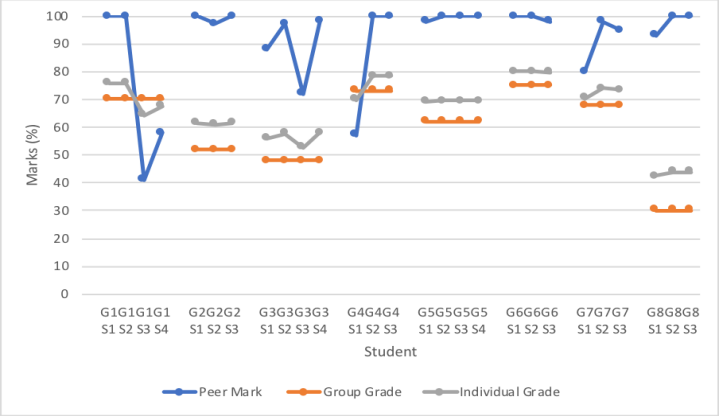

Figure 1. Outcomes of Addition Method

Multiplier Method

Similarly, individual marks derived from the multiplier method are presented in Figure 4. Contrary to the addition method, the final individual grades always mimic the pattern of peer marks. Final marks are sometimes lower than the group mark even though the pee mark is higher than the group mark. On the other hand, multiplier method depicts a better correlation (0.38, p=0.05) between peer mark and individual mark compared to addition method, yet the correlation is not very strong, and the standard of the individual mark was 18.

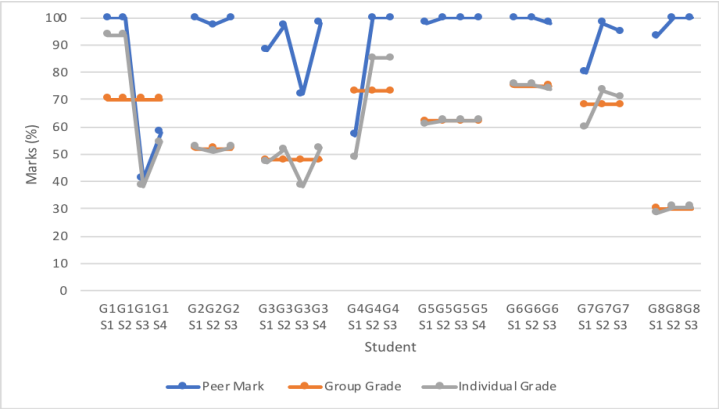

Figure 2. Outcomes of Multiplier Method

DISCUSSION

Primary data findings clearly present the difference in outcomes of the two peer assessment methods. When the process of collaborative skills is tested via addition method, the grades tends to be higher than the group grade unless the peer mark is lower than the group mark. This method in a way escalates final individual grades without a proper rationale. However, with multiplier method, final individual mark is derived in relation to the overall group's contribution. This implies if the individual's contribution was higher than the overall group's contribution then the final individua mark was higher than the group mark and vice versa. Assuming all members of the group contributed equally, the group mark will become the final individual mark for everyone in the group. Hence, the escalation of the final grades in multiplier method is justified by the fact that the students covering for disengaged students are awarded additional points for contribution beyond the requirement.

The impact of the two methods on the final outcomes is explained by the differing standard deviation and the coefficient of correlation. As in the addition method, the standard deviation of the individual marks is lower than the standard deviation of peer marks whereas in multiplier method the standard deviation of the individual marks is higher than the standard deviation of peer marks. This implies that 66 percent of the class has a mark between 55 and 77 with addition method as opposed to between 41 and 78 with multiplier method. Accordingly, addition method looks attractive based on the standard deviation yardstick.

Based on the correlation coefficient analysis, multiplier method shows a moderate correlation between peer mark and the final mark as per Cohen's yardstick[41] although according to Evans's this is considered very low. [42] On the other hand, no correlation was found in the addition method (almost zero). This suggests, of the two methods, individual marks are positively correlated with peer marks in the multiplier method which can be explained by the fact the multiplier method uses a multiplication factor to calculate the final mark from peer mark, resulting in a certain level of correlation. Yet, the correlation was not very strong. Correlation coefficient is a factor that can be considered in choosing a peer assessment method although not compulsory. However, multiplier method should be chosen if the tutor wants final marks to be a distinct reflection of peer marks.

CONCLUSION

Use of peer assessments in group projects are becoming popular to address the problem of free riders and to engage students effectively in group projects. However, choosing an effective method amongst a pool of methods can be challenging. Therefore, this research attempted to shed some light in this regard by conducting a systematic review of the recent literature, followed by an evaluation of real-life data to demonstrate the impact of addition and multiplier peer assessment methods. Literature findings indicated that two methods are predominantly in practice over the last decade including distribution method and multiplier method, both intending to assess the final product. Addition/deduction method has now become unpopular due to this method geared towards process assessment as opposed to product assessment and academics preferring product-based peer assessments.

Distribution method is comparatively easy to understand than some of the multiplier methods. Lacking objectivity is one of the key shortfalls of distribution method. Contrarily, objectivity is a key strength of multiplier methods while the level of complexity makes this method difficult to interpret (by students) and hence, less desirable. Despite the advancement of multiplier functions, a simpler function is deemed effective in the eyes of students. Besides, both methods lead to a 'no free-rider' zone while improving team dynamics.

Evaluation of addition and multiplier methods reveal that the rigour of final individual marks can be ensured in multiplier method through meticulously developed equation. However, similar rigour is difficult to achieve with addition method. On the other hand, addition method seems to have a healthy spread of marks with a lower standard deviation as opposed to the multiplier method with a higher standard deviation for the analysed sample. In addition, multiplier method produces a better correlation compared to addition method. The choice, however, is not between addition or multiplier method but process-based assessment or product-based assessment.

Further, it is important to define the aim of the assessment (product or process) and communicate it clearly to students to improve the credibility of peer assessments. In addition, appropriate training to students as assessors is also crucial for the assessment process to be reliable and to reflect the reality. Therefore, the design of peer assessments and the training of students should be treated as equally important to achieve the goal of peer assessments, which is to improve the quality of group works by positively influencing the attitudes of students.

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