Mobile-flipped learning for an information systems course

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ABSTRACT: In the current era, almost all workplaces use computers, where computer technology is used to produce information systems. Such systems contain programmed components and integrated data for more efficient information management. To prepare information system experts, the learning approach to information and computer technology (ICT) in schools should match market needs. In order to identify the best learning strategies, the research outlined in this article was used to compare general collaborative learning (GCL) with mobile-flipped learning (MFL). The Mann-Whitney *U* test was the means by which analysis and comparison was made of two classes with similar abilities, but one was taught using CGL and the other using MFL. The results showed a significant difference between the two classes. The score of the MFL class was higher than that of the CGL class.

INTRODUCTION

In the 21st Century, information and computer technology (ICT) is widely applied in the workplace. Increased use of ICT is a consequence of a number of developments, i.e. smart devices, collaboration, co-operation and data analysis [1].

There is a high demand for integrated, effective information systems. Therefore, there is an increasing need for quality information system education, which should include mobile applications and collaboration. This should support the production of quality information systems for various fields of work [2]. Efforts to improve the quality of information system education require the selection of appropriate learning strategies [3].

Current learning is *face-to-face* between lecturers and students, and this leads to problems, such as passive learning, lack of student concentration, lack of understanding and lack of variation [4]. This negatively affects student understanding and skills. To address these problems, innovative learning strategies are required with an emphasis on collaborative, active learning.

Collaborative learning is an active learning method that requires students to work together to accomplish a task or solve a problem. This learning stimulates students to think actively and critically [5]. Students are responsible within their group for their learning. Research shows that collaborative learning has the following positive impact [6][7]:

- Students' interest in learning increased.
- Two-way learning between lecturer and students was more intense.
- Increased knowledge and ability of practice.
- Ability to co-operate in solving problems.
- Improved learning outcomes.

Utilisation of appropriate media or tools can make the learning more effective. Flipped learning is a type of collaborative learning, while mobile-flipped learning allows collaboration through mobile technology. Research has shown positive results from its implementation.

The aim of this study was to compare student understanding of general collaborative learning and mobile-flipped learning. The subjects for this research were two classes from an information systems course in higher education.

Each class was taught using one of the two learning approaches. Assignment scores and observations during learning were used to compare the two approaches and so determine the appropriate approach to be implemented in the information systems course.

The development of the smartphone has had a significant impact on social life and peoples' habits, and has also affected learning and education. A mobile application can be used to browse subject material anywhere and anytime. A lecturer can innovate in the use of mobile technology to make learning more fun and interesting.

Trello is an application developed to assist learning. Trello is Web-based and used as a collaborative tool. In addition, a mobile version of Trello is available, so it can be accessed anytime and anywhere from a mobile device. Hence, Trello allows lecturers to conduct learning outside of the classroom.

Figure 1 shows the main page, which contains several boards sorted by class, group or subject assignment. The lecturer can set an assignment, control who is working on a task and how the task should be processed.

For students, it is like having *sticky notes* that indicate tasks to be done with teammates. They can access and upload a task on-line. Collaboration with teammates is facilitated by comment and discussion features. Therefore, Trello supports collaborative and mobile learning without the need for additional tools.

