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Nurturing entrepreneurial mindset among engineering technology students via blended group activities

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Abstract

In 2015, Malaysia's education transformation plan was introduced in response to global changing employability and job demand specifications, which puts greater emphasis on nurturing graduates with enhanced skills and competence on top of the fundamental technical knowhow. The first key shift in the transformation plan is creating an entrepreneurial mindset, particularly among engineering and technology students in the university. In line with the nation's aspiration, the compulsory course of entrepreneurship which has been incorporated as part of the curriculum for years can no longer be delivered via conventional lectures. Students must be taught to think like an entrepreneur when dealing with technical problems of their respective fields, always weighing the causes and consequences in terms of financial, labour and time costs. In order to engage students in more effective cultivation of an entrepreneurial mindset in class, a series of blended group activities were assigned in accordance with the relevant topics, i.e. organizational structure, marketing, operations and financial management. Each task was accompanied with different materials, including an animated movie, a pre-packed food product, a water conservation initiative, a construction material and an online technopreneurial lecture. These materials were meant to initiate students' active discourse on the specific topics, by relating the course contents with real-life, actual events, products and situations. Working in groups, students were next asked to illustrate their understanding in prescribed worksheets with guided instructions. From the post-activity survey conducted among the students, it was found that these activities did not only help in enabling in-depth understanding of the topics, but also encouraged development of other soft skills otherwise neglected in a conventional lecture session. To moderate assessment in such group settings, a peer assessment exercise was also carried out to ensure fairness in the individual evaluation process. All in all the new approach appeared to be welcome by the students, who considered the blended group activities to be refreshing and stimulating them to think outside the box, inculcating values and skills useful for their future employment in a more and more borderless, challenging world.

Keywords
task-based learning, entrepreneurship, engineering / technology education, soft skills, blended activities

1. Introduction

The proliferation of a variety of entrepreneurial courses and programmes across the different disciplines of study has ensued the promotion of entrepreneurship as an important academic discipline for today's graduates (Piperopoulus, 2012).This is perhaps not surprising, taking into account the proven contribution of entrepreneurial activities towardsa nation's technological development and job creation (Reynolds et al., 2011). Kolvereid & Moen (1997)even posited that the entrepreneurial basic knowledge acquisition is closely linked to greater entrepreneurial enthusiasm and inclination to start new businesses among fresh graduates. Besides, entrepreneurial traits are not necessarily inborn personal characteristics, but a skill set transferrable via teaching (Van der Sluis & Van Praag, 2007). It is therefore imperative that students not enrolled in business studies with compulsory undertaking of the course be exposed to some similar course contents to inculcate the entrepreneurial values to gain an advantageous competitive edge in the growing diversity and connectivity of today's job market. As evidenced by the increased blurring of global boundaries and communication barriershas resulted in unprecedented free-flow of international trade, education and collaborative alliances. Joining the work force of such dynamic nature, it is no longer adequate for graduates to be equipped with technical competence alone, where supplementary skills are necessary to prepare them for the challenges and demands of the globally connected economy.

It was further highlighted byNeck & Greene (2011) that graduates inculcated with entrepreneurial skills, attitudes and abilities usually function as agents of change and make a positive difference at work. As postulated by Zellweger et al.(2011), the undertaking of entrepreneurial courses would either awaken or sharpen the students' entrepreneurial intentions. It follows that awakening the students' enterprising consciousness could effectively give them a valuable competitive edge on top of the technical competencies acquired from the core technical courses. To face and efficiently manage the myriad challenges encountered in the technical field on a regular basis, entrepreneurial characteristics and self-efficacy often associated with business startups could be helpful to nurture the confidence level of technical graduates (McGee et al., 2009). These positive supporting traits could also trigger entrepreneurial intentions (Douglas, 2013), equipping graduateswiththe motivation to engage in innovative business ventures or more relevantly, to drive graduates for career excellence regardless of the field of work. The positively different and astute perspective of work and life in general constitute the cultivation of an "entrepreneurial mindset" among graduates.

