Using a Community of Practice
to Enhance Undergraduate
Students’ Graduate Attributes
Through Problem-Based Learning

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Recently, increasing emphasis has been placed on university graduates’ attainment of generic capabilities that enable them to function effectively as citizens in both local and international communities. In this connection, this community of practice attempts to assess how well our students have attained the seven Hong Kong Baptist University Graduate Attributes (GAs) through their
participation in problem-based learning (PBL). A mixed-methods model was adopted. A total of 313 students from 10 academic courses completed both pre- and post-GA surveys, and the paired samples t-test indicated a significant increase in students’ perceived attainment of 14 GA subcategories in the post-PBL intervention scores. Qualitative data from the focus group interviews also provided evidence to support that the PBL intervention did have a positive effect in four of the GA subcategories, namely, Social Responsibility, Problem Solving, Critical Thinking, and Teamwork.

The primary aim of education is to help students learn how to learn. In addition to acquiring knowledge, skills, and attitudes that are pertinent to the discipline or profession studied, university graduates should attain generic capabilities and attitudes, such as critical thinking, problem solving, teamwork, social responsibility, and communication skills, which are embedded in the seven Graduate Attributes (GAs) of Hong Kong Baptist University (HBKU): citizenship, knowledge, learning, skills, creativity, communication, and teamwork. These attributes enable students to function effectively as citizens in both local and international communities. In other words, the goal of education is to nurture our students and develop them as whole persons. In Hong Kong, the issues of whole person development and well-rounded skills recently addressed by the University Grants Committee (2005) significantly impacted the need to include components within curricula to help students acquire generic capabilities.

The “Rainbow Team” is a community of practice (CoP) that was established at HKBU in July 2013. This CoP acknowledges that many of the whole-person attributes are developed through a wide range of extra- and co-curricular activities offered by various teaching support and administrative units, e.g., the Office of Student Affairs, the Library, and the Centre for Holistic Teaching and Learning. The CoP, however, wanted to emphasize the re-structuring of academic courses and the adoption of new pedagogies to assist students to achieve whole-person development.

With the full implementation of outcomes-based teaching and learning and the adoption of criterion-referenced assessment at HKBU, there is an expectation that evidence will be shown of students’ achievement of the seven GAs and the GA subcategories (Wong et al., 2016; see Table 1) exhibiting the characteristics of HKBU’s Whole Person Education. Since GAs and the learning outcomes of courses and programs are all constructively aligned through curriculum mappings, the evidence in ascertaining how well students have attained the GAs relies principally on
assessments at the course level.

In this connection, the Rainbow CoP gathered a group of academic and administrative colleagues who were interested in adopting innovative pedagogies to improve students' learning and to assess how well students had attained the GAs through their participation in classroom activities and/or specially designed projects, e.g., embedding the assessment of the selected GAs in the CoP members’ own courses. Thus, the goal of the CoP has been to assess students’ attainment of GAs through a kind of teaching and learning activity, problem-based learning (PBL). PBL has been practiced in class and/or out of class by teaching colleagues in this CoP for at least one academic year (2012-2013). Members of the CoP have a consensus that PBL can assist students in attaining the seven GAs, particularly the following elements of individual GAs: (a) Social Responsibility in the GA Citizenship; (b) Problem-Solving Skills in the GA Skills; (c) Critical Thinking in the GA Creativity; and (d) Teamwork Skills in the GA Teamwork. The reasons for putting an emphasis on the above four and for choosing PBL are as follows:

1. Along with good technical understanding and subject knowledge, employers often outline a set of skills that they want from an employee. Members of our CoP believe that both problem-solving and critical-thinking skills are important transferable skills our university graduates need to make them “employable.”

2. PBL was defined as “the learning that results from the process of working towards the understanding of a resolution of a problem. The problem is encountered first in the learning process” (Barrett & Moore, 2011, p. 4; Barrows & Tamblyn, 1980, p. 1). This teaching method is generally accepted as an arrangement that incorporates many elements of an ideal environment for student learning. PBL is widely used in medical and professional training in both international and local settings. With the aim of (a) structuring knowledge for better recall, (b) developing an effective reasoning process, (c) developing self-directed learning, and (d) increasing motivation for learning, students can learn through the systematic exploration and investigation of problems on their own, with support from their teachers.

