Can Blended Learning Replace Face-to-Face Teaching in Machine-Knitting Courses?

Kawai Lo, The Hong Kong Polytechnic University, Hong Kong SAR
Chu-po Ho, The Hong Kong Polytechnic University, Hong Kong SAR
Jinyun Zhou, The Hong Kong Polytechnic University, Hong Kong SAR
Hiu-ting Tang, The Hong Kong Polytechnic University, Hong Kong SAR

The Barcelona Conference on Education 2022
Official Conference Proceedings

Abstract

Over the past two years, the COVID-19 pandemic has made unprecedented impacts on teaching and learning (T&L). In tertiary education, face-to-face classes were replaced by online teaching, while most of the hands-on classes and practicums were suspended. The transition was challenging yet it gave us a chance to rethink about the pedagogy and T&L direction in the future. The aim of this study is to compare the learning efficiency and students' learning experience of blended learning with face-to-face (f2f) teaching in the machine-knitting course. The blended learning course included online self-study modules and a training workshop to examine the learning outcomes. It was believed to maximise the learning effect yet reduce the total study hours. A pilot test was carried out on a group of knitwear design students who had taken f2f knitting classes before, so that they can compare the learning experience and efficiency between blended learning and f2f teaching. The students' learning outcomes were assessed by the knitting tasks in the workshops. Data and comments collected from questionnaires and interviews after the course were analysed. The results proved the effectiveness of combining self-learning with hands-on workshops, but at the same time it emphasised the important of hands-on training which was irreplaceable. This study could provide references for improvement on future course design and similar hands-on training courses in other institutes.

Keywords: Blended Learning, Online Self-Study Modules, Hands-On Training, Machine-Knitting Courses, Teaching and Learning

iafor

The International Academic Forum
www.iafor.org

Introduction

Over the past two years, the COVID-19 pandemic has made unprecedented impacts on our life in all aspects. It has brought about enormous changes in education sector, altering the format of teaching and learning (T&L). In tertiary education, face-to-face classes were replaced by online teaching, while most of the hands-on classes and practicums were suspended. The transition was challenging and the learning efficiency was affected in the beginning, yet students, teaching staff and universities showed quick response and tremendous resilience gradually (Naidoo et al., 2021; Thakur, 2020; Schwartzman, 2020). Both students and teachers have been well 'trained' and they start to get used to the new T&L approach. Such a shift also gives us a chance to rethink about the pedagogy and T&L direction in the future.

Blended learning could be one of the solutions under social isolation, especially for subjects with essential practical components. A number of empirical studies have proved adopting blended learning in education can raise students' learning effectiveness (Thai et al., 2017). Various approaches of blended learning have been proposed and investigated. Flipped learning is a kind of student-centred learning that suggests students study the teaching materials before class, enabling effective use of class time for problem solving and practicing with supports from the teacher (Long et al., 2019). It shifts the learning instruction to the pre-class activities, so students can interact and be more focus in the in-class activities (DeLozier & Rhodes, 2017). Integrating with thinking and reflection, they can have a better understanding of the learning content and teaching materials (Hwang & Lai, 2017). Although Flipped learning provides a good learning environment with lots of advantages, it requires a high level of self-motivation and self-discipline from students. To enhance the T&L model, Chang et al. (2022) proposed combining flipped learning with self-regulated learning (SRL), which requires self-planning, self-monitoring and self-adjusting. The integrated approach was proved applicable in hands-on training with significant improvement in students' learning achievement.

The aim of this research is to compare the learning efficiency and students' learning experience of blended learning with face-to-face (f2f) teaching in the machine-knitting course. Conventionally machine-knitting subjects are taught in f2f mode as students can only access to the knitting programme and operate the machines in the knitting lab. Having studied different approaches of blended learning, the knitwear teaching team of Institute of Textiles and Clothing carried out a pilot test in the advanced machine-knitting course to determine if the T&L efficiency of blended learning was same as that of f2f teaching. To maximise the learning effect yet reduce the total study hours, a series of online self-learning modules of STOLL ADF programming and machine operation was designed. It was followed with a training workshop to examine the learning outcomes. Learning analytics was applied to measure, collect and analyse the data through the entire T&L project (Siemens, 2013).