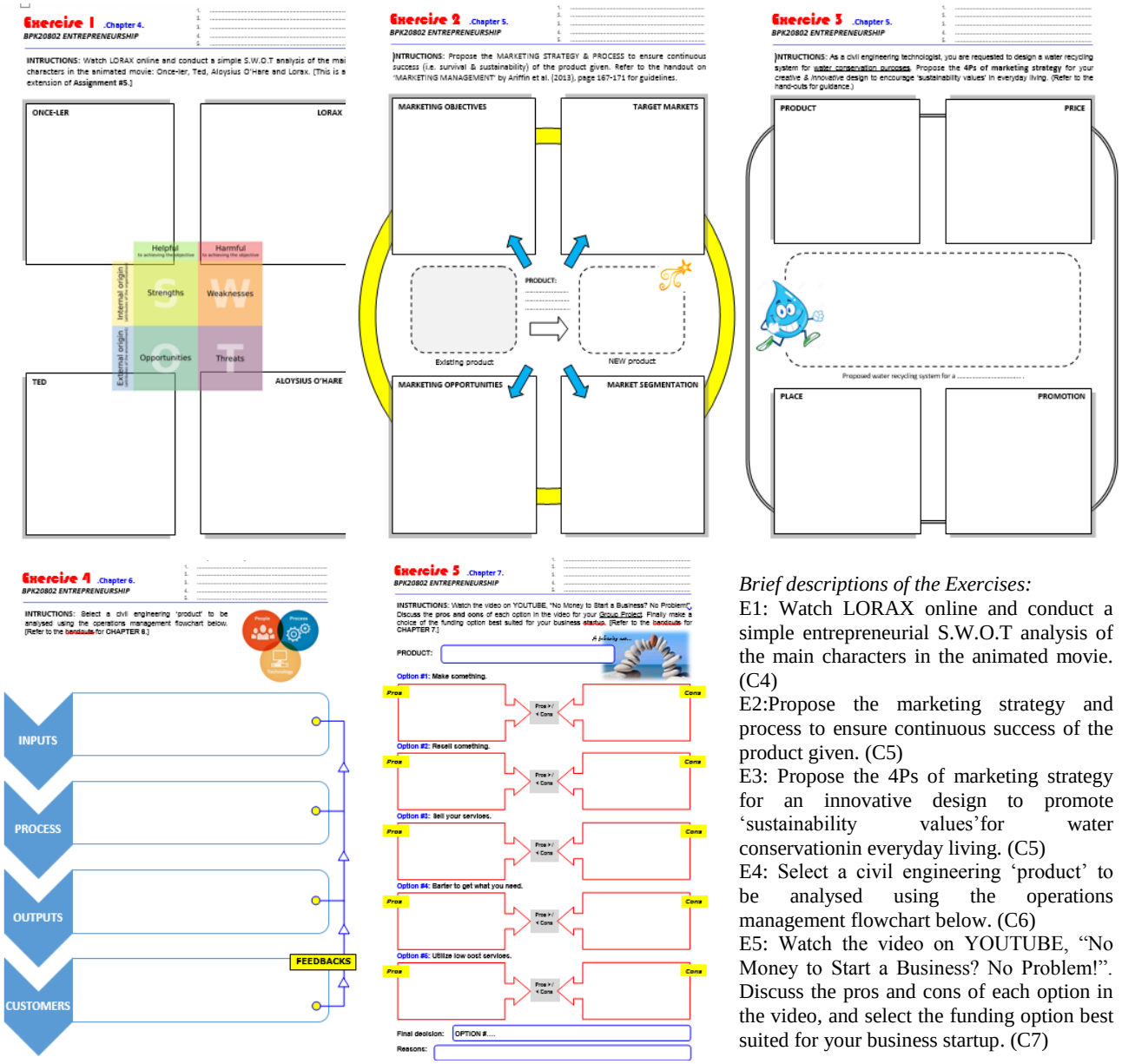
In line with the expediency highlighted above, in 2015, the Ministry of Higher Education Malaysia (MOHE) has launched 10 major shifts in the core functionality of the nation's higher institutions of learning, with the primary aim of nurturing graduates with 21st century aptitude and mindset. The integrated transformational step at tertiary level propounds the cultivation of holistic human capital, with sound technical competencies and equally profound humanistic valuesingrained. The emphasis is placed on the cultivation of an adaptable yet robust character anchored to the tenacity and flexibility of an "entrepreneurial mindset". This paper examines the efficacy of incorporating blended group activities in the compulsory Entrepreneurship course for a class of 22 second year Civil Engineering Technology undergraduates at the University. A total of 5 topical Exercises were completed by the students (divided into 5 groups) in the 14-week semester, corresponding to the key topics outlined in the course syllabus. These group tasks were aimed at facilitatingbetter cognitive grasp of the practical side of the primary entrepreneurialtopics, and encouragingthe development of employability skills lacking in conventional lecture sessions. Performance of the students in these Exercises was analyzed and discussed, with relation to the self- and peer review conducted at the end of the tasks.

