Guest Editorial: "HOW" to Design, Implement and Evaluate the Flipped Classroom? – A Synthesis

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The "flipped classroom" as a technology-supported pedagogical innovation, has gained prominence worldwide. "WHAT" is the flipped classroom? Although there is no single definition, it is generally characterized by its course structure comprising in-class and out-of-class activities. It uses classroom time for students to actively engage in interactive learning activities, while traditional lectures are delivered out of formal class time with videos, audios, content-rich websites, games and simulations, and the like (Baepler, Walker, & Driessen, 2014). Based on sound pedagogical and theoretical principles, the "flipped classroom" approach aims at exploiting classroom time and space for appropriately designed interactive learning activities to foster students' active learning, in which students engage in collaborative and problem-based learning activities to develop higher order thinking skills (Prince, 2004). Such an instructional design intends to have lecture instructions out of class time, thus affords more classroom time to engage students in active learning (e.g., Jungić, Kaur, Mulholland, & Xin, 2015; Sohrabi & Iraj, 2016; Wasserman, Quint, Norris, & Carr, 2015) to bring about paradigm shift where the teacher becomes a "guide on the side" instead of a "sage on the stage" (King, 1993), and students are empowered to explore and solve problems either independently or in groups to achieve their learning goals.

Although a common understanding is reached on "WHAT" the flipped classroom is, there is still a pressing need for studying "HOW" to implement the flipped classroom and, moreover, to be able to connect this pedagogical design with evidence of advantages related with various aspects of student learning. A review of the literature on the flipped classroom has discovered several issues, for example, (1) a large number of studies on the flipped classroom do not present their pedagogical designs with strong theoretical underpinning and are lack of pedagogical principles to guide the design, implementation and evaluation of the flipped classroom (Kim, Kim, Khera, & Getman, 2014); (2) because in-class activities vary from one to another widely, ranging from discussions, quizzes, individual/group presentations to role-play (O'Flaherty & Phillips, 2015), it is not clear what activities can help students develop critical thinking skills effectively and how; (3) due to abstract concepts or difficult contents on some learning topics, students are not able to acquire the knowledge on their own by watching lectures out of class, thus are not well prepared for in-class activities (Mason, Shuman, & Cook, 2013); (4) because of the mixed impact of the flipped learning on students' learning outcomes and students' perceptions of flipped learning, more research into pedagogical design is needed employing different research methods (e.g., Jungić et al., 2015).

Thus, the special issue aims to discuss pedagogical design and implementation of the flipped classroom grounded in solid theoretical principles, and evaluation of students' learning outcomes via appropriate research methods. The ambition of this special issue is to facilitate opening the "black box" of "HOW" to design, implement and evaluate the flipped classroom, contributing insights into future directions of pedagogical practices in school and tertiary education. This special issue attracted 38 submissions with two rounds of double-blind reviews by 76 international experts. Finally, 12 papers have been selected for publication covering a wide range of topics in this field including pedagogical design, implementation and evaluation, bridging in- and out-of-class learning, learning approaches, the action research method and student perceptions of flipped learning on various subjects across school and higher education.

Designing and implementing flipped classroom in professional development remains scant. Gökçe Kurt, in her contribution entitled "Implementing the flipped classroom in teacher education: evidence from Turkey", reports a quasi-experimental study on implementing the flipped classroom in a Classroom Management course in a pre-service English teacher education programme in higher education. The findings revealed that pre-service teachers in the flipped classroom developed more self-efficacy beliefs and performed better in their learning outcomes than those in the traditional classroom. This study provides detailed description of the pedagogical design of flipped classroom for pre-service teachers premised on the constructivist theories and differentiated instruction in its design, which enlightens future research on professional development using flipped learning approach.

Recognizing the challenges for students to comprehend the learning material on their own in flipped learning, Gwo-Jen Hwang and Chiu-Lin Lai, in their contribution entitled "Facilitating and bridging out-of-class and in-class learning: an interactive e-book-based flipped learning approach for math courses," report a quasi-experimental study in mathematics learning in a primary school, aiming at facilitating and bridging in- and out-of-class learning using an interactive e-book-based flipped learning approach. Adopting this approach, the instructional videos, quizzes and learning guidance provided by the teacher were integrated into e-books presented on mobile devices. The results indicate that the proposed approach not only promoted the students' self-efficacy for learning mathematics, but also improved their learning achievement, especially students with lower self-efficacy. This study contributes to the "seamless flipped learning" literature.

Although many research studies on flipped classroom have been conducted in various domain subjects, few studies have carried out in K-12 ICT (Information Communications Technology) course. Christoforos Kostaris, Stylianos Sergis, Demetrios Sampson, Michail Giannakos and Lina Pelliccione, in their contribution entitled "Investigating the potential of the flipped classroom model in K-12 ICT teaching and learning: An action research study," present the design and implementation of an action research to examine the effect of the flipped classroom approach on K-12 ICT teaching and learning. The study provides evidence for potential advantages in students' cognitive learning outcomes related to subject domain knowledge, the exploitation of teaching time during the classroom face-to-face sessions, the students' level of motivation, as well as their level of engagement. It adds value to the research literature in flipped classroom regarding its first trial of the approach in the educational context of K-12 ICT teaching and integrating the four-phase of action research (Plan, Act, Observe and Reflect) into the flipped classroom.

Addressing the issue of lack of theoretical underpinning for flipped classroom pedagogical design, Chung Kwan Lo and Khe Foon Hew, in their paper entitled "Using 'first principles of instruction' to design secondary school Mathematics flipped classroom: the findings of two exploratory studies," explicitly examined how flipped classroom can benefit underperforming or high ability students premised on first principles of instruction design theory in secondary school mathematics learning. Their findings show that adopting the design theory in the flipped classroom can help enhance both underperforming and high ability students' mathematics achievement. Another interesting finding is that "high ability students even asked for extending the class time in order to engage more advanced problems." The authors, therefore, suggest that practitioners prepare extra basic exercises for underperforming students and provide high ability students more advanced and real-world problems.