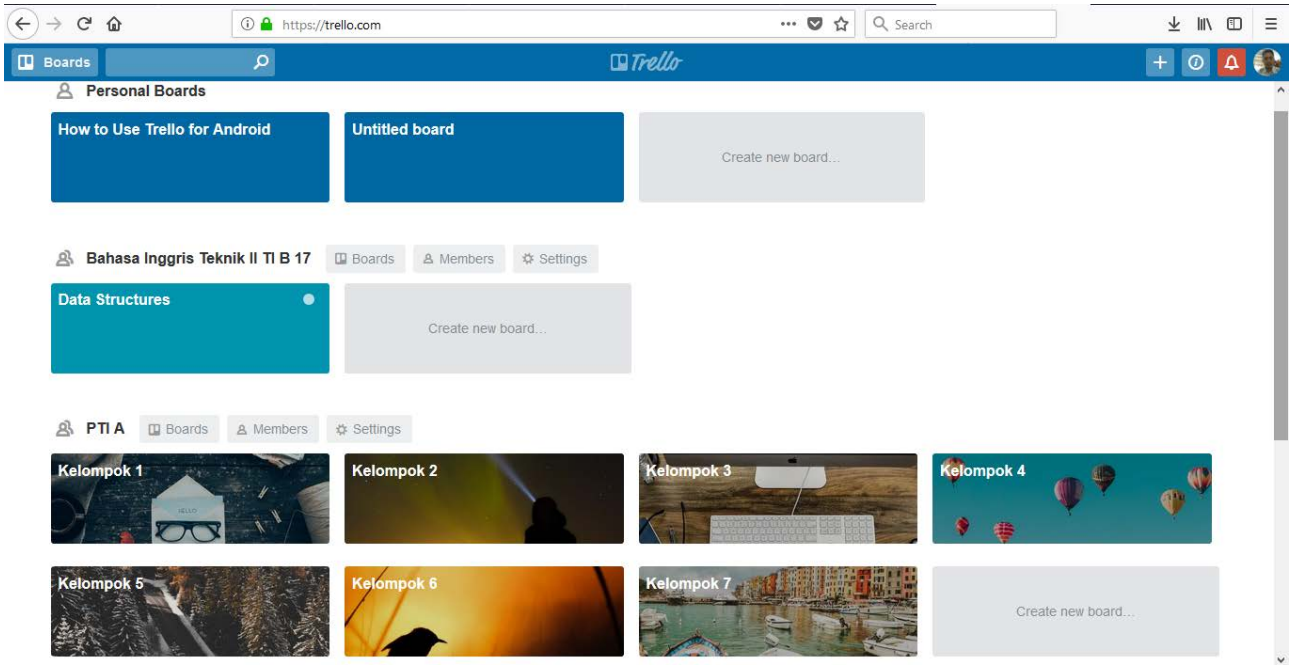

Figure 1: Main page of Trello.

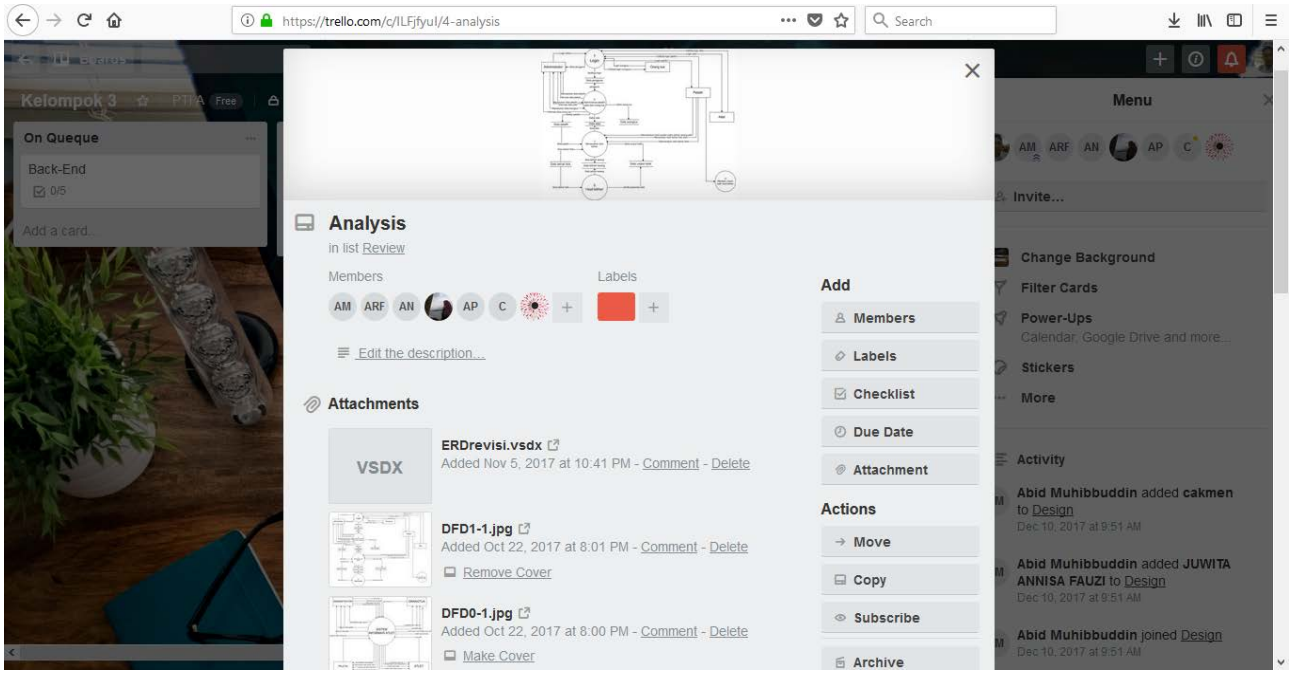

Figure 2: Example of a task given to students.

