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Tracking Classroom Activities in Mobile Technology-Mediated Lessons

Siu Cheung KONG[a*], Gary CHENG[a] & Man Lee LIU[b]
[a]*The Hong Kong Institute of Education, Hong Kong*
[b]*Association of Mobile Technology and Education, Hong Kong*
*sckong@ied.edu.hk

Abstract: In this paper, we report on the findings with regard to classroom activities and their time use in a number of mobile technology-mediated classrooms at Hong Kong. The data was collected from a mobile learning project specifically designed to promote students' group and independent learning across a range of subject disciplines through using mobile devices within school environment. A total of 30 lessons in 10 primary and secondary schools were videotaped and analyzed. Results indicate that mobile devices can support establishing a well-balanced structure of classroom activities controlled by both teachers and students, where about 40% of the total class time was allocated to direct teaching and 40% was assigned to students' learning in independent and/or collaborative ways.

Keywords: Mobile technology, School Education, Independent Learning, Group Learning

1. Introduction

Recent advances in mobile devices and technologies have expanded the boundaries and pedagogies of traditional learning [1, 2]. Innovative learning experiences that can take place beyond school settings have emerged, such as informal learning with a mobile museum guide [3] or for environmental awareness [4], experiential learning on a field trip [5, 6], situated and active learning with mobile game [7]. These out-of-class learning experiences can bring opportunities to supplement students' learning in the formal school curriculum. It is still not well known, however, whether mobile technologies can be effectively applied to teaching and learning activities within school settings. To date, research that addresses this issue across a range of subjects in a systematic way is still limited [2].

During classes, apart from direct teaching activity, school teachers may consider to provide students with opportunities to learn individually and in small groups. Based on cognitive constructivism [8], individual students are believed to learn better if they are engaged in active construction of knowledge rather than passive reception from teachers. This perspective provides ground for teachers to promote independent learning activity among students. On the other hand, with its root in social constructivism which emphasizes communication and interaction among students for collaborative knowledge construction [9], group learning activity is recognized as another means of fostering students' learning.

Drawing on the theory of mobile learning advocated by Sharples and his colleagues [10], two critical issues are particularly relevant to the analysis of classroom activities supported by mobile technologies. They include: 1) the control issue which focuses on the level of student control over learning process; and 2) the communication issue which refers to the level of interaction between peers and between teachers and students. In this article,

therefore, we focused on examining whether or not mobile devices help attaining a reasonable level in both issues by analyzing the time spent on different kinds of teaching and learning activities in classroom. The results of our study can be applied to inform the effective design of classroom activities with mobile devices for teaching and learning formal curriculum.

2. The Study

There were five primary schools and five secondary schools joined this research project. A representative teacher from each participating school was nominated to participate in the study (6 males and 4 females). The primary school teachers were specialized in teaching Mathematics, General Studies, Chinese, English, Computer and Physical Education, while the secondary school teachers were specialized in teaching Visual Arts, Biology, Integrated Science, Liberal Studies and Computer Studies. In addition, the former had teaching experience varying from 3.5 years to 14 years, while the latter's experience ranged from 3 to 22 years. On the other hand, a total of 278 students participated in the study (163 from primary schools and 115 from secondary schools). The primary school students aged between 8 to 12 years and studied from Primary 4 to Primary 6, while the secondary school students aged between 14 to 18 years and studied from Secondary 3 to Secondary 6. Most participants reported little knowledge of using mobile devices in school education.

Prior to the study, the 10 participating schools were equipped with a wireless classroom management system, namely Infinity Mobile Control (IMC), where teachers can control any mobile devices and broadcast information to them within a Wi-Fi enabled school environment. The schools also purchased a sufficient number of mobile devices like UMPC, Tablet PC or Pocket PC for teaching and learning purposes. During the study, at first, the teacher participants were given training on how to use the mobile devices and operate the IMC system. Second, they were asked to design a lesson plan on using mobile devices to teach two self-chosen subject topics for three consecutive lessons. Finally, a total of 30 corresponding lessons were videotaped and the videos were analyzed with a focus on the control and communication issues.

3. Results and Discussion

3.1 Teaching activities

Teaching activities were divided into two subcategories: teacher-led direction instruction and teacher-led interactive instruction. Table 1 shows that the distribution ratio of the class time spent on teaching activities for the two subcategories was about 1:1. With reference to the teacher-led direct instruction, lecturing (introduction, illustration, revision and/or summary) was the most commonly used way of delivering subject curriculum, and it accounted for nearly 20% of the whole class time. Hence, even though mobile devices were distributed to students, teachers could still maintain their control in a reasonable level.

Regarding the teacher-led interactive instruction, most teachers broadcast student artifacts to mobile devices for initiating and promoting class discussion, which accounted for over 10% of the whole class time. Within this context, mobile device could be viewed as a collaborative whiteboard, and it was advantageous to enhance the communication between

peers and between teachers and students in two ways: a) by offering a platform for individual students to share their artifacts with the whole class; and b) by stimulating peer and teacher feedback and discussion about the artifacts displayed on the mobile devices.