In spite of comparing flipped learning approaches with the traditional teaching approaches, Morris Siu-yung Jong, in his contribution entitled "Empowering students in the process of social inquiry learning through flipping the classroom," presents a study that integrates the idea of the flipped classroom into the process of guided social inquiry learning for promoting students' learning achievement and self-efficacy in social and humanities education. The study shows that the proposed flipped approach has different degrees of positive effects on high, moderate, and low academic-achieving students. The approach premised on social constructivist theories adds value to the design and implementation of flipped classroom research.

Attempting a new model in flipped learning, Hsiu-Ling Chen and Chiung-Yun Chang, in their contribution entitled "Integrating the SOP^2 model into the flipped classroom to foster cognitive presence and learning achievements", report a study that explores student teachers' cognitive presence and learning achievements by integrating the SOP^2 model ("S": Self-study, "O": online group discussion, and "P^2": Double-stage Presentations) into the flipped classroom. The design and implementation of the SOP^2 Model can be a useful reference for future adoption of the flipped classroom strategy in the higher educational context. Adopting another new approach in flipped learning, Chung-Kai Huang and Chun-Yu Lin, in their contribution entitled "Flipping business education: transformative use of team-based learning in Human Resource Management classrooms", presents a study on integrating flipped classroom and team-based learning in two Human Resource Management classes with a two-dimensional design of pre-class, in-class and post-class activities combining with individual, team and class activities. The study shows positive relationships among students' perceived team members' valuable contribution, motivation, enjoyment, and learning outcomes. The findings indicate that students are more likely to learn better once they perceive that their team members are devoted to team projects.

Contrasting with the learning design of flipped classroom where direct instruction via video clips is assigned as homework task first, followed by more challenging problem solving activities in class, Yanjie Song and Manu Kapur, in their contribution entitled "How to flip the classroom – 'productive failure' or 'traditional flipped classroom' pedagogical design?" propose adopting the "productive failure-based flipped classroom" pedagogical design where students' problem-solving goes before the instruction to enhance students' domain knowledge and conceptual knowledge in mathematics learning in a secondary school. By inverting the traditional flipped

classroom design, this new approach is characterized by a design where students are provided opportunities to explore, discuss and solve problems related to new concepts first in class even though they might come across failures, followed by consolidating the newly learned concepts and associated procedures using video clips at home. The research results show that compared with those in the traditional flipped classroom, students in the "productive failure-based flipped classroom" made significant improvement in their conceptual understanding of solving problems. This suggests that the "productive failure" pedagogical design may be better able to improve students' problem solving skills than traditional flipped classroom design.

Action research has hardly ever been touched on in studies of the flipped classroom. Vasiliki Aidinopoulou and Demetrios Sampson, in their contribution entitled "An action research study from implementing the flipped classroom model in primary school history teaching and learning," report a rare case that uses flipped classroom approach for the history course adopting action research in four phases, and make this paper a very good reference for those who intend to apply flipped classroom to social studies courses using action research. They also integrated both flipped classroom and action research together and conducted this research over an entire school year with two different History classes; one followed the flipped classroom model and the other followed the traditional lecture based approach. They not only compared students' performances on the learning goals of a history course (i.e., memorization of historical content) but also examined the effects on the cultivation of historical thinking skills (HTS). They found the engaging student-centered activities in classroom time contributed to better learning outcomes in terms of demonstrating critical HTS.

Developing students' self-regulated learning is crucial in cultivating 21st century skills in order to succeed in the digital age. Ünal Çakiroglu and Mücahit Özturk, in their contribution entitled "Flipped classroom with problem based activities: exploring self-regulated learning in a programming language course," presents a study on using flipped classroom model to enhance student problem based learning and self-regulated skills in a university programing course. The study recorded student learning activities and learning skills development throughout the whole course, and demonstrated different skills development in face-to-face and home sessions. Strengths and weaknesses in applying flipped classroom model contributing to self-regulated learning for students are also discussed. This study provides insights for using problem based activities in flipped learning.

Identifying the issue of mixed research results in promoting students' performance and/or satisfaction from flipped learning studies, Xuesong Zhai, Jibao Gu, Hefu Liu, Jyh-Chong Liang and Chin-Chung Tsai in their contribution, entitled "An experiential learning perspective on students' satisfaction model in a flipped classroom context" report on a longitudinal survey study of examining students' satisfaction with the flipped classroom based on the experiential learning theory in higher education. The findings show that prior learning experience is a far more significant antecedent for predicting students' satisfaction, and perceived quality (with five first-order dimensions) and perceived value are two vital mediators to students' satisfaction.

Finally, Zandra de Araujo, Samuel Otten, and Salih Birisci, in their contribution entitled "Conceptualizing 'homework' in flipped mathematics classes" present their proposed framework for flipped mathematics homework. It categorizes types of homework, as well as drawing on technology literature and mathematics education literature to discern the quality for each type of homework. In addition, they show how the quality of instructional videos can vary and how teachers can assign the videos to motivate subsequent in-class work on mathematics tasks. The proposed framework provides a basis for design research focused on developing effective materials for flipped instruction in mathematics.

To conclude, "HOW" to flip the classroom? The 12 papers have addressed varied research issues from different perspectives, which provide insights into future research. We have to admit that this special issue cannot answer all the concerns related to the "HOW." We hope that there will be more research studies to answer the question, and ultimately be able to theorize the flipped classroom to better guide the pedagogical design, implementation and evaluation of the practices.

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