Methodology

Design of the blended learning course

After reviewing the existing advanced knitting course, a new blended learning course on STOLL ADF programming and machine operation comprising self-learning modules and training workshops was proposed to implement in semester two 2021/2022. Fifteen year-3 knitwear design students were asked to participate in this blended learning course. They had

experienced face-to-face knitting classes in semester one and learnt basic knowledge of machine-knitting. As the 'end-users', they had been informed the purpose and arrangement of the blended learning course in the beginning of semester one, so that they could compare the learning experience and effectiveness between face-to-face teaching and blended learning, contributing to the learning analytics in this T&L study.

The class components of face-to-face teaching and that of blended learning are structurally different (Figure. 1). The existing course outline includes 18 hours of class contact, i.e. total 6 weekly lessons and 3 hours per week, and 35 hours of student study effort. Usually the 3-hour class is split equally into the face-to-face teaching section, i.e. demonstration of knitting machine programming and operation, and the in-class practice, which students operate the knitting machine under the teacher's or lab technician's supervision. Students can ask the teacher or technician when they encounter problems and they can receive feedback or solutions immediately. Due to the limitation of class time, students used to practice and complete knitting assignments on their own after lesson. However, the technical support may be not that sufficient compared to the class time. In the propose blended learning mode, a series of online self-learning materials was prepared by the subject lecturer and experienced technicians. The learning contents were edited into 6 short modules (including jacquard using colour arrangement, plating, inlay, multi-coloured intarsia, devoré knitting and ADF machine operation) with clear written instructions and illustrations. The contents were streamlined and organised in a more readable way (Figure. 2). A knitting task was set at the end of each module to achieve the learning outcomes. The self-learning materials were uploaded on a shared drive for easy access. Students were expected to read through the learning contents within 10 hours before joining the training workshop for practice with technical support. The hands-on training was composed of 9 workshops in 2 hours each. Due to the limitation of class size under pandemic, students came in a group of three and only two groups of students can stay in the knitting lab at the same time, which is half of the maximum capacity of the lab. One experienced technician was assigned at a time to provide technical support to the students. However, they were expected to finish the knitting tasks and solve problems on their own unless there were serious technical problems.
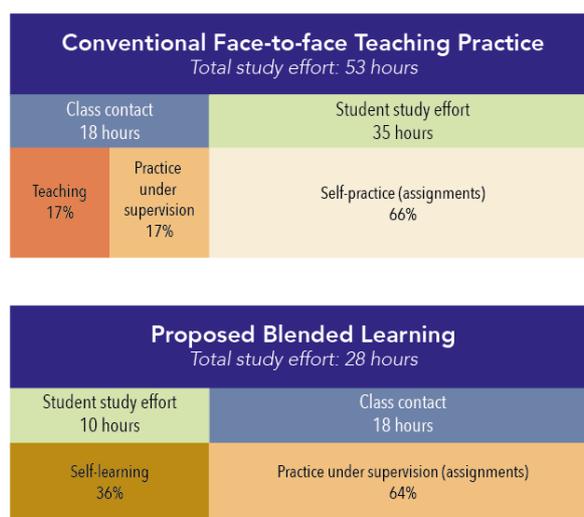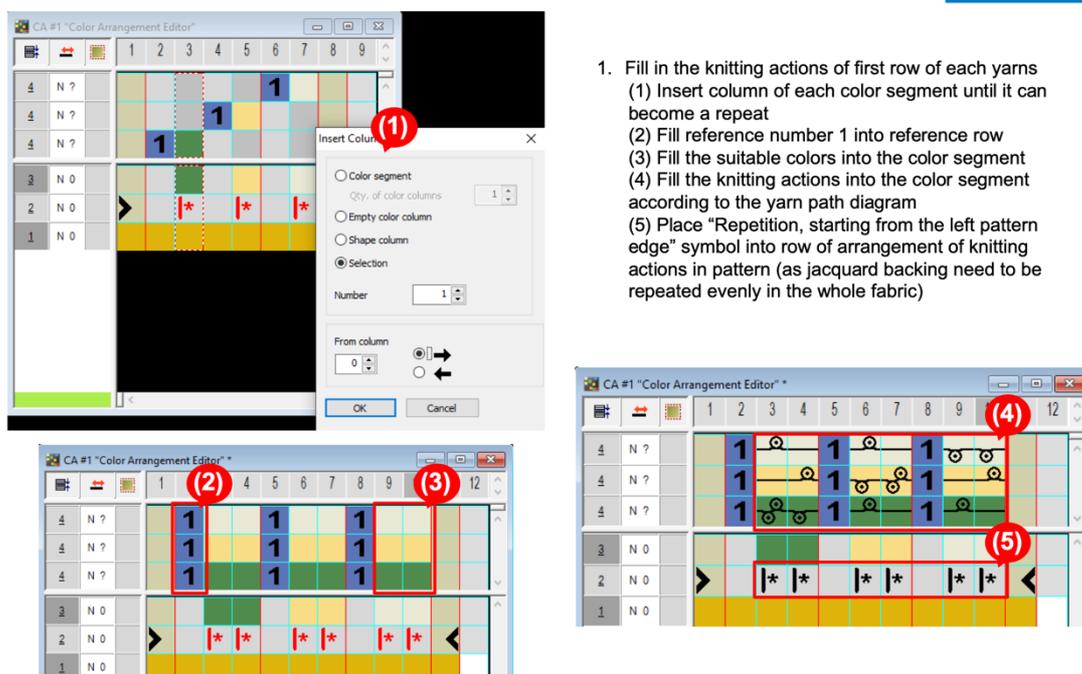