Figure 2 shows an example of a task set by a lecturer. The task was the analysis phase of the development of an information system. The students were to produce an entity relationship diagram (ERD) and data flow diagram (DFD) of the information system.

After uploading to Trello, the task will show up on the screen and be accessible to other groups who are able to comment and discuss the task. With Trello, learning is more interesting and fun. This is because Trello has a user-friendly interface and many features to support learning. In addition, with on-line access, students have flexibility in choosing the time and place to learn and access subject material.

Mobile learning should be applied with an appropriate learning approach. Flipped learning was the approach used for the information systems course. This is a student-centred learning, where classroom type learning is *flipped* to outside the classroom. In flipped learning, class material is given before class through Trello. Students should access the material to learn about the subject before the class. This may involve the use of video or other media. After accessing the material, they will then discuss in class, what they have learned with other groups or the lecturer. So, this is active learning in the classroom, with an emphasis on teamwork. When the class is over, the lecturer will give students an assignment and upload it to Trello. Hence, students further deepen their knowledge of the subject material outside the classroom.

RESEARCH METHOD

For this research method a post-test design was adopted with two groups of subjects. The aim of this approach was to compare two groups who receive different treatments in the experiment. Subjects in this study were from two classes of information systems students [8]. Table 1 shows the research scenario. The control class was not given the treatment, while the experimental class was. After learning, the control and experimental classes were assessed through the post-test assessment.

Table 1: Scenario of trial implementation.

Class	Treatment	Post-test
Control	no	Y1
Experimental	yes	Y2

Table 2 shows the strategies for each group. In general collaborative learning (GCL), lecturers explain the material in class, followed by discussions between the lecturer and students and between students. After discussions the lecturer sets a task for the students. Students discuss the task with their teammates or other groups.

In mobile-flipped learning (MFL) the subject material was accessed through Trello by students before the class. The lecturer uploaded video or other media learning material for students. Students already knew the material before the class, so they spent time in class discussing the material.

Table 2: Treatment given to the two groups.

Treatment	General collaborative learning (GCL)	Mobile-flipped learning (MFL)
Subject material	• During class meeting	• On-line through Trello before the class
Discussion	• After explanation by lecturer	• During the class, discussing the previously provided material • On-line assignment discussion
Group assignment	Yes	Yes
Final assignment	Yes	Yes
Post-test	Yes	Yes

The same post-test assessment was carried out on the two groups to measure the effect of the treatment on students' understanding of the material. The post-test scores were analysed using the Mann-Whitney *U* test. This test is a non-parametric test that does not require normally distributed data [9]. This test was chosen because of the assumption that the subjects in the two groups (classes) had similar initial abilities [10].

RESULTS AND DISCUSSION

The results obtained from the post-test scores for the two classes were analysed using the Mann-Whitney *U* test. The results of the analysis are shown in Table 3.

Table 3: Average results for the two groups (ranks).

	Group	No.	Mean rank	Sum of ranks
Results	Group A	31	24.74	767
	Group B	32	39.03	1,249
	Total	63		

Table 3 shows the mean rank between the two groups. In group A (control group), the average was 24.74. For group B (experimental group), the average was 39.03. An analysis was carried out to see, if the difference between the two groups was statistically significant. The result of the significance analysis is shown in Table 4.

Table 4: Results of the significance analysis based on two-grade post-test results (test statistics[a]).

	Result
Mann-Whitney *U*	271
Wilcoxon W	767
Z	-3.099
Asymp. sig. (2-tailed)	0.002

[a] Group variable: group

The null hypothesis H_o is that there is no significant difference between the two groups. The alternative hypothesis H_a is that there is a significant difference between the two groups. From Table 4, the *U* and W values lead to the value of Z = -3.099. On the Mann-Whitney *U* test:

- If the asymptotic significance (asymp. sig.) (2-tailed) is smaller than 0.05, the hypothesis H_a is accepted.
- If the asymp. sig. (2-tailed) is greater than 0.05, the hypothesis H_a is rejected and H_o is accepted.

The significance analysis shown in Table 4 yielded an asymp. sig. (2-tailed) = 0.002, and so hypothesis H_a is accepted. Thus, it can be concluded that there is a significant difference between groups A and B with the treated class (group B) using MFL having higher post-test results than the untreated class (group A) using GCL.