2. Course Background

BPK20802 Entrepreneurship is a compulsory course for Civil Engineering Technology year 2 undergraduate students at the University. It consists of 2-hour lecture accompanied by 4 hours of self-regulated practical session weekly. The course encompasses 7 main topics, i.e. (C1) Introduction to Entrepreneurship, (C2) Entrepreneur Characteristics and Motivation, (C3) Screening the Business Environment, (C4) Starting a Business, (C5) Marketing, (C6) Business Operations and (C7) Financing a New Business. The 5 Exercises (E) fell under the category of cognitive learning domain and constituted 5 % of the total cognitive component assessment. The cognitive domain assessment also included a Test and Assignments, but these are not covered in the present discussion.

3. Blended Group Activities

Problem-oriented learning in peer-based and self-regulated small groups is known to be popular in classes of STEM disciplines (Drane et al., 2005). The small group learning platform allows students to engage in more collaborative and less competitive mode of learning, particularly desirable for the under-performing and under-represented students (McLean et al., 2006). According to Hendry et al. (2003), small group learning approach also encourages active participation among students, leading to the sharing and questioning of ideas for deep conceptual learning. Besides, students in small group formations have more opportunities to apply and share prior knowledge in composing solutions to a given problem (Schraw et al., 2006), gradually developing their individual awareness to monitor their own cognition and learning processes (Iiskala et al., 2011). These observations all point to the expediency of engaging students in small group activities for better cognitive learning.



Brief descriptions of the Exercises:
E1: Watch LORAX online and conduct a simple entrepreneurial S.W.O.T analysis of the main characters in the animated movie. (C4)
E2:Propose the marketing strategy and process to ensure continuous success of the product given. (C5)
E3: Propose the 4Ps of marketing strategy for an innovative design to promote 'sustainability values'for water conservationin everyday living. (C5)
E4: Select a civil engineering 'product' to be analysed using the operations management flowchart below. (C6)
E5: Watch the video on YOUTUBE, "No Money to Start a Business? No Problem!". Discuss the pros and cons of each option in the video, and select the funding option best suited for your business startup. (C7)

Figure 1. Exercises assigned to students in the Entrepreneurship class

The blended group activities comprised of 5 topical tasks completed by the students within 30-45 minutes within the 2-hour lecture session. The cognitive learning outcome emphasized on a good grasp of basic concepts and tenets of entrepreneurship. Note that the Exercises were designed according to the second half of the chapters in the course as described earlier, i.e. chapters C4-C7.These topics contained key entrepreneurial components of the course and the Exercises were meant to aid in strengthening the students' understanding as well as putting the topical contents into practical context. Students were first introduced to the topical content through handouts and lectures in the first hour, continued with the group activities in the following hour. The handouts included lecture notes as well as additional reference materials to assist students' learning of the topic via various sources, e.g. technical papers, articles and relevant current data. The students remained in the same group formations for all 5 topical Exercises.

Each task was tailored with a certain solution approach, with a difference product or output expected of every group. The Exercises were pre-printed, with the instructions and solution columns fitted in a single sheet of A4 size paper (Figure 1). The solution column was designed to guide the students in formulating their proposed ideas and solutions in the rather short time frame. Students were observed to demonstrate considerable enthusiasm in their engagement with other members in the group in these sessions. There was also an active interaction with the lecturer who played the role of a facilitator, where one-to-one explanation per group was welcomed by the students for the prompt and direct response to their specific questions or doubts on the Exercises.