Figure 1: Comparison of course composition – the proposed blended learning approach increased the practice time under supervision yet shortens the total study hours.

Figure 2: Example of the online self-learning materials, the instructions are clearly illustrated.

Implementation of learning analytics

Learning analytics(LA) was applied to measure, collect data and analyse the effectiveness of the proposed blended learning course in this study (Siemens, 2013). Referring to the process of SRL proposed by Zhao et al. (2014), the following aspects were reviewed and analysed during the course planning and implementation:

- Learning objectives – students' interest towards learning the new knitting techniques and motivation
- Learning resources – content of learning materials, arrangement of learning and technical support in the course
- Learning outcomes – understanding of course contents and ability of integrating the skills in knitwear design

A theoretical model was developed to predict the learning objectives, observe the learners' behaviour, achieve the learning outcomes and reflect the learning experience (Figure. 3). It suggested an iterative data collection, analysis and reporting process during design of learning resources and implementation of the course. In the beginning, the course planner predicted student performance before designing the learning materials and planning the course. The students' learning behaviour was observed and recorded during the implementation of blended learning. Learning effectiveness was assessed by the results, whether the students can achieve the learning outcomes, and reflections of all parties including the teacher, technicians and students participated in the course. The data collected could enhance the existing learning resources or alter the prediction of learning objectives.
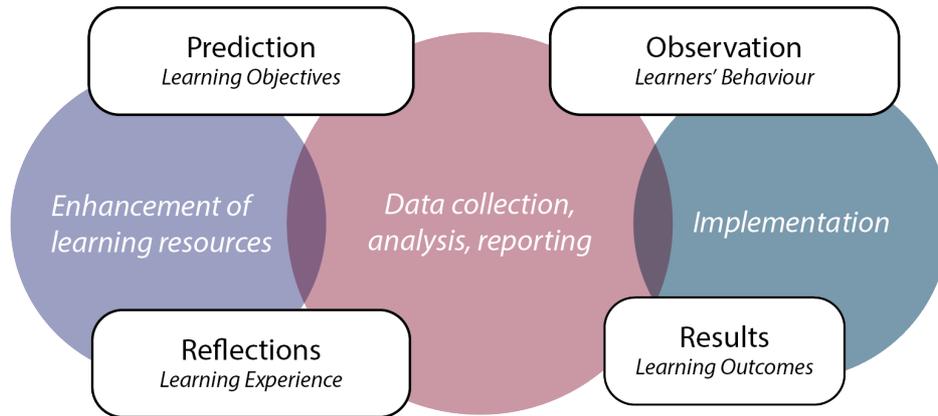
Figure 3: Learning Analytics Model for blended learning with hands-on training