3. Critical thinking is the cognitive engine for making better judgments and independent real-world decisions. It is the ability to make judgements based on interpretation, analysis, evaluation, and inference (Facione & Facione, 1996). Competence in critical thinking is one of the expectations of higher education (Ozturk, Muslu, & Dicle, 2008).

4. The obvious characteristic exhibited by HKBU graduates is “kind-heartedness.” Our goal is to instill in our graduates a sense of social responsibility, developing their spirituality and morality to guide
them to wellness in life. With the GA Citizenship being a definitive attribute of Whole-Person Education at HKBU, it is important to design a teaching and learning strategy that can raise students’ sense of social responsibility in internal and external communities.

5. Working well with other people from different disciplines, backgrounds, and expertise is essential to accomplish a task or goal. It is believed that PBL can help improve students’ teamwork and problem-solving skills as well as civic awareness.

Therefore, this study sought to investigate the impact of the CoP-focused pedagogy, PBL, on students’ attainment/improvement of critical thinking skills, problem-solving skills, social responsibility, and teamwork.

**Methods**

This study adopted a mixed-methods model that involved the collection of both quantitative and qualitative data (Creswell, 2014; Tashakkori & Teddlie, 2010) by closed-ended and open-ended questions aimed at exploring the impact of PBL on student attainment of the four focused GA subcategories. All participating instructors agreed to implement their PBL activities from week 3 to week 10 in their 12-week courses. GA Surveys (see Appendix A) with the keywords of the 17 GA subcategories stated were administered in each course, before and after the PBL activities. The GA survey aimed to collect students’ self-evaluation of their attainment of the 17 GA subcategories based on their learning experience before and after the PBL intervention.

A paired samples t test was used to analyze whether there was any significant pre-post difference between the paired samples in the courses (Field, 2009).

After analyzing the quantitative survey data, the preliminary quantitative results were used to develop questions for semi-structured student focus groups. The focus groups aimed to collect students’ perceptions of their learning experiences in their courses. Each discussion was audio recorded with the students’ consent. Coding and memoing (Bailey, 2007) techniques were applied to the focus group transcripts to summarize the qualitative data. The salient excerpts were consolidated with the quantitative findings for triangulation and integration.

The above procedures were repeated in the ensuing academic term (2014-15) for the two courses that are the same. An independent samples t test was used to compare the quantitative data of the two identical courses in the different academic terms in order to determine whether there were any statistically significant differences between the mean scores involved in the two courses (Johnson & Christensen, 2008).

Qualitative focus group data from all of the involved courses in the
Results

Quantitative Survey

A total of 313 students from 10 academic courses completed both pre- and post-GA surveys by the end of the second term of this project (see Appendix B). Only the eight courses with a response rate of over 50% were included for the paired samples t-test analysis. Thus, after excluding the student responses from Courses A and I, the number of students included in the analysis was 298 (65.6% response rate), of which 38.6% were male and 61.4% were female (see Table 1). The details of the participating courses and their respective PBL activities are listed in Appendix B.

Figure 1 shows the overall mean scores of students’ self-perceived attainment of the 17 GA subcategories before and after the PBL intervention. The paired samples t test indicates a significant increase in students’ perceived attainment of 14 GA subcategories in the post-PBL intervention scores (* = p < 0.05; ** = p < 0.01; *** = p < 0.001). That is, the effect of PBL-based teaching and learning in the eight courses helped to facilitate students’ development in these 14 GA subcategories. Three GA subcategories, Ethical Reasoning, Critical Thinking, and Teamwork do not have significant pre-post differences, which required further investigation through focus group interviews.

Based on the independent samples t test, no significant gender difference is observed when comparing the differences in the pre-post scores of male and female students (see Table 1). However, a relatively similar pattern of statistically significant pre-post differences is observed between the two groups.

Table 2 shows the statistically significant differences of the pre- and post-GAs surveys across the eight PBL-included courses. The paired samples t test indicates that all courses, except Course E, have significant pre-post differences in various GA subcategories. While the majority of the significant differences reflect an improvement in students’ attainment of various GA subcategories, that is, with the post-scores being significantly higher than the pre-scores, an exception is found in Course C, with a post-score for Self-Development/Spirituality that is significantly lower than the pre-score. The adoption of PBL learning activities in the eight courses to improve students’ attainment of the four focused GA subcategories, Social Responsibility, Problem Solving, Critical Thinking, and Teamwork, does not seem very effective. However, for the two GA subcategories Interdisciplinary Knowledge and Creative Thinking,
significant pre-post differences have been found in five courses. It is worth noting that there was a repeat offering of two courses in the first and second terms by the same teacher: Courses C and G on photography and Courses D and H on University English, although there were two different sets of students. The adoption of PBL in the second run of these two courses reveals a significant impact on students’ attainment of various GA subcategories.