4. Cognitive Learning Domain: Group Exercises

Referring to Figure 1, each Exercise presented a problem of a unique nature where the students were required to search for the answers in a different way. Exercise 1 involved critical review of an animated movie in the entrepreneurial context, where each group came up with S.W.O.T analysis of the main characters in making a potential business startup successful (E1-C4). Exercise 2 saw each group being given an existingpre-packed food or beverage product for ideas of betterment of the established brand and product in terms of sales (E2-C5). Exercise 3, on the other hand, related the students' civil engineering technology background with water conservation efforts in a variety of everyday commercial and social activities, i.e. carwash centre, house of worship, dobby, restaurant and water theme park (E3-C5). In Exercise 4, each group selected a building material for a review of the operations management workflow, with inputs of innovative improvement measures (E4-C6). Last but not least, the task for Exercise 5 required students to explore financing opportunities for a startup based on ideas presented in an online video (E5-C7).

Cognitive categorization can be made with reference to Bloom's taxonomy of educational objectives for the 6 levels of cognition as adapted by the Malaysian Qualification agency (MQA), i.e. in the ascending order of remembering, understanding, applying, analyzing, evaluating and creating. The Exercises were laid out topically, assigned and completed with the progress of time in the 14-week semester, where students gained gradual foothold of the course as a whole. Intuitively the tasks would increase in difficulty level from E1 to E5, though in a smooth transition throughout the weeks. Table 1 illustrates the relationship between the cognitive level and Exercises in this respect. Note the transitional cognition level expected of the students in E2 and E4 with shared consecutive thinking levels.

Table 1. Exercises in the cognitive level framework

Exercises	Cognitive Level							
	Remembering	Understanding	Applying	Analyzing		Evaluating		Creating
E1				✓				
E2					✓			
E3						✓		
E4							✓	
E5								✓

5. Results and Discussions

5.1Assessment

It is imperative to provide immediate feedbacks to promote more meaningful knowledge acquisition and retention among the students, as this infuses a healthy dose of competition among individuals and groups vying for the top spot (Hattie & Timperley, 2007). Michaelson & Sweet (2008) went on to claim that immediate feedback is inherent in group-based learning for effective knowledge and application understanding among students, which constitutes

the lower and mid-level of thinking orders for essential knowledge retention (see Table 1). In view of this, the Exercises were therefore marked and returned in the successive lecture session the following week without further delays.

The marks attained by each group in the Exercises are compiled and presented in Figure 2. Note that the average marks for each group is also represented by the line plot for ease of comparison. Per task, the performance was best for Exercise 1 and the least satisfactory for Exercise 2, recording marks of 7.8 and 6.2 out of 10 respectively. This is interesting and unexpected as the level of difficulty for the tasks was raised accordingly (see Table 1). A plausible explanation is that the students were still at exploratory stage of the Exercises and course contents, resulting in the better performance over time. On the other hand, by comparing the Group performance, G1 stood out to be the high flyers rather consistently in all the Exercises (i.e. marks = 8/10), followed by G2, G4 and G5 at second place with average 7/10, while G3 scored 6/10 overall. Observe in the bottom right plot of Figure 2 that G3 registered a rather narrow band in terms of marks attained compared to G1's relatively consistent, broader band of achievement. Indeed G3 showed a continuous dip in performance from E1 to E4 before picking up slightly with E5. Several possible factors are posited: non-uniform distribution of cognition level within the group, lack of team cohesion as well as skills for information search and adoption. These are further discussed in the following sections.

