

Effect of Collaborative Learning on Enhancement of Students' Self-Efficacy, Social Skills and Knowledge towards Mobile Apps Development

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Abstract This study investigated the impact of a collaborative learning intervention on students' self-efficacy, social skills and knowledge toward mobile apps development. Twenty-nine undergraduate students were recruited for participation in the research study. They participated in a 12-week collaborative learning intervention. The self-efficacy for learning and performance scales from the Motivated Strategies for Learning Questionnaire and Social Skills Inventory were used to evaluate students' self-efficacy in mobile apps development and social skills respectively. A knowledge of mobile apps assessment form was designed to assess a student's knowledge in mobile apps development. The results revealed that students experienced a significant increase in knowledge of mobile apps. However, collaborative learning only has a small positive effect on a student's self-efficacy and social skills. Implications for practice and research are provided for future study.

Keywords: *self-efficacy, social skills, collaborative learning, knowledge of mobile apps*

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1. Introduction

Excessive use of the Internet is detrimental to students' way of life. Several studies have found that increased exposure to the Internet can lead to adverse impact on people's face-to-face communication skills [1,2,3]. Communication on the Internet is less socially regulated, and has negative effects on people's interaction and their self-confidence, and leads to anxiety and most importantly, loss of real-life social relationships [4,5,6]. Some studies found that the Internet had a negative association with health and academic performance [2,5,7]. The possible consequences of Internet overuse can be very diverse: decreased amount of sleep, less face-to-face interaction, and a shorter attention span. Especially, that the shorter attention span can seriously lower students' academic performance, as revealed by some previous studies that substantial exposure to the Internet is associated with decreased reading and verbal literacy and thinking skills [2,5,7].

Hong Kong employers frequently use the term "self-centered" to describe the Generation Y. Current undergraduate students belong to this group which are adults aged 19 to 32 [8]. Being self-centered, they will be more egocentric, self-oriented, poor in communicating their ideas and uncooperative with others. Put it in another way, this group of youngsters lacks social skills.

Social skills include interpersonal qualities such as cooperation, assertion, responsibility, and empathy that

improve communications between people. According to Farrington et al. [9], a lack of social skills may affect academic performance because effective teaching and learning have strong social, emotional, and academic components. Social skills can improve academic performance as students with good social skills will be involved actively in classroom activities that nurture learning [9].

Poor performing students or ineffective learners are low in self-efficacy [10,11]. Self-efficacy is a key element of social cognitive theory, which is a framework of triadic reciprocal interactions among behavioral and environmental variables, and personal factors [11]. It refers to people's belief in their abilities in performing specific tasks. According to Bandura, self-efficacy does not reflect people's actual ability to perform a task. Nonetheless, people's beliefs in their self-efficacy have direct impacts on their abilities and engagement in accomplishing a task [12,13]. Another important aspect is that self-efficacy is task or context specific, meaning people who have low self-efficacy in performing Task A may not necessarily have low self-efficacy in performing Task B [11,12]. Hence to achieve good performance and effective learning for students, it is vital to focus on the four main sources of self-efficacy which include mastery experience, vicarious experience, social persuasion, and physiological states [12].

Previous studies have shown that self-efficacy is positively related to learning. Students of high self-efficacy are more willingness to spend effort and persistence on tasks, especially when they are facing difficulties. Abundant

evidence suggests that self-efficacy has positive effects on academic performance [15,16,17,18].

Collaborative learning can be adapted to the traditional classroom environment, comprising joint intellectual effort by students, or students and teachers together. In general, students are working in groups of two or more, jointly examining for understanding issues, solving problems, finding resolutions or co-creating a product. Collaborative learning activities are diverse, but most important of all students are involved in exploring or applying the course material, not simply focusing on presentations or expositions by the students [19]. Collaborative learning shifts the responsibility of knowledge pursuit to students. Collaborative learning gives students opportunities to engage in dialogue, take charge of their own learning. Students become self-directed learners and exchange their ideas or thoughts actively through group activities directed toward a common goal and their active participation in these collaborative activities is the same as interacting in a social activity [20]. Furthermore, collaborative learning boosts their self-efficacy because it brings both direct and vicarious experiences to all group members. Hence, collaborative learning leads students to acquire and hone social skills and to contribute towards development of positive attitude of learning.