In this study, data was collected by both quantitative and qualitative methods. Questionnaires were distributed to the course participants, investigating their expectations of the course, comments on the online self-learning modules and training workshops, as well as learning efficiency compared with face-to-face teaching classes (Figure 4). 5-point Likert scale was adopted in the questionnaire, with '5' referring 'strongly agree' and '1' referring 'strongly disagree'. To compare learning efficiency of blended learning with that of face-to-face teaching, the paired sample t-test was used to determine the mean difference between these two sets of participants' comments. The null hypothesis was assumed to be no significant different between blended learning and f2f teaching.
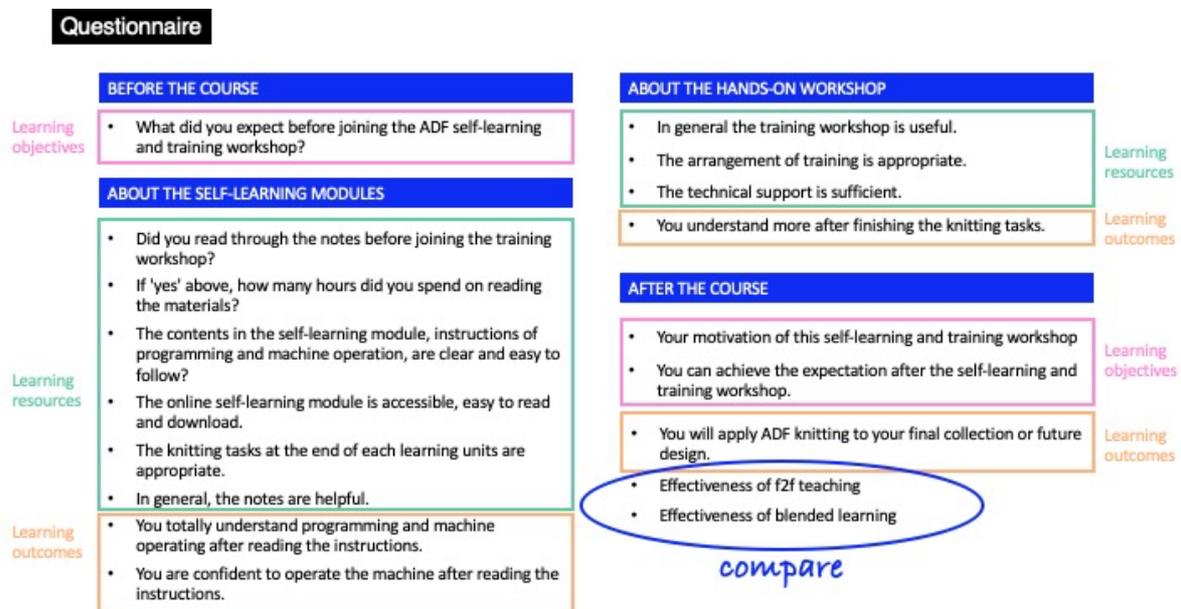

Figure 4: Questions in the questionnaire which were designed to collect comments on learning objectives, learning resources, learning outcomes, as well as comparing the effectiveness of the two teaching and learning approaches

An in-depth semi-structured interview with a focus group was also conducted. Four students (named as Student A, B, C and D) were selected randomly from the class and they were asked open-end questions about the arrangement of the course and their learning experience. The interview was recorded and transcribed to identify specific patterns of problems encountered by the students.

Findings and Discussion

Fourteen students submitted the questionnaires, the final findings were quite surprising. In general, the participated students found the self-learning modules and the training workshop useful, resulted in 4.43 and 4.07 out of 5.0 respectively. They were basically satisfied with the arrangement of training workshops, yet there was one interesting comment from one student -   The number of classes should be reduced but the duration should be elongated so that it could reduce the traveling times to school. This made sense during the pandemic situation when people should lessen social activities and possible body contact. The students' learning motivation in this blended learning course was 4.0, which was quite similar to that in f2f teaching classes. The students mostly agreed they spent less time but they can achieve the expectation of this course and learning outcomes after the training workshop. Regarding the learning effectiveness, the two-tail p value was 0.08 (> 0.05), which indicated there was no significant difference between these two T&L methods in students' point of view (Table 1). However, the mean of effectiveness of f2f teaching (4.43) was slightly higher than that of blended learning (4.21).