Table 1. The distribution ratio of time use for teaching activities

Activity type		Detailed Activity	Time (mins)	Percentage		
				Individual	Subtotal	Total
Teaching time	Teacher-led direct instruction	Lecturing (introduction, illustration, revision and/or summary)	355	19.8%	22.2%	42.4%
		Playing multimedia resources	20	1.1%		
		Broadcasting student artifacts to mobile devices (without discussion between teacher and students)	17	1.0%		
		Checking answers (without discussion between teachers and students)	7	0.4%		
	Teacher-led interactive instruction	Broadcasting student artifacts to mobile devices (with discussion between teacher and students)	193	10.8%	20.2%	
		Asking questions	75	4.2%		
		Discussing with students	48	2.7%		
		Choosing students to report answers	28	1.6%		
		Checking answers (with discussion between teacher and students)	19	1.1%		

3.2 Student activities

The time allocation for student activities was approximately equivalent to that for teaching activities, which accounted for about 43% of the whole class time (see Table 2). On the basis of the number of students involved, student activities could be divided into “group learning” and “independent learning”. Through group learning activities, students may learn better with the assistance of other group members, resulting in an improvement over their social awareness and communication skills. Through independent learning activities, on the other hand, individual students may be engaged to study autonomously and subsequently develop their own learning strategies for acquiring knowledge and solving problems.

However, independent learning approach requires individuals to be capable of managing their own learning process, so it may not be feasible for an average class containing a number of low-ability students. Teachers tended to believe that primary and secondary students perform better through group learning than by learning alone, bringing the class time use with group learning to almost three times as much as that with independent learning, as shown in Table 2.

3.3 Non-teaching activities

Table 3 indicates that only a small proportion of total class time (15%) was spent on non-teaching activities (see Table 3). Among the non-teaching activities, the distribution of mobile devices or learning resources was a necessary job at the beginning of a lesson. As expected, this kind of job was not a big concern for teachers and it merely imposed a very low overhead (less than 6%) on class time. What teachers really worried about using mobile devices in class may be the large overhead on solving technical problems caused by the mobile technology, which could seriously affect the normal teaching and learning progress. Surprisingly, no more than 2% of the total time was spent on solving technical problems.

Our result challenges the argument against using mobile devices within school environment because of their significant influence on slowing down the normal teaching and learning paces.

Table 2. The distribution ratio of time use for student activities

Activity type		Detailed Activity	Time (mins)	Percentage		
				Individual	Subtotal	Total
Student activity time	Group learning	Discussing with peers based on accessing the preloaded resources in mobile devices, and/or completing worksheet	366	20.4%	31.3%	42.6%
		Discussing with peers based on accessing the Internet resources, and/or completing worksheet	125	7.0%		
		Discussing with peers based on the resources searched by their own using mobile devices, and/or completing worksheet	36	2.0%		
		Completing worksheet (without surfing the Internet/Intranet or using mobile devices)	27	1.5%		
		Discussing with peers based on accessing the Intranet resources, and/or completing worksheet	8	0.5%		
	Independent learning	Completing worksheet based on accessing the preloaded learning resources in mobile devices	164	9.1%	11.3%	
		Completing worksheet based on accessing the Internet resources	26	1.5%		
		Completing worksheet based on accessing the Intranet resources	8	0. 5%		
		Completing worksheet (without surfing the Internet/Intranet or using mobile devices)	5	0. 3%		
		Completing worksheet based on the resources searched by their own using mobile devices	0	0.0%		

Table 3. The distribution ratio of time use for non-teaching activities

Activity type	Detailed Activity	Time (mins)	Percentage	
			Individual	Total
Non-teaching time	Entering classroom	93	5.2%	15.0%
	Distributing mobile devices to students	76	4.2%	
	Distributing learning resources to students	29	1.6%	
	Solving technical problems	31	1.7%	
	Taking pre- and post-tests	40	2.2%	

3.4 Overall structure of classroom activities

As seen in Table 4, the distribution ratio of the total class time for teaching activities, student activities and non-teaching activities was about 4:4:2. The fairly even distribution of teaching and student activities shows that the class time use for teacher-led instruction was almost the same as that for student activities, implying that both teachers and students took an equally active role in exercising control over the learning process. The mobile devices gave impetus to change in the traditional teacher-centered pedagogy where the learning process is solely controlled by teachers. In the mobile technology-mediated classes, teachers no longer dominated the class time for direct instruction. Instead, they provided students

with more opportunities to participate in various independent and group activities with mobile devices. Moreover, the result also indicates that using mobile devices to support in-class teaching and learning was a feasible approach because it did not lead to a high percentage of time spending on non-teaching activities (e.g., distributing mobile devices to students and solving their technical problems).

Table 4. The distribution ratio of time use for different types of classroom activities

Activity type		Time use (mins)	Percentage		
			Individual	Subtotal	Total
Teaching time	Teacher-led direct instruction	399	22.22%	42.43%	100%
	Teacher-led interactive instruction	363	20.21%		
Student activity time	Group learning	562	31.29%	42.59%	
	Independent learning	203	11.30%		
Non-teaching time		269	14.98%		

4. Concluding Remarks

This study provided analyses of classroom activities from 30 mobile-technology mediated lessons in 10 primary and secondary schools at Hong Kong. Drawing on the theory of mobile learning theory [10], this study focused on the control and communication issues associated with using mobile devices in class that could impact students' learning. Our results show that mobile devices could support establishing a well-balanced structure of classroom activities in terms of control and communication, where the distribution ratio of the total class time for direct teaching, group learning and independent learning was 4:3:1.

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