The pre-post differences of Courses C and G and Courses D and H are shown in Figure 2 and Figure 3, respectively. Statistically significant improvement is observed in the second run of Course G on students’ attainment of Social Responsibility, Lifelong Learning, Critical Thinking, Creative Thinking, Oral Communication, and Health Awareness when comparing the differences in the pre-post scores of Course G and Course C (first run), based on the independent samples t test.

Similarly, based on the independent samples t test, when comparing the differences in pre-post scores of Course H and Course D, statistically significant improvement is observed in the second run of Course H, compared with the first run of Course D, with respect to Lifelong Learning, Problem Solving, and Oral Communication.

Qualitative Interviews

After comparing and contrasting all of the student survey data from the eight courses, in-depth semi-structured focus group interviews were conducted with students to understand their learning experiences in these courses and to explore whether and how PBL helped them to achieve the four focused GA subcategories (see Table 4).

A total of 13 focus group interviews were conducted within one month after the last day of teaching. Each focus group comprised one to seven students from different disciplines, covering all of the eight courses. Individual interviews for the two teachers of the photography course and the University English course were also conducted, which helped to explain the reasons for a significant improvement in students’ attainment of various GA subcategories in the second run of these two courses (see Discussion).

Most of the students in the focus group interviews could give examples of PBL-related activities and could explain how these activities facilitated their attainment of or improvement in the attributes of Social Responsibility, Problem Solving, Critical Thinking, and Teamwork (see Table 3). An analysis of the four themes by PBL activities that appeared from the focus group discussions was conducted, and the result is illustrated in Table 4.
Discussion

Our CoP is based on a group of teaching and administrative staff who have developed and cultivated a spirit of collegiality through involvement in various social and academic activities over the past three years, which include engaging in the social functions of the University, such as annual Christmas dinners, frequent lunch and dinner gatherings, karaoke, workshops, and conferences, during which we shared our CoP work with colleagues and academics from other universities. The Rainbow CoP Team, therefore, has a fairly strong foundation built on trust and willingness to share teaching experiences. Another unique feature of the Rainbow Team is its composition of teaching staff from all of the schools/faculties of the university, so there is no single unit that dominates the group. In the CoP, there are members with diverse expertise, ranging from Arts (Language), Communication (Film), Business (Marketing), Social Sciences (Physical Education, History), to Science (Biology) and Medicine (Chinese Medicine). In addition to sharing experiences on teaching and learning internally, in the spirit of a successful CoP (Cox, 2014; Cox & Richlin, 2004), the Rainbow Team strove for better teaching through the adoption of different teaching pedagogies, the assessment of their impact on the learning of students from different disciplines, and, ultimately, the development of a scholarship of teaching and learning through sharing the CoP findings with the academic community. Inspired by the experience, sub-CoPs of the Rainbow Team were also formed to assess students’ development of teamwork skills (Lau & Kwon, 2016) and the impact of peer tutoring in a language classroom (Ng & Lau, 2016).

This article details the PBL approach adopted and the impact that the intervention has had on students’ attainment of different subcategories of the GAs. After the introduction of PBL, from the overall mean scores of students’ self-perceived attainment it can be observed that there is significant improvement in the attainment of the Social Responsibility and Problem Solving GAs in some courses (see Table 2). However, perhaps surprisingly, no significant improvement in the GAs on critical thinking and teamwork is found, although some degree of increase is observed. This may be attributed to the diverse nature and emphasis of the different courses in this study, as can be reflected in the significant changes in different GAs in the pre- and post-PBL interventions among the different courses. For example, the courses in Biochemistry and Molecular Biology with problem-based questions concerning space travel to Mars would undoubtedly involve interdisciplinary knowledge and quantitative reasoning. The course in the Foreign Relations of Modern China (History) would require cross-cultural competence. However, the course in Marketing Management would involve disciplinary knowledge, cross-cultural experience, and teamwork. Interestingly, although there are
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reports suggesting that there may be gender differences in relationships between team members’ awareness of one’s emotions and team effectiveness in PBL projects (Dunaway, 2013), these differences have not been observed in the 17 subcategories of the GAs when comparing the pre- and post-scores of the male and female students, respectively (see Table 1).

