A case-study on intra-group assessment of inter-disciplinary group work

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BACKGROUND
Group project works are common in higher education. Assessment of group work is a complicated challenge, especially in inter-disciplinary courses/ units of study. Previous studies by the first author revealed that self assessment and peer assessment of group works are useful arrangements to augment the teacher assessments in such courses. Our literature review revealed that diverse approaches are being considered for group work assessment in higher education and relevant adaptation arrangements are deemed as useful. Hence, we commenced a focused research to benchmark good practices and develop rational frameworks for inter-disciplinary group work assessment in higher education.

PURPOSE
Our research is focused on developing effective assessment arrangements for inter-disciplinary group work in higher education. Main aim of this research is to explore for effective integration of teacher assessments with students' assessments such as (a) intra-group peer and self assessments and (b) inter-group peer assessments. This paper covers key details of a case-study related to intra-group peer and self assessments of group work in an inter-disciplinary cohort. A set of quantitative explorations were considered in this case-study explorations, which include: (i) verifying student competencies for self assessment and intra-group peer assessments in inter-disciplinary group works – to rationalise assessment frameworks; (ii) comparing the intra-group assessments by male and female students to find whether there is any significant difference i.e. gender bias; (iii) comparing the intra-group assessments of students from different years of undergraduate studies (i.e. Year 2, Year 3 and Year 4) to determine whether there is any bias with respect to level of students in the cohort.

DESIGN/METHOD
In a 'seed funded' pilot research at Swinburne University of Technology, the first author reviewed specific problems in group work assessments to develop suitable rational arrangements, e.g. templates and protocols for peer assessments. By customising some of the relevant frameworks, the second author led an exploratory case-study in a group work based subject that had a large undergraduate cohort from different faculties at the National University of Singapore. 108 valid datasets (i.e. 53 males and 55 females) from the case-study were used for specific quantitative research explorations, e.g. correlations and ANOVA.

RESULTS
This case-study research revealed interesting observations such as (a) significant correlation between self assessment and intra-group peer assessment by students and (b) significant difference between Year 2 and Year 3 students' intra-group peer assessment ratings. Furthermore, there is no gender bias, i.e. no significant difference between male and female ratings observed in this case study.

CONCLUSIONS
Intra-group peer and self assessments are useful supplements to the teacher assessments in inter-disciplinary cohorts, which can be beneficial to both teachers and students.   However, rational frameworks and relevant protocols can be useful for facilitating harmony in implementation. Also, case-study findings are bounded by limitations and assumptions of the study. Hence, further research is required to establish theories and strategies based on case-study findings.

KEYWORDS
Group work, inter-disciplinary cohort, self assessment, peer assessment.

Introduction

Group projects are useful learning arrangements in higher education. In general, the units (i.e. subjects) in higher education have some discipline-specific learning requirements and hence the group project works are also mostly discipline based. However, due to growing significance for multi-disciplinary knowledge and inter-disciplinary interfaces in various industries (e.g. global manufacturing, project-based industries such as construction), inter-disciplinary units are also common in many universities. For example, Chettiparamb (2011) discussed some etymological and pedagogical aspects of inter-disciplinary arrangements in UK based urban studies programs.

Gibbs (2010) suggested that 'right' assessment arrangements will motivate and facilitate student learning in the higher education sector. Freeman (1995) indicated that effective assessment of group projects is a difficult challenge. Especially, the objective judgment of individual contributions in group works requires suitable rational arrangements (e.g. Earl, 1986; Cheng and Warren, 2000). Moreover, assessment of group project works in the inter-disciplinary cohort units is much more complicated e.g. due to disciplinary and inter-disciplinary requirements. Our literature review revealed that diverse approaches are being considered for group work assessment in higher education (e.g. Palaneeswaran and Kapoor, 2010). Subsequently, the authors conducted further research to develop rational frameworks for inter-disciplinary group work assessment in higher education, which includes a case-study based exploration in an undergraduate cohort at the National University of Singapore (NUS). This paper presents selected key details of the case-study based explorations.

