

LEOPOLD'S MANEUVER MOBILE LEARNING TECHNOLOGY FOR FACILITATING KNOWLEDGE APPLICATION AND SELF-REPORTED CONFIDENCE OF PRECLINICAL MEDICAL STUDENTS

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Abstract

Multimedia programs have emerged in preclinical medical students' programs, and hand-held mobile learning technology provides opportunities for medical students to use self-instructional training. However, there is not clear evidence that they can improve medical students' learning. To compare mobile content and a didactic lecture for preclinical medical students for use in performing the Leopold's maneuver. All the preclinical medical students received a didactic lecture and an instructional guide book. Students were provided with mobile content as a resource facility before the clinical skill activity. Interpretation was performed by the medical staff to check accuracy. The preclinical medical students were assessed for knowledge and self-confidence in the maneuver. A paired t-test was used to analyze the difference in knowledge and confidence between the didactic lecture and the mobile content. All 60 preclinical medical students completed the Leopold's maneuver skills training. Knowledge increased after both the didactic lecture and the mobile content. There was significantly increased knowledge from the didactic lecture compared with the mobile content between before and after the training (t-test = 2.750, $p = 0.008$), the completeness of the content (t-test = 2.275, $p = 0.027$), the knowledge of teaching (t-test = 2.621, $p = 0.011$), and answering questions in class (t-test = 2.121, $p = 0.038$). The mobile content increased the confidence and knowledge that can be applied in reality, the knowledge for preparation of the procedure, and interpretation when compared with the didactic lecture but the difference was not statistically significant.

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Mobile learning technology increased both the knowledge and confidence in the ability to perform Leopold's maneuver when compared with the didactic lecture but the difference was not statistically significant.

Keywords: Preclinical medical student, didactic lecture, mobile learning technology

Introduction

Medical students must have knowledge and skills in women's health and obstetrics and gynecology under the supervision of the medical staff (Autry *et al.*, 2002; Carmody *et al.*, 2011). The abdominal examination method of Leopold's maneuver is a way to determine the position of a fetus inside the uterus by touching the abdomen with the hands. Additional training with an obstetrics manikin or simulator improves medical students' comfort and provides higher levels of confidence and a better learning experience when performing obstetrics procedures (Deering *et al.*, 2006; Jude *et al.*, 2006; Dayal *et al.*, 2009).

Early clinical experiences may promote the learning behavior of preclinical medical students by exposing them to clinical role models, improving their clinical skills, and eventually reducing the stress in the clinical years. Early clinical experiences have been shown to give medical students more confidence to interact with patients in their first clerkships. In many medical schools all over the world, clinical skills training is offered to preclinical medical students in facilities called skills laboratories. Skills laboratory staff are fully devoted to education, whereas hospital staff will prioritize patient care over teaching. Various formats are available in clinical education. Mobile technology with videos in clinical skills, especially surgical skills, improves learning outcomes and the availability of learning resources (Jowett *et al.*, 2007; Gormley *et al.*, 2009; Khogali *et al.*, 2011; Lenchus *et al.*, 2011).

The use of mobile technology or web-based computers for medical education is becoming increasingly common in medical schools around the world and may present both benefits and obstacles to medical students (Clay, 2011; Sandars, 2012). Overall mobile technology has benefits in clinical education

but there are major obstacles to its use in many medical schools including a lack of resources or an especially good network.

In Thailand, one strategy to increase opportunities for clinical exposure has been the inclusion of rural placements. Suranaree University of Technology (SUT) offers a 6-year undergraduate entry medical program for the Nakhonchaiburin area (Nakhon Ratchasima, Chaiyaphum, Buriram, and Surin provinces). The clinical component of teaching in this course involves didactic lectures, case discussions, problem-based learning, and clinical skills. Students are relying on technology for learning more than ever, and educators need to adapt to facilitate student learning. The current generation of medical students has been raised in the age of technology and has come to rely on mobile phone and computer applications for the learning of complex material. Therefore, it has become important for the medical staff to understand what technologies are available and, more importantly, how to implement these various technologies into the curriculum to achieve optimal learning results.

The aims of this research were to survey the self-evaluation by third-year medical students of their confidence in knowledge and application of Leopold's maneuver, a basic obstetrics and gynecology procedure.

Materials and Methods

Study Population

The study was performed in the undergraduate curriculum with third-year medical students who were randomly sampled in 2015. These students were in the last semester of their preclinical studies in the medical curriculum of the introduction to clinical medicine. The Suranaree University of Technology Research

Ethics Committee approved this study (EC-58-03).

