HOW DOES THE USE OF MOBILE DEVICES AFFECT TEACHERS' PERCEPTIONS ON MOBILE LEARNING?

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ABSTRACT

The purpose of this study is to investigate the potential impact and effectiveness of mobile learning in the context of a flipped classroom and also address implications for future curriculum design. The researchers developed a mathematics curriculum featuring the use of mobile devices in the context of a flipped classroom. Thirty pre-service secondary teachers participated in the study. They completed a pre-study survey, student reflections about the usefulness of mobile learning, and a post-study survey of their views on their use of mobile devices and their TACI classification scores. Results show there was a statistically significant difference in students' TACI scores between the pre-survey and post-survey. Mobile devices were mainly used for task performance in individual learning and group discussion in cooperative learning. Students' potential and self-confidence were improved through connection, communication and collaboration activities using mobile devices. For better pedagogical scaffoldings in classroom environments, four necessary conditions were suggested in this paper: approachable convenience (access route to a website), the convenience of using mobile devices (free data environment), promotion of real-time interaction between students (instantaneous messaging), and connection between communicating and sharing activities from group discussion to whole class discussion.

KEYWORDS

Flipped classroom, mobile learning, TACI, mobile connection, mobile communication, mobile collaboration

1. INTRODUCTION

Multinational and multischool cooperation can achieve education for promoting sustainable development in order to jointly respond to problems related to social changes due to technology. Communication and sharing in a community are basic principles of learning for sustainable development. In a rapidly changing technological era, knowing how to communicate and share through the use of mobile devices as learning tools is a valuable asset for future society (Deming, 2015). Mobile learning has enabled students to expect seamless connectivity whenever and wherever they are to interact with various information through innovative advances in information technologies. With mobile technology, students can save time, engage in convenient self-directed learning activities, and experience cooperative learning by communicating with their classmates. In addition, systematic connections between individual and cooperative learning in mobile learning environments help to flip a class. However, mobile learning cannot be successful without autonomous participation. The teacher's capability to promote students' participation is what will make or break mobile learning by combining individual and cooperative learning (Jensen et al., 2002). Because a flipped classroom cannot be successful without students' learning autonomy, teacher's capabilities to promote their autonomy are especially important in this type of learning environment. In order to develop these teacher capabilities, we can help teachers perceive the effectiveness of mobile learning by changing their perceptions of mobile devices in a positive way and then improving their perceptions of mobile learning activities with ideas about how to motivate students' participation and promote their autonomy in class. The purpose of this study is to develop a curriculum based on mobile learning in the context of the flipped classroom and to analyze how this curriculum affects pre-service teachers' perceptions of mobile devices and mobile learning activities. This study specifically is guided by the following two research questions: "How does mobile learning in the context of the flipped classroom affect pre-service teachers' perceptions of mobile devices and learning activities?" and "What are the necessary conditions to improve mobile learning environments in the context of the flipped classroom?"

2. RESEARCH METHOD

Participants were 30 pre-service teachers taking a course in computer and mathematics education in a university in Seoul, South Korea during the spring 2015 semester. Four instruments were used to collect primary data: participants' perceptions of mobile devices and mobile learning activities and the necessary conditions to improve mobile learning environments. First, student adopter index classifications were measured using Technology Adopter Category Index (TACI) (Dugas, 2005). The second questionnaire asked how often students used mobile devices for different kinds of activities. The third questionnaire was used to gather students' perceptions of the usefulness of mobile learning. Based on the three themes of connectivity, communication, and collaboration, students were asked to reflect on how the use of mobile devices can improve their self-confidence and engagement in mobile learning. The last reflection questionnaire solicited students' thoughts on four categories of interaction with the mobile resources (i.e., how to use, connect, communicate, and collaborate) and their recommendations to improve mobile learning environments (Kim et al., 2013).

3. RESULTS

3.1 Perceptions of Mobile Devices

We used paired *t*-tests to assess the difference in means of TACI scores from the pre-questionnaire and post-questionnaire, and the result was statistically significant, as shown in Table 1. Specifically, more participants were classified with a lower TACI in the post-questionnaire than in the pre-questionnaire.