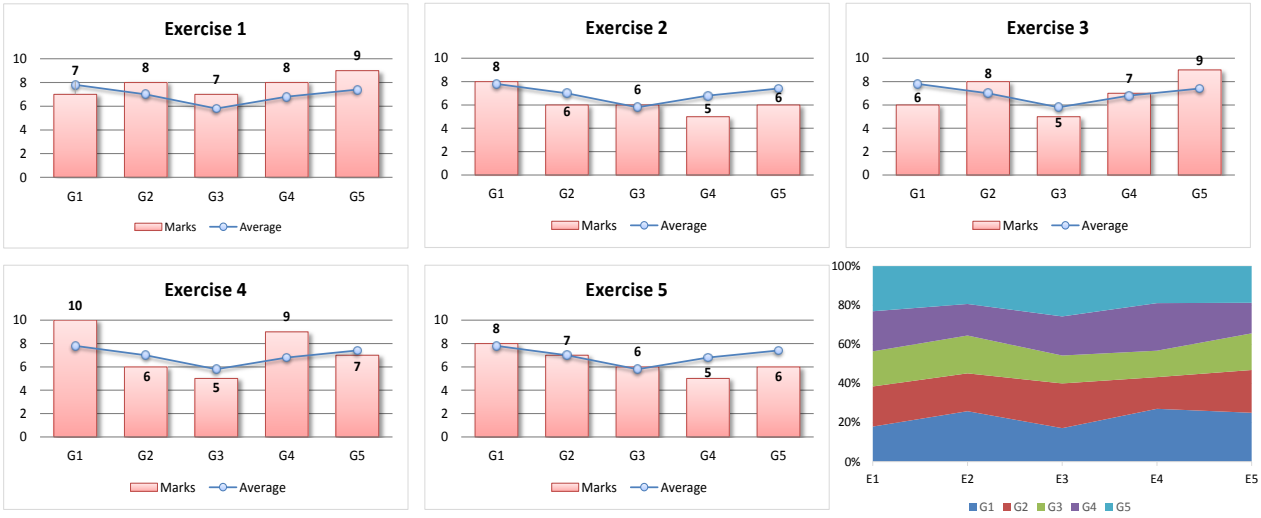


Figure 2. Performance of individual groups for each Exercise (full marks = 10)

5.2Self-Review per Exercise

At the end of each Exercise, the students were asked to complete a simple self-review to gauge their perception on the relevance of the task as well as its contribution towards their cognitive learning and certain soft skills cultivation. On a scale of 1 to 5, the questions are as follows:

1. The task is related to the topic.
2. I find my learning to be more effective.
3. It is fun learning this way.
4. It drives me to explore new skills.
5. My teamworking skills are improved.
6. I find my language skills getting better.
7. The task helps to develop my presentation skills.
8. I learn to search for information more effectively.
9. I can relate the task contents with other courses in the Civil Engineering Technology programme.
10. The task helps in my organisational skills.

The students' responses are captured in Figure 3 per group. The dashed line included in every plot represents the average score for each question by the entire class. All in all, focusing on the top 5 highest scored outcomes, the students found the Exercises to be a novel approach in learning and most impactful in training them to work as a team. The group learning experience also enhanced their learning experience and effectiveness, and improved their information management as well organizational skills. This was clearly displayed in the students engaged in

browsing internet resources ad hoc using personal mobile devices for information in a structured manner, where each group member was assigned a specific component of the Exercise to address.

It is interesting to note that G2, G3 and G5 showed remarkable corresponding scores with the overall average, while G1 and G4 scored above and below the average respectively. Referring to G1's exceptional performance in 5.1 and Figure 2, the group'sself-review suggests a positive outlook of the tasks, particularly with regard to working as a team, command of English for effective communication, search and utilization of external sources for learning. G4, on the other hand, seemed to be of low opinion of the tasks' impact on their learning. Coincidentally or not, G4 was also the second last ranked group in terms of the assessment (Figure 2). On average, G1 scored the highest at 4.7/5.0, corresponding with the best performance as discussed in 5.1. G4 had the lowest scores in this survey, i.e. 4.1/5.0, though the group ranked number 2 overall in the assessment. It can be observed that the high flyers (G1) had matching outlook of their work with the group performance, as reflected in the positive perception expressed in the self-review and the marks.