Case-study overview

The case-study motive and design of research instruments were conceived from the first author's precursor research at the Swinburne University of Technology (SUT). The 'seed-funded' pilot research was sponsored by the Engineering and Science Education Research Group (ESER) in the Faculty of Engineering and Industrial Sciences at SUT. In this pilot research, the first author reviewed specific problems of assessing individual contributions in group work assessments to develop suitable rational arrangements including useful templates and protocols. By customising some of the suitable frameworks for inter-disciplinary group works, the second author led an exploratory research at NUS, which included a case-study in a group work based unit (i.e. subject) that had a large undergraduate cohort drawn from six faculties. The case-study aims at developing harmonious integration of teacher assessments with inter-group peer assessments as well as intra-group peer and self assessments. Hence, the case-study explorations compared the intra-group and inter-group peer assessments by the students with the teacher assessments. A set of quantitative explorations were considered in this case-study explorations, which include: (i) verifying student competencies for self assessment and intra-group peer assessments in inter-disciplinary group works; (ii) gender based comparisons of intra-group assessments to determine whether there is any significant difference; (iii) year of study based comparisons to determine whether there is any bias in this aspect.

The case-study targeted to explore in an undergraduate cohort of *SSD2210 Managing Singapore's Built Environment*, which is a Singapore Studies module taken by different NUS faculties. Mainly, *SSD2210* is based on an inter-disciplinary group work, which included the teacher assessment as well as self and peer assessment by the students. For example, the intra-group self and peer assessment by students constitute 5 per cent of the overall continuous assessment marks in this unit/ subject. Using structured templates, case-study data were collected from (a) intra-group self and peer assessments (i.e. students' assessment of their own group's performance), (b) inter-group peer assessments (i.e. students' assessment of performance of other groups) and (c) teacher assessments for all groups. For example, the inter-group assessment of group work presentations were based

on a 5-point scale – in which "0" being *wrong/ boring*, "1" being *average*, "2" being *above average*, "3" being *very good*, "4" *outstanding* presentation. Similarly, the intra-group assessment of group work was based on a 6-point scale – in which "-1" being *hindrance to the group*, "0" being *no help*, "1" being *not as good as most of the other members in the group*, "2" being *average contributions in the group*, "3" being *better than most of the other members of the group*, "4" being *outstanding contribution in the group*. Table 1 portray a sample set of rubrics used in this case-study to consolidate the perceptions of students on intra-group assessments in a 2011 cohort of SSD2210.

Table 1: A sample extract of rubrics used for intra-group assessments in the case-study

Criteria	Hindrance to group (-1: fail)	No help or insignificant in the group (0: not good)	Not as good as most others in the group (1: just bearable)	Average - same as most others (2: average)	Better than most others in the group (3: very good)	Outstanding contributions in the group (4: Best)
Collection of info/ data	Did not provide any useful data/ information	Data/ Information collected is of no/ little relevance to the group work	Just adequate data/ info collected for group work	Relevant data/ info collected for group work	Very useful data/ info collected for group work	Excellent data/ info collected for group work
Analysis of data/ info	Did not participate in analysing data/ info or wrong analysis	No/ wrong analysis of data, insignificant contributions	Weak data analysis, also inadequate or not specific enough	Average analysis, points are adequate, but not specific enough	Very good contribution, useful data analysis; provided specific useful points	Excellent data analysis, very valuable, demonstrate excellent grasp of knowledge
Contribute in meetings and discussions	No attendance Even if attending, mostly disruptive and hindrance	Contributions in meetings and discussions were not relevant	Sincere attempts for contributions, but those were minimal use and/ or somewhat relevant	Made relevant suggestions and contributions	Made very good suggestions/ contributions - which also set useful directions in group work	Made very significant and valuable contributions – which set noteworthy directions in the project
Preparation of answers/ solutions and report	Did not provide answers/ solutions. Also, mostly disruptive	Provided irrelevant or insignificant contributions only	Some basic answers, limited knowledge on group work topics	Useful answers, adequate knowledge on topics	Appropriate answers, demonstrate reasonable knowledge on topics	Excellent answers with relevant examples, demonstrate broad and in-depth knowledge
Motivation and attitude	Our group would have been better – without this member (proactive and reactive hindrances)	His/ her presence made little/ no difference to the group (mostly reactive)	Passable, but I/ we prefer not to work with this person again (Normally reactive, not proactive)	Reasonable and adequate (mainly reactive, sometimes proactive)	Very good team working and leading (mainly proactive and promptly reactive)	Excellent team working and exemplary leadership (mostly proactive, led by example)