Mobile devices have become popular nowadays, particularly for the Generation Y who can undoubtedly use them as excellent educational platforms for physical and mental workout. The popularity also brings forth more creative mobile apps development opportunities for undergraduate students and thus provides a testing ground to try out collaborative learning.

The aims of this study were to examine the effectiveness of collaborative learning on undergraduate students' self-efficacy, social skills and knowledge of mobile apps in learning mobile apps development. The research questions of this study were:

1. Will collaborative learning increase students' self-efficacy in writing mobile apps?
2. Will collaborative learning increase students' programming knowledge?
3. Will collaborative learning increase students' social skills?

2. Methods

2.1. Participants and Setting

This study used an experimental design to examine the effect of collaborative learning in an actual classroom setting. The participants were the undergraduate students who were studying in an elective course named Mobile Apps Development in The Education University of Hong Kong.

2.2. The Collaborative Learning

In this collaborative learning programme, students were asked to co-construct mobile apps for health education. Groups of four to five students had to submit proposals and present their ideas in designing mobile apps. In order to help students familiarize with their group members so as to engage in collaborative learning, ice-breaking games

were played at the start of the course. Besides, a briefing on the benefits and the process of collaborative learning was conducted for the students.

Collaboration will not happen just by putting the students in groups. Social interaction is the key to collaboration. To enhance the social interaction for collaborative learning, the strategies of promotive interaction and positive interdependence were used. Setting common learning goals is important in promotive interaction. Therefore, the groups were asked to set up their group learning goals before the collaborative learning sessions. With the goals in mind, the students were joined together by the common goal and would interact in ways that encouraged and helped one another to accomplish the group's goal. Groups now become cohesive groups through the promotive interactions. Apart from setting learning goals, it is also important that the level of the collaborative tasks is one that creates positive interdependence among group members. If the collaborative task is too simple, students may tend to work alone and are not likely to get involved in discussions. The most appropriate is to set collaborative tasks at moderate to high level of difficulty within a defined timeframe to promote positive interdependence. In so doing, students are linked to one another in such a way that each team member cannot succeed unless the others in the group succeed. In the collaborative learning sessions of this study, students had ten weeks to discuss, design and construct their mobile apps.

After finishing the 12 weeks' collaborative learning, the collected data were used to elicit information that helped determine the effect of collaborative learning on the students' self-efficacy, social skills and knowledge of mobile apps. All the classroom artifacts including self-efficacy in learning, social skills and knowledge of mobile apps were used to measure the pre- and post-effect of the collaborative learning programme. They are explained in the following sections.

2.3. Instrumentation

Self-Efficacy for learning and performance. This study used the Motivated Strategies for Learning Questionnaire (MSLQ), which is a self-reporting instrument that includes 81 items developed to measure students' motivation by value, outcome expectancy, affective components, cognitive and metacognitive strategies, and the use of resource management strategies [20]. Eight items of self-efficacy for learning and performance from MSLQ were used to assess the students' self-efficacy in mobile apps development. The internal reliability of Self-Efficacy for Learning and Performance component was 0.93. Overall, the Cronbach's alphas were robust, ranging from 0.52 to 0.93. Confirmatory factor analyses were performed. The goodness of fit index and the root mean square residual ranged from 0.77 to 0.78 and 0.07 to 0.08 respectively. The results indicated that the MSLQ showed reasonable factor validity [21].

Social skills inventory (SSI). SSI is a 90 items Likert type inventory for self-assessment of one's basic social skills with respect to emotional expressivity, emotional sensitivity, emotional control, social expressivity, social sensitivity and social control. The Cronbach's alphas

reliability coefficients of the social skill subscales in Riggio's studies varied between 0.56 and 0.82 [22].