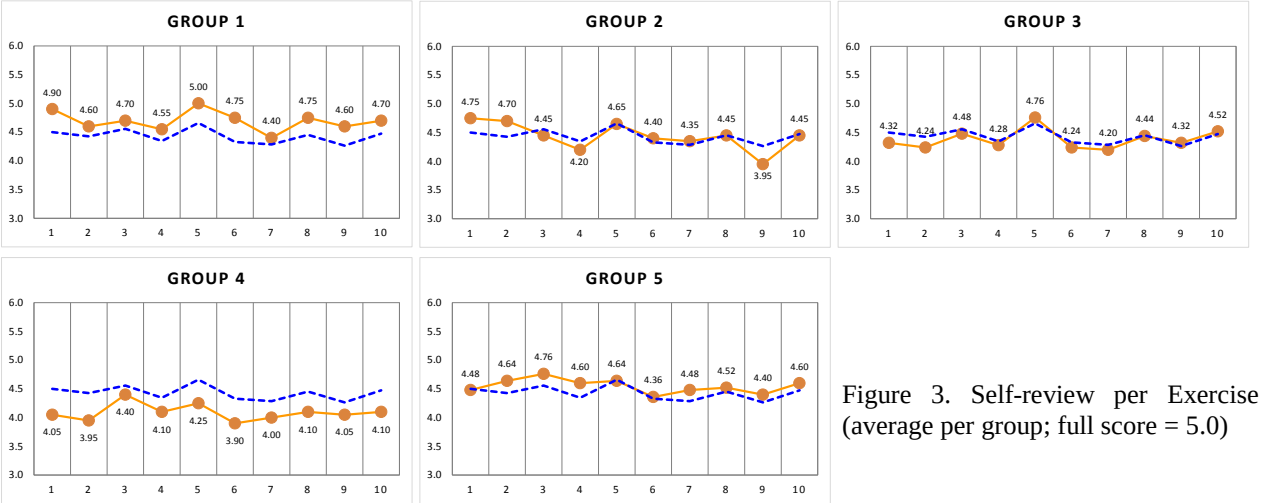


Figure 3. Self-review per Exercise (average per group; full score = 5.0)

5.3SummativeSelf- and GroupReviews

At the end of the group tasks (E1 to E5), all students completed a summative self- and group reviews on the overall effectiveness of the Exercises. On a scale of 1 to 5, each student identified the extent of his/her entrepreneurial cognitive development as well as soft skills cultivation. The questions posed in the survey was divided into self (SA and group (GA) assessments:

1. I/We explore and learn new skills from completing these tasks.
2. I/We improve teamworking skills as a whole (being a leader and team member).
3. I/We am/are now more confident in making oral presentations.
4. I/We understand the respective topics better by completing the tasks.
5. I/We learn to work in a more systematic and organised way (shared responsibilities).

Summary of the summative reviews per Exercises and per group are shown in Figures 4 and 5. The average scores are incorporated as a line plot in the same figures. Element-wise, the students reckoned new skills acquisition and systematic working approach to be the most significant outcomes of the tasks, in both self- and group reviews (Figure 4). Nonetheless, improvement of communication skills (see 5.2) did not seem to be accompanied by a substantial boost of the students' confidence in making oral presentation in English, where the element was rated the lowest in both self- and group summative reviews. Hypothetically it was a good start as similar exposure and training in other / future courses would help build the students' confidence level for public presentations.

Reviews per group, however, shed light on the students' self-perception and judgment of their respective group as a whole (Figure 5). The average scores for self- and group reviews were found to be in the descending order of G1=G3 > G2 > G5 > G4 (score range 4.1-4.9), and G3 > G1=G2 > G5 > G4 (score range: 4.4-5.0) respectively. Note the distinct demarcation of the top 3 and bottom 2 groups distribution in both cases, which agreed well with the group performance for G1 and G5 only, as the top and bottom scorer as a whole. G2, ranked number 2 in the assessment showed self- and group perceptions which fell in the mid-range in both cases. Also,G4 which ranked number 3 in the assessment rated themselves in the most severe manner for both self- and group reviews, i.e. lowest

scores for the summative self- and group reviews. It would appear that both G2 and G4 did fairly well in the Exercises but were laden with a self-deprecatory attitude if not lack of confidence in their good work. On the other end of the spectrum, G3 reported seemingly affirmatory self- and group reviews but fared poorly in the assessment. This is suggestive of either over confidence in terms of the group's competence or latent talent waiting to be tapped and harnessed.