Although quantitatively, no significant difference was shown in the GAs on Social Responsibility, Problem-Solving, Critical Thinking, and Teamwork, it was evident from the qualitative analysis based on student feedback from the focus groups that the PBL interventions in the different courses did have some impact on the students in these four areas (see Table 3). Upon more detailed analysis of the responses from the students interviewed in the focus groups, it was found that the PBL activities do seem to help them achieve the four GA subcategories mentioned above (see Table 4). For example, in the course under the Chinese medicine discipline, the students found that the research element in the PBL approach to topics such as “New air pollution index” and “Space travel to Mars” increased their awareness in terms of social responsibility and also their critical-thinking and problem-solving skills, and working in groups improved their spirit of teamwork. Similar findings were also reported in the course on Marketing, in which the students believe that the PBL project in developing a marketing plan helped them to become more socially responsible, effective team players and benefited their problem-solving skills and critical thinking. These results align closely with the PBL activities designed by our teachers when they implemented PBL in their courses (see Appendix B).

Among the courses involved in this study, two of them, namely the Principles of Photo Imaging (Courses C and G) (Communication) and University English (Courses D and H) (Arts), had PBL interventions employed for two consecutive terms (Terms 1 and 2). It is interesting to note that there was marked improvement in both courses when they were run the second round. For the course Principles of Photo Imaging, in term 1, there were no significant changes in any of the 17 GA subcategories except Spirituality (with a significant decrease in the mean score after the PBL intervention) (see Table 1). When the course was repeated in Term 2, there were significant increases in areas such as Social Responsibility, Ethical Reasoning, Interdisciplinary Knowledge, Lifelong Learning, Spirituality, Information Literacy, Technological Literacy, Creative and Critical Thinking, and Oral and Written Communication (see Table 1). In the CoP, through the monthly regular meetings, there was often sharing about teaching experiences among the members. This undoubtedly encouraged self-reflection and a desire among the members to constantly improve their teaching. These have been shown to be essential elements in the development of professionalism in teaching (Goh & Loh, 2013;
Rabikowska, 2009).

In the case of the course on photography, based on the feedback from the first term trial, the staff member concerned made improvements in the second run by having more field trips, well-designed homework, and activity feedback forms. Above all, the instructor allowed more interactions with individual students and showed more concern for their work. Similar findings were also observed in the University English course in which the staff member, based on the survey results in the first run, provided more specific feedback to students and gave them more challenging tasks in the second run, resulting in significant improvements in areas such as Disciplinary and Interdisciplinary Knowledge, Lifelong Learning, Spirituality, Creative Thinking, and Oral Communication (A. Ng, personal communication, 28 May 2015). As the research is ongoing, it will be interesting to see if a similar impact, based on sharing of teaching experiences and self-reflection that are well fostered and promoted in a CoP environment, can be observed for the other courses.

Conclusion

University students perceived that they achieved higher attainment of 14 GA subcategories after PBL teaching and learning experiences. In addition, the qualitative data from focus group interviews supported a positive effect in the GA areas of Social Responsibility, Problem Solving, Critical Thinking, and Teamwork. The repeat running of the same course with improved pedagogies based on the findings in the previous course proved to be beneficial to the overall enhancement of the GAs. The findings from this CoP project will contribute to the knowledge base of teaching and learning in higher education. The CoP is planning to invite individuals from other universities world-wide to create a global CoP to enhance students’ attainment of graduate attributes.

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References


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Table 1
Gender Comparison of Pre-Post Differences on the GAs Survey

<table>
<thead>
<tr>
<th>GAs</th>
<th>Male (38.6%)</th>
<th>Female (61.4%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre</td>
<td>Post</td>
</tr>
<tr>
<td>Citizenship</td>
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<td>7.29 **</td>
</tr>
<tr>
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<td></td>
</tr>
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<td>6.59</td>
<td>7.32 ***</td>
</tr>
<tr>
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<td>7.83 **</td>
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<td>6.95</td>
<td>7.26 *</td>
</tr>
<tr>
<td>09 Technological Literacy</td>
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<td>7.09 **</td>
</tr>
<tr>
<td>10 Problem Solving</td>
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<td>7.69 *</td>
</tr>
<tr>
<td>11 Quantitative Reasoning</td>
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<td>6.90 **</td>
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<td>17 Health Awareness</td>
<td>6.94</td>
<td>7.50 **</td>
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Note.
* = p≤0.05; ** = p≤0.01; *** = p≤0.001
Table 2
Pre-Post Difference in Students’ Self-Perceived Attainment of Graduate Attributes (GAS) Subcategories Before and After Taking PBL-Based Courses