The case-study cohort was in a 2011 semester and comprised 113 students who were drawn from 6 NUS faculties such as Faculty of Arts and Social Sciences, Faculty of Engineering, Faculty of Science, School of Business, School of computing and School of Design and Environment. Out of this, 5 students did not continue and only 108 datasets (including 53 males and 55 females) were available for case study explorations. Figure 1 portrays some basic details of the case-study dataset.
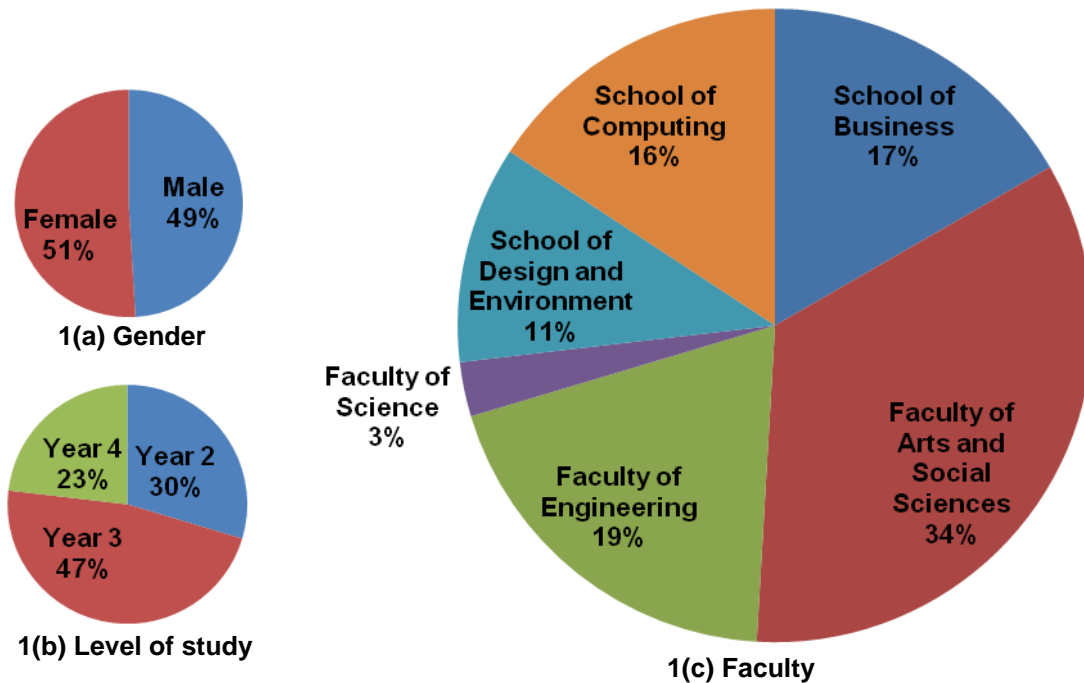

Figure 1: Inter-disciplinary cohort details of case study dataset

Case-study results and discussions

Basic exploration of intra-group self and peer assessment outcomes

Initially, the outlier analysis by Mahanabolis distances was conducted on the case-study data, which revealed that there is no notable outlier. An extract of descriptive statistics and multivariate analysis results are presented in Table 2. The multivariate analysis of case-study observations indicate a higher correlation between "self assessment" and "intra-group peer assessment" i.e. $r = 0.512$ whereas the correlation between "teacher assessment" and "intra-group assessment" is just 0.391. Also, the mean and standard deviation of intra-group self assessment ratings were matching the corresponding values for intra-group peer assessments by students. Such findings are also in line with Zoller and Ben-Chiam (1997) that the students are reasonably competent in self-assessment of group works.

Table 2: An extract of descriptive statistics and multivariate analysis outcomes

Basic exploration	Result
Correlation between self assessment and intra-group peer assessment by students	r = 0.512, significant 2-tailed = 0.000
Correlation between intra-group assessment by students and teacher assessment	r = 0.391, significant 2-tailed = 0.000
Descriptive statistics for self assessments by students	Mean = 16.5741; Standard deviation = 2.5106
Descriptive statistics for intra-group peer assessments by students	Mean = 6.2037; Standard deviation = 1.0569

Comparing self assessment and intra-group ratings of different genders

One-way ANOVA test was conducted to compare the self assessment and intra-group ratings of male and female students. The ANOVA results are presented in Table 3, which highlight that there is no significant difference between the intra-group assessment ratings by male and female students of the case-study cohort (i.e. with 0.05 as the significance level benchmark for the differences). Furthermore, the case-study findings are similar to related observations of previous researchers such as Fachikov and Mangin (1997) and Girard and Pinar (2009) who had also confirmed that the gender of students do not vary the self and peer assessment of group work in higher education.