Study Protocol

The students within the clinical skill laboratories met in small groups (7-8 students/group) for 3 h and had resource sessions during the week to address student-derived learning issues. Students were provided with a mobile content resource session on basic obstetrics procedures before the clinical skills activity. The clinical skills activity was included within a small group session to determine the students' learning of the procedures within the scenario-based case. Briefly, students entered their small group rooms and immediately performed a demonstration. The case that they used with manikins was identical to the case patient they had discussed in their group. After the demonstration, the students remained in their small groups and addressed learning issues with the medical staff. The faculty facilitators of the small groups were present for each small group in the skill laboratories center.

The questionnaire for the students consisted of their knowledge, application, and confidence requiring a response on a 5-point Likert scale (strongly agree to strongly disagree). Discussing

each item thoroughly with 3 medical staff members and researchers at the university ensured the face validity of the study.

Data Collection

Data were collected at least 2 weeks after the term started, not during an examination period.

Statistical Analysis

Descriptive statistics (such as the means and standard deviation) were compared between the classroom lecture and mobile content data. A paired t-test was used to analyze the exam data for the 2 delivery modes to find out whether there was any statistically significant difference in knowledge and self-reported confidence between the 2 groups. The statistical significant difference was at p -value < 0.05 , 95% confidence level.

Results and Discussion

All medical students completed their skills training procedure. The scores of the 2 groups were significantly different in the following domains (Table 1). knowledge, knowledge

Table 1. Knowledge and application in Leopold's maneuver

Domain	Content	Didactic lecture Mean $\pm$ SD	Mobile content Mean $\pm$ SD	Paired t-test difference 95% CI		p -value
				Lower	Upper	
Content knowledge	Knowledge improvement	1.20 $\pm$ 1.132	0.950 $\pm$ 1.064	0.068	0.432	0.008*
	Complete content	4.03 $\pm$ 0.663	3.85 $\pm$ 0.755	0.022	0.345	0.027*
	Clear data and contents	4.05 $\pm$ 0.649	3.83 $\pm$ 0.785	0.051	0.382	0.011*
	Description of all contents	4.05 $\pm$ 0.769	3.88 $\pm$ 0.696	-0.006	0.339	0.058
Technical application	Content integration	4.05 $\pm$ 0.663	3.92 $\pm$ 0.755	-0.028	0.294	0.103
	2-way communication ability	4.00 $\pm$ 0.76	3.77 $\pm$ 0.810	0.013	0.453	0.038*
	Appropriated time use	3.93 $\pm$ 0.710	4.02 $\pm$ 0.725	-0.243	0.076	0.301
Knowledge Application	Appropriate indication/contraindication/complication of procedure	3.88 $\pm$ 0.691	3.72 $\pm$ 0.761	0.031	0.302	0.017*
	First Leopold maneuver	3.95 $\pm$ 0.699	3.80 $\pm$ 0.755	0.001	0.299	0.049*
	Second Leopold maneuver	3.88 $\pm$ 0.846	3.85 $\pm$ 0.755	-0.101	0.168	0.621
	Third Leopold maneuver	3.80 $\pm$ 0.860	3.82 $\pm$ 0.770	-0.198	0.164	0.854
	Fourth Leopold maneuver	3.72 $\pm$ 0.904	3.83 $\pm$ 0.806	-0.307	0.074	0.226
	Fetal heart sound	3.86 $\pm$ 0.816	3.92 $\pm$ 0.759	-0.250	0.128	0.518
	Clinical Interpretation	3.78 $\pm$ 0.798	3.82 $\pm$ 0.755	-0.027	0.260	0.109

*Statistical significant difference at $p < 0.05$

increase after the traditional classroom lecture and SUT mobile content (t-test = 2.750, $p = 0.008$), the completeness of the contents (t-test = 2.275, $p = 0.027$), knowledge of teaching is clear (t-test = 2.621, $p = 0.011$), and answering questions in class (t-test = 2.121, $p = 0.038$) but the knowledge application differences were not significant.

In the domain of self-reported confidence (Table 2), the mobile content increased the confidence and knowledge that can be applied to reality, but the knowledge for preparation of the procedure and interpretation differences were not significantly different.

The primary aims of this research were to survey self-evaluation by third-year medical students to see if their knowledge Leopold's maneuver skill, and application were better from the didactic lecture or from the mobile content. In general, the objective structured clinical examination was used for evaluating the students' performances, but our study was a more measurable test for knowledge application and self-reported confidence in the basic obstetrics procedures. From the data collected, there were significant differences in the students' knowledge and application based on the teaching method but no difference in their self-confidence in application to a real case. The observed higher score in the fourth Leopold's maneuver and fetal heart sound examination might suggest that complexity is better imaged by the mobile content than by the didactic lecture but the differences were not significant.