<table>
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<th>Course</th>
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<th>C</th>
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<td>8.52</td>
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<td>13 Creative Thinking</td>
<td>6.00</td>
<td>7.00*</td>
<td>8.04</td>
<td>7.92</td>
<td>6.54</td>
<td>6.82</td>
<td>6.98</td>
<td>6.80</td>
</tr>
<tr>
<td>Communication</td>
<td>14 Oral Communication</td>
<td>6.67</td>
<td>6.85</td>
<td>7.76</td>
<td>7.44</td>
<td>7.27</td>
<td>7.45</td>
<td>7.48</td>
<td>7.64</td>
</tr>
<tr>
<td></td>
<td>15 Written Communication</td>
<td>6.67</td>
<td>7.07</td>
<td>7.40</td>
<td>7.60</td>
<td>7.27</td>
<td>7.68*</td>
<td>7.36</td>
<td>7.50</td>
</tr>
<tr>
<td>Teamwork</td>
<td>16 Teamwork</td>
<td>7.26</td>
<td>7.63</td>
<td>8.28</td>
<td>7.80</td>
<td>7.57</td>
<td>7.77</td>
<td>8.07</td>
<td>8.00</td>
</tr>
<tr>
<td></td>
<td>17 Health Awareness</td>
<td>6.93</td>
<td>6.96</td>
<td>7.88</td>
<td>7.20</td>
<td>6.71</td>
<td>7.77***</td>
<td>8.11</td>
<td>8.00</td>
</tr>
</tbody>
</table>

Note:
* = p<0.05; ** = p<0.01; *** = p<0.001
On the other hand, it is believed that the most significant impact which this PBL component benefited to us is that students are being motivated to learn more about latest social policies such as the implementation of Air Quality Health Index (AQHI). Therefore, we can be more familiar with the trend of the development in our society and our social awareness is also enhanced. (Student 6, Course B, Term 1)

This PBL project slightly enhanced my “Citizenship – Social Responsibility”. For example, I learnt more about the developmental history of public housing estates in Hong Kong. I became more aware of the importance of conservation and revitalization of historical monuments. Also, the environment in the housing estate is special. For example, when you work along the corridor in the housing estate, you can listen to the songs sung by the elderly. Besides, some flats in the housing estates are illuminated by natural sunlight. Moreover, some housing estates such as Tai Hung Tung Estate even don’t have an elevator. The design of those old housing estates is like a prison and is completely different from that of contemporary housing estates. As I have never lived in a public housing estate, such scenery is quite fascinating to me. (Student 40, Course G, Term 2)

Which Graduate Attributes did you improve after completing this PBL project? The first one is “social responsibility” as we learnt more about social enterprise and it is very meaningful towards students. (Student 16, Course J, Term 2)

From the prospective of Citizenship, we have been benefited in “Social Responsibility” and “Cross Cultural Competence”. There is an exchange student in our group. As he isn’t familiar with the situation in Hong Kong, we need to introduce the background information to him. This exchange student comes from France. He introduced the European operational model of social enterprise to us. Then we tried to compare the operational models of social enterprise between Europe and Hong Kong and we try to find out if there are any significant differences between them. (Student 17, Course J, Term 2)

The first Graduate Attribute which I had great improvement is “Citizenship” as we proposed to establish a social enterprise in our PBL project. Although Hong Kong is a developed region, some Hong Kong citizens are living below the poverty line. We become more familiar with this social phenomenon. As a member of the community, I realize that I can improve the living standard of the general public by contributing to the society after graduation. In the old mindset, business students are only concerned about profit making which leads to greater economic inequality. Therefore, I believe that this kind of PBL project related to social enterprises is very meaningful and essential for students. (Student 28, Course J, Term 2)

We need to identify the problem by ourselves and then work out a feasible solution to address the problem. The PBL project trained us to work out a solution in an unfamiliar situation. However, the most common source of solution is researching from the Internet. (Student 15, Course B, Term 1)

As my major of study is Film and Media, I’m quite familiar with the operation of a camera such as adjusting the aperture and ISO, etc. The problem which I need to tackle during the PBL project is related to geographical knowledge. Sometimes, not every area of a housing estate is open to public. If you really want to visit there and take some photos, you may need to try to contact some friends of friends for easier access. (Student 40, Course G, Term 2)