Pre- and post-knowledge of mobile apps assessment form. Before the briefing of collaborative learning activities, the students completed a pre-course assessment form covering knowledge of mobile apps. This assessment form was developed by the course lecturer based upon the required knowledge for the elective course of 'Mobile Apps Development for Health Education' and it focused solely on student's knowledge of mobile apps. After development, it was reviewed by a course team. The post-course assessment on the knowledge of mobile apps was done upon the completion of the course in Week 12. The sample questions of the course assessment form was presented in Table 1 below.

Table 1. Sample questions of course assessment form

Q1. What is the full form of HTML?
Q2. The following is a web-page: <pre><html> <head><title>JavaScript</title></head> <body bgcolor="#0000ff"> <script language="JavaScript"> <!--document.write("<h1>hello world</h1>");//--> </script> </body> </html></pre> When the above web page is loaded into a browser, what will happen?
Q3. Which of the following is not a web browser?
Q4. Which of the following is the correct HTML code to create an email link?
Q5. Which of the following is not be considered an application defect or bug?
Q6. Which of the following method is not suitable to publish your app for public?
Q7. What operating system is used as the base of the Android stack?
Q8. What does the .apk extension stand for?
Q9. The emulator is identical to running a real phone EXCEPT when emulating/stimulating _____.
Q10. While developing Android applications, developers cannot test their apps on _____.

2.4. Data Analyses

Paired *t*-test or Wilcoxon signed-rank test were used to find the pre- and post-collaborative learning changes of self-efficacy levels, social skills and knowledge of mobile

apps. The criterion for statistical significance was set at 0.05 level.

2.5. Ethical considerations

Approval of the study was obtained from the Ethics Committee of the Education University of Hong Kong. Confidentiality and anonymity of participants were assured. Students with randomly assigned codes were asked to complete and submit their questionnaires and assessment forms to protect their privacy. The codes were used for matching the pre- and post-scores for each student and in no way could they be used to identify the participants. Besides, the collected data obtained were used for research in this study only, and all raw data were destroyed after the study was completed.

3. Results

3.1. Sample Characteristics

All respondents were studying an elective course, comprising 72.5 % men and 27.5% women. Mobile Apps Development, in The Education University of Hong Kong. The total number of students taking this elective course was forty and the response rate was 72.5% (n= 29). They were all Chinese.

The pre- and post-mean scores on the self-efficacy for learning and performance were analyzed and presented in Table 2 below. The mean increase in mean scores on the self-efficacy for learning and performance from MSLQ was 0.239. The Wilcoxon signed-ranks test indicated that the median post-test ranks, Mdn = 4.375, was higher than the median pre-test ranks, Mdn = 4.250 ($Z = -1.599$, $p = 0.110$). The students had an insignificant increase in their mean scores on their self-efficacy for learning and performance.

The mean increase in mean scores on the knowledge of mobile apps was 2.7241. The pre- and post-mean scores on the knowledge of mobile apps were presented in Table 3 below. The Wilcoxon signed-ranks test indicated that the median post-test ranks, Mdn = 7.000, was statistically and significantly higher than the median pre-test ranks, Mdn = 4.000 ($Z = -4.063$, $p = 0.000$). The students had a significant increase in their mean scores on the knowledge of mobile apps.

Table 2. Wilcoxon signed-rank test of pre- and post-mean scores on self-efficacy for learning and performance

Self-efficacy	Mean	N	Std. Deviation (SD)	Percentiles	Z	p
				Median (Mdn)		
Pre-mean score	4.19	28*	0.77	4.25	-1.599	0.110
Post-mean score	4.43	29	0.93	4.38		

*One missing data.