Table 1. The difference between the means of TACI from the pre- and post survey (Note: *p < .05)

TACI score	Pre-survey	Post-survey	df.	t	Sig.(2-tailed)
	M (SD)	M (SD)			
	5.43 (1.33)	4.63 (1.56)	29	2.89	0.007*

One interesting finding was that participants indicated that the usage of mobile devices engaged them more in viewing contents, collaborating activities, academic purposes, and professional development than before.

Table 2. Frequency summary of use of mobile devices (Note: *p < .05)

Contents	Pre-survey	Post-survey	df.	t	Sig. (2-tailed)
	M (SD)	M (SD)			
Reading contents (e.g., news, articles, etc.)	1.40 (0.89)	1.53 (0.57)	29	-0.75	0.459
Listening contents (e.g., news, podcasts, etc.)	1.07 (1.08)	1.40 (0.89)	29	-2.28	0.030*
Watching contents (e.g., TV, YouTube, etc.)	0.67 (1.06)	1.10 (0.80)	29	-2.04	0.051
Internet search (e.g., Google, Yahoo, etc.)	1.40 (0.62)	1.53 (0.73)	29	-0.72	0.475
Creating contents (e.g., news, articles, etc.)	-0.70 (1.05)	-0.90 (0.84)	29	1.24	0.227
Sharing contents (e.g., document, files, etc.)	-0.13 (1.20)	-0.23 (1.14)	29	0.41	0.682
Connecting activities (e.g., information access, social networking, etc.)	1.43 (0.82)	1.60 (0.56)	29	-1.00	0.326
Communicating activities (e.g., phone call, email, etc.)	1.30 (0.79)	1.37 (0.85)	29	-0.32	0.752
Collaborating activities (e.g., group work, discussions, etc.)	-0.17 (1.05)	0.47 (1.01)	29	-3.74	0.001*
Classroom activity (e.g., reading and watching contents, etc.)	0.23 (0.97)	0.53 (0.97)	29	-1.56	0.130
Academic purposes (e.g., group works, assignments, etc.)	-0.10 (0.99)	0.53 (0.97)	29	-2.92	0.007*
Social activities (e.g., Facebook, etc.)	1.37 (1.03)	1.30 (0.79)	29	0.42	0.677
Professional developments	-0.73 (0.94)	-0.10 (0.99)	29	-3.36	0.002*
Entertainments	0.07 (1.34)	-0.03 (1.33)	29	0.37	0.712

3.2 Perceptions of Mobile Learning Activities

To answer the second research question about participants' perceptions of mobile learning activities, we explored the characteristics of mobile learners in terms of their experience, as shown in Table 3. The results demonstrate that providing a mobile learning environment can help students be more confident in learning.

Table 3. Frequency summary of use of mobile devices (Note: *p < .05)

Contents	Pre-survey	Post-survey	df.	t	Sig. (2-tailed)
	M (SD)	M (SD)			
The use of mobile device is convenient and allows a flexible learning.	1.00 (0.83)	1.13 (0.63)	29	-0.75	0.459
The use of mobile devices enables students to take control of learning.	0.00 (0.96)	0.24 (1.02)	29	-0.94	0.354
It is good use of "dead time"	0.93 (0.94)	0.73 (0.83)	29	0.90	0.375
It fits for many different learning styles.	1.10 (0.66)	1.30 (0.60)	29	-1.29	0.206
It improves students' self-confidence in learning through mobile connection activities.	0.23 (0.82)	0.73 (0.83)	29	-3.18	0.003*
It improves students' self-confidence in learning through mobile communication activities.	-0.07 (0.74)	0.37 (0.89)	29	-2.44	0.021*
It improves students' self-confidence in learning through mobile collaboration .	0.07 (0.69)	0.53 (1.01)	29	-2.73	0.011*
It improves students' engagement in mobile connection activities.	0.63 (0.93)	0.70 (0.99)	29	-0.30	0.769
It improves students' engagement in mobile communication activities.	0.43 (0.86)	0.47 (0.97)	29	-0.18	0.856
It improves students' engagement in mobile collaboration.	0.50 (0.86)	0.50 (1.01)	29	0.00	1.000