Table 3: One-way ANOVA test for comparing the intra-group ratings of different genders

Intra-group assessment category	Mean$_{(Males)}$	Mean$_{(Females)}$	F value	Significance "p"
Self assessment	16.6226	16.5273	0.039	0.845
Intra-group peer assessment	6.1321	6.2727	0.476	0.492

Comparing self assessment and intra-group ratings of different levels of study

Similarly, to compare the self assessment and intra-group ratings of students from different levels of study, a set of pair-wise groupings were considered, i.e. comparisons between (a) Year 2 and Year 3, (b) Year 3 and Year 4, and (c) Year 2 and Year 4 students. Accordingly, the one-way ANOVA test results are consolidated in Table 4, Table 5 and Table 6. Interestingly, there is no significant difference in self assessment ratings in all three comparisons.

Table 4: Comparing the intra-group ratings of Year 2 and Year 3 students

Intra-group assessment category	Mean$_{(Year 2)}$	Mean$_{(Year 3)}$	F value	Significance "p"
Self assessment	16.4375	16.2941	1.815	0.183
Intra-group peer assessment	6.5625	5.8235	2.926	0.001

However, the one-way ANOVA results of intra-group peer assessment (Table 4) indicate that there is some significant difference between Year 2 and Year 3 students' intra-group ratings. One potential explanation for this could be the lack of experience/ maturity of Year 2 students. Moreover, from the authors' experience, it is evident that Year 3 students are more careful and conscious about the significance of group assessments.

Table 5: Comparing the intra-group ratings of Year 3 and Year 4 students

Intra-group assessment category	Mean$_{(Year 3)}$	Mean$_{(Year 4)}$	F value	Significance "p"
Self assessment	16.2941	17.3200	2.756	0.101
Intra-group peer assessment	5.8235	6.5200	7.031	0.010

Also, the one-way ANOVA results of intra-group peer assessment (Table 5) indicate that there is a significant difference between Year 3 and Year 4. Although the maturity and experience is not an issue, the brainstorming discussions with few students revealed some possible reasons, e.g. (a) Year 3 students are more competitive and serious for pushing up grades, (b) Year 4 students have other priorities as well in their final year studies (such as their final year project) and higher marks in this inter-disciplinary unit may not significantly alter their overall grades.

Table 6: Comparing the intra-group ratings of Year 2 and Year 4 students

Intra-group assessment category	Mean$_{(Year 2)}$	Mean$_{(Year 4)}$	F value	Significance "p"
Self assessment	16.4375	17.3200	1.815	0.183
Intra-group peer assessment	6.5625	6.5200	0.024	0.877

Interestingly, there is no significant difference observed in the intra-group ratings of Year 2 and Year 4 students (Table 6). Apparently, the Year 3 students seem to be more serious on intra-group peer assessments than Year 2 or Year 4 students. Although some brainstorming and experience based tacit knowledge indicate basic reasons, further research will be useful to identify specific root causes and develop causal maps. As the management of large cohorts will be a difficult challenge, developing suitable software for group work assessments will be useful and such software shall be seamlessly integrate with facilitating online platforms (such as Blackboard).

Conclusions

The case-study findings on intra-group assessments revealed that students are capable of self appraisal of their contributions in inter-disciplinary group work. Also, the case-study observations indicate a significant correlation between self assessment and intra-group peer assessment by students. Interestingly, the comparisons revealed that there is no significant difference between genders. Also, similar observations are found for self assessments of students from different years. Moreover, the systematic assessment framework seems to have improved the motivation of students in group work contributions and assessment.

Basically, the findings reported in this paper are limited to the case-study explorations and may be relevant to similar inter-disciplinary group work based units. The case-study sample and analyses are not adequate to generalise the results and conclusions, even with reference to a particular institution. However, further research to develop rationalising of group work assessments and improving learning arrangements will be useful.

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