Besides, this PBL project helped us improved our problem solving skills. It helps us cultivate a logical and analytical mind when we deal with a problem. (Student 16, Course J, Term 2)

This Marketing plan PBL project significantly improved my “Creative Thinking” as well as “Critical Thinking”. When designing a new product or service for a social enterprise, we need to unleash our creativity in order to generate some innovative ideas. After that, we need to adopt “Critical Thinking” in order to evaluate every idea based on certain criteria and determine if it is feasible to launch it in the reality. For example, if our target customers are foreigners or children, we need to find out the facts and figures such as the number of foreign visitors to Hong Kong per year in order to support our ideas. Therefore, we need to keep a balance between “Creative Thinking” and “ Critical Thinking”. (Student 17, Course J, Term 2)

I would like to make some supplementary comments on “Creativity – Creative Thinking”. Since we need to create a kind of new product or service, “creativity” plays an important role during the process. On the other hand, from the prospective of “Creativity – Critical Thinking”, as we are operating a social enterprise, we need to think about when a company makes profit, whether the company also needs to fulfill certain degree of corporate social responsibility. (Student 28, Course J, Term 2)
I believe that “Teamwork” is the Graduate Attribute that we improved most. It is because some complicated tasks such as producing photos in the dark room and tuning the settings in the studio can only be accomplished with concerted efforts of group mates. For instance, in the dark room, you need to be aware of the actions taken by your teammates. Before taking a particular action such as switching on the light, you need to inform all members in advance. Otherwise, you may adversely affect your teammates. In case your teammate is producing photos in the dark rooms and you open the door without prior notice, all the efforts will be in vain. In addition, during the process, we need to discuss whether the light exposure is optimal, whether the quality of the photo chemical is appropriate. When we work on our group project, we need to have consensus to set the direction of our project. After that, we need to assign tasks to the most suitable teammates. In the actual implementation, we need to discuss the setting of lighting, equipment and the angle of shooting. Finally, we have to discuss the flow of our presentation. (Student 1, Course C, Term 1)

My “teamwork skill” and “Communication Skill” were greatly improved. Regarding “Teamwork”, it would be difficult to cooperate during the debating session if someone focuses on reading the script word by word. Besides, the views between group members were quite diversified. There are two sub-teams in our debating group: for- team and against- team. It is possible that you personally favor the issue but are assigned to argue against it. Therefore, quarrels will often occur. (Student 12, Course D, Term 1)

Regarding “Team Building”, I benefited a lot in this aspect. In our project group, all of us are year 2 students and we are usually very busy in our studies. Therefore, good teamwork is required for smooth cooperation. We encountered various kinds of problems when working on our PBL project. For instance, the views of our members were quite diversified and sometimes led to quarrels. We have improved our teamwork skills after solving those problems. (Student 16, Course J, Term 2)

I’m deeply impressed by (our) “Teamwork”. Our Marketing project is related to a “Rational Buying Process”. We adopted a case in order to illustrate the idea. The characteristic of case analysis is that every part in the case is closely related and cohesive. Therefore, when I worked on part 3, I needed to coordinate well with my group mates who were responsible for part 2 and even part 4. If the coordination is not very good, the case would become unrealistic even if we applied the Marketing concepts exceptionally well. We wish to show a realistic scenario to our audiences. (Student 21, Course J, Term 2)
### Table 4
Focus Group Report: PBL Activities That Helped Students Achieve the Four Focus GA Subcategories