3.3 Four Necessary Conditions

The analysis of the reflection question "What do you recommend to make the use of mobile device(s) easier for this project?" indicates that the majority of participants reported that the access route to a course website should be made more simple and convenient, with student comments such as: "The process of approaching to data (e.g., video clips and PDF files) should be simple. If there are many steps to watch a video clip, I may not often access to the data due to their inconvenience" and "Convenience of use (Blackboard app → Course selection → Message board →... Process is too complicated." Pre-service teachers seemed to think that content data used for individual learning and message boards for cooperative learning should be easily assessable in order to guarantee the effectiveness of learning. Thus the analysis of the first reflection question suggests the first necessary condition, *approachable convenience*, to improve mobile learning environments. The second reflection question is "What do you recommend to increase students' connection activities in using mobile devices for this project?" The majority of participants emphasized the environment of using free data in their responses. Statements from the participants that support this include "Mobile devices are convenient to watch a video clip, but their weakness is to be connected to Wi-Fi. Once I watched an internet lecture and could download its file, the price was reasonable" and "Watching video clips while moving back and forth is uncomfortable because students are using a small mobile data pricing. It would be better to upload files." In order to watch video clips for individual learning, the participants in the study felt that pricing issues for data use should be resolved. On the basis of the above evidence, we suggest the second necessary condition, *convenience of using mobile devices*, for improving mobile learning environments. The third reflection question is about how to improve communication, and the fourth reflection question is regarding how to improve collaboration in mobile learning environments and with mobile devices. In these two questions, the majority of participants reported that instantaneous messaging was needed as a communication tool to facilitate learning activities: "A message notice should pop up whenever someone uploads a message. Otherwise, it is not clear when to use" and "Instantaneous messaging helps to attract other's attention." It appears that the participants thought that if someone uploads his or her opinion on the website, an instantaneous messaging system can help them to effectively communicate and collaborate with their group members. Thus, *promotion of real-time interaction between students* is the third necessary

condition for improving mobile learning environments. In order to upload a common group opinion on the course website, the participants in the study needed to communicate with their group members first. They communicated with their group members by using Kakao-Talk (free messaging and communicating software) and then summarized their communications to upload their group opinion on Blackboard. Even though they can hold a group discussion by using Blackboard, they used Kakao-Talk due to its instantaneous messaging system. Communicating activities among group members and sharing activities between groups had to be separated because participants had to use instantaneous messaging in communicating activities on Kakao-Talk and then upload a group opinion on Blackboard. *Connecting communicating activities with sharing activities* can improve the quality of communicating and sharing activities and their communicative convenience in mobile learning environments.

4. CONCLUSION AND DISCUSSION

In the context of the flipped classroom, we explored pre-service teachers' perceptions of mobile devices and mobile learning activities as well as necessary conditions for improving mobile learning environments through the use of mobile technologies. Based on the results of our study, we can conclude the following. First, mobile learning in the context of the flipped classroom affects pre-service teachers' perceptions of mobile devices positively. This result implies that mobile learning experiences may help pre-service teachers become more comfortable with using their own devices. If they change their beliefs about the use of mobile technology, they should be more likely to use mobile learning devices for pedagogical scaffoldings in their future classes. Second, our participants perceived the effectiveness of mobile learning activities in the context of the flipped classroom. A positive mobile learning environment can cultivate confidence in mobile technology use. Students' motivation and interests in mobile learning in the context of the flipped classroom initiate willingness to participate, and this willingness can foster self-confidence in learning (Keller, 1987; Wang & Lin, 2008). Finally, understanding the four necessary conditions for improving mobile learning environments in the context of a flipped classroom will help educators to design and implement appropriate mobile learning. The results suggested that accessing and viewing mobile contents should be simple and convenient for mobile connectivity, and mobile contents should be easily downloadable. It seems that these two necessary conditions can optimize the autonomy of individual learning in designing mobile learning environments. Furthermore, in order to maximize the effectiveness of cooperative learning, promoting real-time interaction between students and making a connection between communicating and sharing activities were suggested. Therefore, autonomy-optimized mobile learning in the effectively implemented context of the flipped classroom can dynamically combine individual and cooperative learning and then facilitate a synergistic effect on both.

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