The most beneficial aspects of the mobile learning technology are good imagery and offering convenient access in which learning can take place across time and locations with

more repetition and less time used (Topps *et al.*, 2013). If the medical staff advise students to prepare before the classroom lectures, it can reduce the time necessary for lectures and give more time for active learning with 2-way communication and feedback from the staff.

The limitations of this method include the difference in time between the didactic lecture and the mobile content (60 min vs 15 min) which may affect the acquisition of complete knowledge and the clarity of the content. An explanation for the poorer performance of the mobile content might be the characteristics of the video-based mobile content that, in this study, comprised technology which was not a version that encouraged interaction by the medical students and which may affect their engagement. Previous studies found a favorable outcome for improving medical students' attitudes and the number of attempts needed to build the learning curve (Palmer and Devitt, 2007; Looi *et al.*, 2010). The number of medical students viewing the mobile technology may reflect their perceptions of the learning activity. The mobile learning videos may be useful in medical students' education even though the videos were viewed for the first time, similar to a previous study showing improvement in patient presentations (Diez-Goñi *et al.*, 2015). Studies have shown a largely positive influence of mobile learning technologies in various clinical settings, especially surgical skills and educational outcomes such as knowledge, psychomotor skills, and engagement by medical students (Tews *et al.*, 2011; Jang and Kim, 2014) and by other healthcare professionals (Miller *et al.*, 2005; Garrett and Jackson, 2006; Maag, 2006; Kenny *et al.*, 2009; Hinck and Bergmann, 2013; Guo *et al.*, 2016). Clinical problems convert

Table 2. Self-reported confidence of medical students in Leopold's maneuver

Domain	Didactic lecture Mean $\pm$ SD	Mobile content Mean $\pm$ SD	Pair t-test difference 95% CI		p -value
			Lower	Upper	
Confidence in basic obstetrics procedures in preclinical year	4.02 $\pm$ 0.59	3.88 $\pm$ 0.651	0.256	0.258	0.017*
Confidence in knowledge application to real case in clinical year	3.83 $\pm$ 0.763	3.72 $\pm$ 0.739	-0.049	0.282	0.163
Confidence in distributing knowledge in public space	3.68 $\pm$ 0.748	3.70 $\pm$ 0.766	-0.163	0.130	0.821

*Statistical significant difference at $p < 0.05$

passive didactic lecturing into active mental activity, which is a must for learning and the key student behavior that brings about active learning is engagement (Meyers and Jones, 1993; Richardson, 2008).

A previous study showed no correlation with confidence and competence in real practice (Barnsley *et al.*, 2004). A high incidence of a lack of confidence among medical students across a groups may indicate areas of the curriculum which need to be examined more closely. Although medical students feel confident in taking obstetrics procedures in the preclinical years there is difficulty in providing students with opportunities to perform examinations in the clinical years and limited exposure to real cases which may lead to a lack of confidence among medical students. Some important factors that may affect putting mobile technologies into the medical setting are cost, wireless capabilities, networks, and support.

Strength of the Study

The most beneficial aspects of implementing mobile applications are good imagery and the capability of repetition anytime and anywhere, but the short period for the presentation and active learning requirement may be a limitation compared with the didactic educational method. This is an encouraging result for the future of social media-based education with new generations of preclinical students. The mobile applications do have the capacity to assist a faculty to boost confidence in performing clinical skills among medical students as an alternative teaching method with multimedia programs, and as a guide to teachers of the course.

Limitation of Study

The frequency and accessibility of mobile learning technology may be best reflected by medical students' perceptions of the activity but this study did not include the frequency of medical students using the mobile content.

Future Recommendations

Overall, mobile learning technology in basic obstetrics procedures provides lower knowledge and application results than a didactic lecture in the classroom, but it may be applied to 3D/4D instruction and interaction with medical students to promote engagement

and produce a series of mobile content in the future. Enjoyment of the learning activity by medical students might promote more engagement, motivation for learning, retention of knowledge, better application and higher confidence in the future.

Conclusions

The mobile learning technology increased both knowledge and self-reported confidence in Leopold's maneuver, when compared with a didactic lecture in the classroom but the interpretation differences were not significant. Interpretation with medical staff to check accuracy and give feedback to medical students after Leopold's maneuver helps facilitate the learning outcome.

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