<table>
<thead>
<tr>
<th>Course</th>
<th>Discipline</th>
<th>PBL Activities as Described By Students That Helped Them Achieve the Four Focus GA Subcategories</th>
<th>Social Responsibility</th>
<th>Problem Solving</th>
<th>Critical Thinking</th>
<th>Teamwork</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Biology</td>
<td>(1) Review of journals related to the latest R&amp;D in Neurobiology.</td>
<td>(1)*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Chinese Medicine</td>
<td>(1) Forming groups to work on a given theme; (2) Doing research; (3) Giving a 15-minute oral presentation.</td>
<td></td>
<td>(2)</td>
<td>(2)(3)</td>
<td>(1)</td>
</tr>
<tr>
<td>C</td>
<td>Photography</td>
<td>(1) Working in groups to develop a series of photos with short text descriptions.</td>
<td></td>
<td></td>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>D</td>
<td>English Language</td>
<td>(1) Forming teams to prepare for a debate on a given motion; (2) Doing research - to generate arguments for or against the motion; (3) Preparing the rebuttals based on the research conducted; (4) Taking turns to present students' arguments.</td>
<td></td>
<td>(1)(2)</td>
<td>(1)(3)(4)</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>Physical Education</td>
<td>(1) Interviewing an athlete who represented Hong Kong in the Asian Games 2014; (2) Identifying &amp; analysing potential psychological problems of the athletes; (3) Designing a 12-week psychological training program tailor-made to client athletes.</td>
<td></td>
<td>(2)(3)</td>
<td>(1)(2)(3)</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>History</td>
<td>No students participated in the focus group interviews</td>
<td></td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>G</td>
<td>Photography</td>
<td>(1) Individually working on “An Investigative Photo Project” (Theme: Human Condition); (2) Discussing the advantages and disadvantages of photos shown in the class; (3) Shooting 5 photos;</td>
<td></td>
<td>(1)</td>
<td>(3)</td>
<td>(2)</td>
</tr>
<tr>
<td>H</td>
<td>English Language</td>
<td>(1) Conducting research; (2) Preparing and delivering a 50-minnute presentation with Q&amp;A session.</td>
<td></td>
<td>(2)</td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>I</td>
<td>Science</td>
<td>No students participated in the focus group interviews</td>
<td></td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>J</td>
<td>Marketing</td>
<td>(1) Developing a marketing plan for an existing social enterprise in Hong Kong.</td>
<td></td>
<td>(1)</td>
<td>(1)</td>
<td>(1)</td>
</tr>
</tbody>
</table>

*Note. The number in parentheses refers to the PBL activity as described by students that helped them achieve the indicated focus GA sub-category in the respective courses.*
Figure 1
Mean Scores of Students’ Self-Perceived Attainment of 17 GA Subcategories
Before and After the PBL Intervention (N = 298)

* = p<0.05; ** = p<0.01; *** = p<0.001

Graduate Attributes sub-categories

Figure 2
Mean Differences of Pre-Post Scores of Course C and Course G

Note. * = p < 0.05; ** = p < 0.01; *** = p < 0.001
Figure 3
Mean Differences of Pre-Post Scores of Course D and Course H

* = p<0.05; ** = p<0.01; *** = p<0.001

Graduate Attributes sub-categories
HONG KONG BAPTIST UNIVERSITY

Appendix A

Self-evaluation on HKBU’s 7 Graduate Attributes
This questionnaire aims to help you evaluate your CURRENT ATTAINMENT based on your learning experience in this course. You are requested to rate to what extent you think you have achieved or made progress in the following 7 Graduate Attributes on a scale of 1-10. Please be warmly reminded that your answers are for research purposes only, so there is no right or wrong answer to the questions.

Citizenship -- Be responsible citizens with an international outlook and a sense of ethics and civility.
1. Ethical Reasoning (道德思維) 1 2 3 4 5 6 7 8 9 10
2. Social Responsibility (社會/公民的責任) 1 2 3 4 5 6 7 8 9 10
3. Cross-cultural Competence (多元文化的認識) 1 2 3 4 5 6 7 8 9 10

Knowledge -- Have up-to-date, in-depth knowledge of an academic specialty, as well as a broad range of cultural and general knowledge.
4. Interdisciplinary Knowledge (跨學術專業知識) 1 2 3 4 5 6 7 8 9 10
5. Disciplinary Exposure (學術專業知識) 1 2 3 4 5 6 7 8 9 10

Learning -- Be independent, lifelong learners with an open mind and an inquiring spirit.
6. Lifelong Learning (終生學習) 1 2 3 4 5 6 7 8 9 10
7. Self-development / Spirituality (個人發展/精神情操) 1 2 3 4 5 6 7 8 9 10

Skills -- Have the necessary information literacy and IT skills, as well as numerical and problem-solving skills, to function effectively in work and everyday life.
8. Information Literacy (資訊處理能力) 1 2 3 4 5 6 7 8 9 10
9. Technological Literacy (資訊科技技能) 1 2 3 4 5 6 7 8 9 10
10. Problem Solving (解決疑難能力) 1 2 3 4 5 6 7 8 9 10
11. Quantitative Reasoning (數理思維能力) 1 2 3 4 5 6 7 8 9 10