A qualitative data analysis from surveys and observations was used to support these findings and suggest explanations. Some students from the experimental class considered MFL learning more appealing. In addition, there was more opportunity to practice.

Previous similar research of student learning outcomes using MFL showed higher project scores. Thus, it may be concluded that MFL has succeeded in providing an active and flexible learning environment that improves student understanding.

Other research results based on surveys show the positive effects of the implementation of MFL, viz:

- Flexibility with much preparation time for discussion.
- Active learning in class.
- More discussion helps clear up student confusion about the subject.
- Helps students since learning is less stressful.
- Students hope that MFL will be applied to other courses.
- Group work is a good learning experience.
- On-line learning allows students to focus and learn.

CONCLUSIONS

The conclusion from this research is that mobile-flipped learning (MFL) is better than general collaborative learning (GCL). The method was used on the information systems course and improved the students' understanding as indicated by the post-test results.

The GCL is active learning, but needs improvement in the use of classroom time. Learning time is in the classroom for GCL and is too limited for students to understand all the subject material. The MFL can be a solution for the lack of learning time by providing additional learning time on-line outside of the classroom.

Students and supervisors prefer to use social media since it is available on smartphones [11]. The MFL, available on smartphones, improves student knowledge, individual skills and teamwork skill. As well, MFL can improve teachers' performance, students' learning satisfaction and students' achievements [12].

Further research could be conducted on the impact of MFL on learning. For example, university-industry co-operation could use MFL and might improve students' real world knowledge of' technical, transferable and business skills [13]. The MFL is an optional approach to apply to other subjects or courses.

REFERENCES

1. Kim, J.A., Heo, H.H. and Lee, H., Flipped learning model for management class. *Adv. Science Technol. Lett.*, 71, 59-62 (2014).
2. Bier, N., Lovett, M. and Seacord, R., An online learning approach to information systems security education. *Proc. 15th Colloquium for Infor. Systems Security Educ.*, 56-62 (2011).
3. Chen, C.S., Self-regulated learning strategies and regulated learning strategies and achievement in an introduction to information systems course. *Infor. Technol. Learn. Perform. J*., 20, **1**, 11-25 (2002).
4. Downing, C.E., A simple and effective method for teaching information systems vocabulary and concepts in a large lecture setting. *J. of Infor. Syst. Educ*., 13, **3**, 165172 (2002).
5. Göl, O. and Nafalski, A., Collaborative learning in engineering education. *Global J. of Engng. Educ*., 11, **2**, 173-180 (2007).
6. Cordingley, P., Bell, M., Thomason, S. and Firth, A., The Impact of Collaborative Continuing Professional Development (CPD) on Classroom Teaching and Learning. Review: How do Collaborative and Sustained CPD and Sustained but not Collaborative CPD Affect Teaching and Learning? (2005).
7. Alfonseca, E., Carro, R.M., Martin, E., Ortigosa, A. and Paredes, P., The impact of learning styles on student grouping for collaborative learning: a case study. *User Model. User-adapt. Interact*., 16, **3**, 377-401 (2006).
8. Davies, R.S., Dean, D.L. and Ball, N., Flipping the classroom and instructional technology integration in a college-level information systems spreadsheet course. *Educ. Technol. Research and Develop*., 61, **4**, 563-580 (2013).
9. Nachar, N., The Mann-Whitney U: a test for assessing whether two independent samples come from the same distribution. *Tutor. Quant. Methods Psychol*., 4, **1**, 13-20 (2008).
10. EL-Deghaidy, H. and Nouby, A., Effectiveness of a blended e-learning cooperative approach in an Egyptian teacher education programme. *Computers and Educ*., 51, **3**, 988-1006 (2008).
11. Jusoh, S. and Al Fawareh, H.M., The use of social media for final year undergraduate project supervision. *World Trans. on Engng. and Technol. Educ.*, 15, **3**, 223-227 (2017).
12. Suswanto, H., Asfani, K. and Wibawa, A.P., Contribution of teaching performance, learning satisfaction and achievement motivation to students' competence achievement. *Global J. of Engng. Educ.*, 19, **1**, 66-71 (2016).
13. Mahnič, V., Student projects as a means of cooperation between academia and industry: some experiences in the area of software engineering education. *World Trans. on Engng. and Technol. Educ.*, 15, **3**, 239-244 (2017).