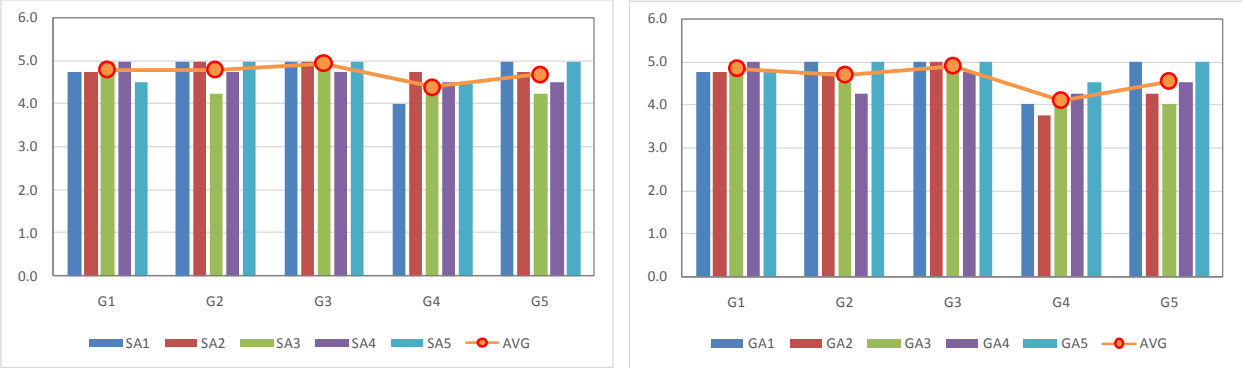


Figure 4. Overall self- and group reviews on impact of the Exercises (per group; full score = 5.0)

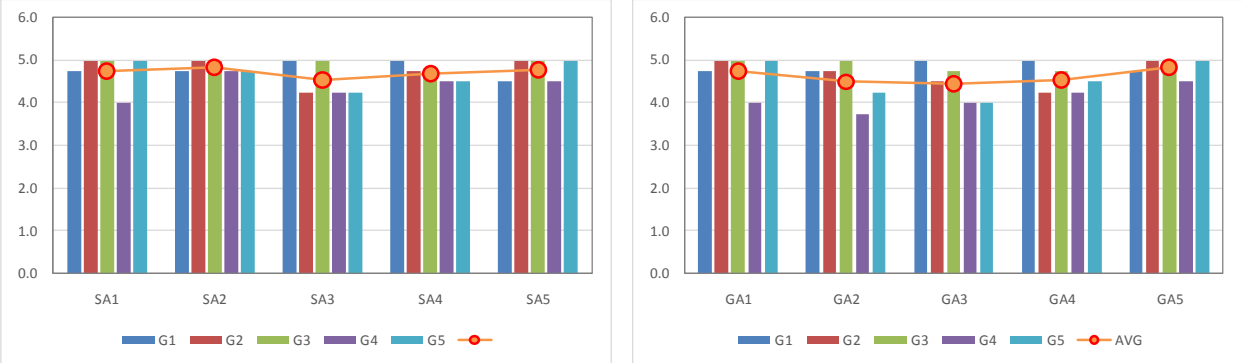


Figure 5. Overall self- and group reviews on impact of the Exercises (per element; full score = 5.0)

5. Conclusions

The blended group activities were found to be remarkably well received among technical students for the Entrepreneurship course. Key findings made from the assessment and reviews are summarized as follows:

a. Overall G1 had the best performance in the Exercises category. The poorer performance of other groups, especially G3, is attributed to the possible lack of uniform cognitive levels and relevant skills among the group members.
b. Self-review completed by the students revealed a good match between good performance in the Exercises and positive perception of the group tasks in general, with the most discernible impact being reported in the areas of learning effectiveness, teamworking, organizational and information management skills.
c. Self-awareness of better communication skills was not perceived to go hand in hand with a growth of confidence level among the students for making open presentations, whether individually or as a group. This is perhaps not too disappointing as a starting point to groom the students for oral presentation in future.
d. Summative self- and group reviews gave a mixed reflection of the actual performance per group, where highly positive reviews did not always concur with good performance and vice versa. Nevertheless the best group (G1) demonstrated compatible reviews and performance, strengthening the proposition that the effectiveness of group learning is closely related with the team's shared cohesion, understanding and aspiration to excel.

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