Creativity -- Be able to think critically and creatively.
12. Critical Thinking (批判思維) 1 2 3 4 5 6 7 8 9 10
13. Creative Thinking (創意思維) 1 2 3 4 5 6 7 8 9 10

Communication -- Have trilingual and biliterate competence in English and Chinese, and the ability to articulate ideas clearly and coherently.
14. Oral Communication – English, Chinese and Putonghua (口述溝通能力) 1 2 3 4 5 6 7 8 9 10
15. Written Communication – English and Chinese (書面溝通能力) 1 2 3 4 5 6 7 8 9 10

Teamwork -- Be ready to serve, lead and work in a team, and to pursue a healthy lifestyle.
16. Teamwork (團隊合作) 1 2 3 4 5 6 7 8 9 10
17. Health Awareness (健康的生活方式) 1 2 3 4 5 6 7 8 9 10
## Appendix B

<table>
<thead>
<tr>
<th>Course</th>
<th>Offering Term</th>
<th>Discipline</th>
<th>PBL Activities</th>
<th>No. of Students</th>
<th>No. Students Participated in Focus Group</th>
</tr>
</thead>
</table>
| A      | Term 1        | Biology             | - Individual work - Theme: Any topics related to Neurobiology  
- Review of journals related to latest R&D of Neurobiology  
- Oral presentation                                                                                                                                                                                                                                                             | 11              | 1                                        |
| B      | Term 1        | Chinese Medicine    | - Group work – Themes: (1) Space travel to Mars; (2) Marathon & biochemical processes in our body; (3) New air pollution index (Air Quality Health Index)  
- Written report + oral presentation                                                                                                                                                                                                                                             | 50              | 7                                        |
| C      | Term 1        | Photography         | - Group work – Theme: Wish you were there  
- Developing a series of photos + a short text description  
- Individual work - Theme: Full of life  
- Submitting five inter-related photos + presentation                                                                                                                                                                                                                       | 46              | 2                                        |
| D      | Term 1        | English Language    | - Group work – Theme: Debate on a given current issue  
- Researching on a given topic presented in the news article provided  
- Generating arguments for or against the motion  
- Presenting their arguments in the form of a debate                                                                                                                                                                                                                         | 87              | 1                                        |
| E      | Term 1        | Physical Education  | - Group work – Theme: How to psychologically prepare for the Asian Games  
- Reviews of research journal articles  
- An interview with an athlete who represented Hong Kong in Asian Games 2014 and his/her coach  
- Designing a 12-week psychological training program tailor-made to client athletes                                                                                                                                                                                                   | 49              | 4                                        |
| F      | Term 1        | History             | - Group work – Theme: China’s foreign relations since the Qing period; Examples of topics: (1) Why did China enter the Korean War (1950 - 1953); (2) Sino-Soviet Conflicts (1960 – 1969); (3) Mao Zedong’s foreign relations (1970 – 1976)  
- Tutorial presentation (12 tutorial sessions, different topics)  
- Term paper: 1 tutorial topic; conducting information search, writing own arguments & conclusions                                                                                                                                                               | 39              | No focus group conducted                |
| G      | Term 2        | Photography         | - Individual work – Theme: Human Condition – An Investigative Photo Project  
- Taking and printing photo images using darkroom techniques  
- Exercising creative problem solving skills (e.g. what camera & lenses to use)  
- Research visual artists doing similar works                                                                                                                                                                                                                                   | 39              | 2                                        |
| H      | Term 2        | English Language    | - Group work – Theme: : Grammar Presentation  
- Research a given grammar topic  
- Analyze audience’s level of proficiency and interest  
- Teaching the grammar topic to their classmates in interesting way                                                                                                                                                                                                     | 42              | 6                                        |
| I      | Term 2        | Science             | - Group Work - Theme: Science principles embedded in movies  
- Identifying a collection of movie clips  
- Extracting Science elements & explain theories behind  
- Identifying a real-life application & new possibility of application  
- Writing a report and doing a presentation                                                                                                                                                                                                                              | 55              | No focus group conducted                |
| J      | Term 2        | Marketing           | - Group Work-Theme: Developing a marketing plan for an existing social enterprise in Hong Kong  
- Identifying a project / service new to an existing social enterprise  
- Identifying the mission of the social enterprise; Conducting SWOT analysis, customer analysis; determining positioning, target markets, points of difference, etc.                                                                                                                    | 103             | 6                                        |