Table 3. Wilcoxon signed-rank test of pre- and post-mean scores on knowledge of mobile apps

Knowledge	Mean	N	Std. Deviation (SD)	Percentiles	Z	p
				Median (Mdn)		
Pre-mean score	3.83	29	1.83	4.00	-4.063	0.000
Post-mean score	6.55	29	1.84	7.00		

Table 4. Wilcoxon signed-rank test for pre- and post-mean scores on SSI

SSI	Mean	N	Std. Deviation (SD)	Percentiles	Z	p
				Median (Mdn)		
Pre-mean score	268.52	29	26.40	268	-0.353	0.724
Post-mean score	269.45	29	13.23	268		

The pre- and post-mean scores of social skills from SSI were analyzed and were presented in Table 4 above. The mean increase in mean scores of social skills from SSI was 0.931. The Wilcoxon signed-ranks test indicated that the median post-test ranks, $Mdn = 268$, was the same as the median pre-test ranks, $Mdn = 268$ ($Z = -0.353$, $p = 0.724$). The students had an insignificant increase in their mean scores of social skills.

4. Discussion

The results revealed that the collaborative learning programme only had a small positive effect on the students' self-efficacy. However, the students had an insignificant increase in their mean scores on the self-efficacy for learning and performance. One possible reason for such enhancement is that students learnt and observed the behaviors of the peers in the process and picked up knowledge and skills that added to their confidence in the subject matter. The finding of this study was consistent with those of other studies [23,24]. According to Stump's study, students' self-reported collaborative learning strategies were associated with increased self-efficacy for learning course material and course grades [24]. In addition, Bandura proposed that vicarious experience is one of the four sources of self-efficacy [23]. Vicarious experiences are important sources of self-efficacy when people do not have previous experiences about tasks. Back to this study, most students expressed that they did not have previous experiences in mobile apps and did not have previous experiences in developing apps. Therefore, vicarious experiences become more important in this study. Through the process of collaboration, students observed the successes, however small, of other members and learnt from them. To assess the gain in knowledge, the pre- and post-course assessment forms on knowledge of mobile apps were used. The results revealed that collaborative learning had more positive effects on students' knowledge of mobile apps. Students had significant improvement in their knowledge of mobile apps. This finding was consistent with other studies in that learning was more effective when students engaged actively in exchanging their ideas [23,25,26]. In the collaborative learning environment, the students had the opportunity to engage in discussions and take responsibility for their learning. The students needed to discuss problems identified and find solutions, through which they enhanced their knowledge. In this collaborative learning, the students developed positive interdependence in their groups and explored with and acquired knowledge from fellow group members through developing the mobile apps from scratch. The method for building knowledge through the collaborative learning environment was explained by Vygotsky. According to Vygotsky [27], students are able to perform at higher

intellectual levels when they are engaging in collaborative situations than they are working alone.

A pre- and post-SSI was conducted to explore the change in social skills. The results showed that collaborative learning only had a small insignificant positive effect on students' social skills. This finding is inconsistent with the results of other studies [19,28]. According to Kessler and Macleod [28], students had less academic stress and anxiety in interactions in collaborative learning. Previous studies found that collaborative learning may enhance social skills with increasing students' social interactions [28]. And Smith and MacGregor stated that learning is the outcome of social interactions which are necessary for collaborative learning. This is the case when students were working in groups of two or more, mutually participating in the process of learning and working towards the common goals [19]. Therefore, collaborative learning helped students learn socially and should finally get enhancement of social skills.

The results of this study have some implications for collaborative learning in mobile apps development. To our knowledge, this study is the first attempt to investigate the effects of collaborative learning in the enhancement of undergraduate students' self-efficacy, social skills and knowledge of mobile apps and there was no relevant literature specifying the design of collaborative learning in enhancing self-efficacy, engagement and social skills. The design of this collaborative study was feasible to be replicated in future research. The results of this study established an evidence base for collaborative learning practices in Hong Kong and refinement of the intervention (collaborative learning) can be applied in other study areas.

5. Limitations

A relatively short intervention period was a limitation of this study. The limited time for collaborative learning in fact rendered the study inconclusive as to whether students' enhancement in learning and social skills was significantly changed in this collaborative learning programme. Besides, qualitative data from interviews or video recordings of some lessons should have been collected in order to provide more in-depth understanding of students' perceptions in the process of collaborative learning.

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