	Effectiveness of blended learning	*Effectiveness of face-to-face teaching*
Mean	4.214285714	4.428571429
Variance	0.489010989	0.571428571
Observations	14	14
Pearson Correlation	0.83153075	
Hypothesized Mean Difference	0	
df	13	
t Stat	-1.882937743	
P(T<=t) one-tail	0.041138433	
t Critical one-tail	1.770933396	
P(T<=t) two-tail	0.082276866	
t Critical two-tail	2.160368656	

Table 1 Results of paired sample t-test on learning effectiveness between blended learning and face-to-face teaching

The findings indicated that conventional f2f teaching was still more effective and preferable. This could also be explained from the feedback of focus group in the interview. Student A and Student C reflected that f2f teaching and learning was easier to understand, students could raise questions about knitting problems and get the solution immediately from the teacher. The interviewed students also agreed hands-on practical classes were essential,

which could deepen the impression of machine operation. 'I spent less time but I can achieve the expectation of this course and learning outcomes after the training workshop.' Student B said. Last but not least, there was an interesting comment from Student D about the arrangement of workshops (9 sessions of 2-hour workshops), 'The number of classes should be reduced but the duration should be elongated so that it could reduce the traveling times to school.' It was particularly critical during the pandemic as it may increase the chance of infection.

Conclusions

The COVID-19 pandemic has brought about a global revolution in teaching and learning. Conventional f2f teaching in the classroom was changed to online or hybrid teaching in order to continue T&L practice under the circumstances. However, subjects with essential hands-on learning components are not possible to be replaced by online teaching or self-learning. To remedy the situation, different blended learning approaches have been proposed and applied to hands-on training courses by education scholars in different fields. The pilot test conducted in this research proved the effectiveness of combining self-learning with hands-on workshops, but at the same time it emphasised the important of hands-on training which was irreplaceable. Learning analytics helped a lot in measuring, collecting, analysing and reporting data in the T&L research. The findings of this paper could provide references for similar hands-on training courses in other institutes.

References

Chang, C., Panjaburee, P., Lin, H., Lai, C., & Hwang, G. (2022). Effects of online strategies on students' learning performance, self-efficacy, self-regulation and critical thinking in university online courses. *Education Tech Research Dev 70*(1), 185–204. https://doi.org/10.1007/s11423-021-10071-y

DeLozier, S. J., & Rhodes, M. G. (2017). Flipped classrooms: A review of key ideas and recommendations for practice. *Educational Psychology Review, 29*(1), 141–151. https://doi.org/10.1007/s10648-015-9356-9

Hwang, G. J., & Lai, C. L. (2017). Facilitating and bridging out-of-class and in-class learning. *Journal of Educational Technology & Society, 20*(1), 184–197.

Long, T., Cummins, J., & Waugh, M. (2019). Investigating the factors that influence higher education instructors' decisions to adopt a flipped classroom instructional model. *British Journal of Educational Technology, 50*(4), 2028–2039. https://doi.org/10.1111/bjet.12703

Naidoo, D'warte, J., Gannon, S., & Jacobs, R. (2021). Sociality, resilience and agency: how did young Australians experience online learning during Covid-19? *Australian Educational Researcher, 49*(1), 81–96. https://doi.org/10.1007/s13384-021-00500-5

Siemens. (2013). Learning Analytics: The Emergence of a Discipline. *The American Behavioral Scientist (Beverly Hills)*, *57*(10), 1380–1400. https://doi.org/10.1177/0002764213498851

Schwartzman, R. (2020). Performing pandemic pedagogy. *Communication Education, 69*(4), 502–517. https://doi.org/10.1080/03634523.2020.1804602

Thai, N. T. T., De Wever, B., & Valcke, M. (2017). The impact of a flipped classroom design on learning performance in higher education: Looking for the best "blend" of lectures and guiding questions with feedback. *Computers & Education, 107*, 113–126. https://doi.org/10.1016/j.compe du.2017.01.003

Thakur, A. (2020). Mental health in high school students at the time of COVID-19: A student's perspective. *Journal of the American Academy of Child and Adolescent Psychiatry.* https://doi.org/10.1016/j.jaac.2020.08.005

Zhao, Chen, L., & Panda, S. (2014). Self-regulated learning ability of Chinese distance learners. *British Journal of Educational Technology*, *45*(5), 941–958. https://doi.org/10.1111/bjet.12118