International Journal of Instruction *July 2022 ● Vol.15, No.3*
e-ISSN: 1308-1470 ● www.e-iji.net *p-ISSN: 1694-609X*
pp. 519-542

Article submission code: 20210705043141
Received: 05/07/2021 Revision: 22/02/2022
Accepted: 17/03/2022 OnlineFirst: 18/05/2022

Promoting Higher Order Thinking Skills among Pre-Service Teachers through Group-Based Flipped Learning

Farah Mohamad Zain
School of Education, Universiti Utara Malaysia, Malaysia, *mz.farah@uum.edu.my*

Siti Nazuar Sailin
School of Education, Universiti Utara Malaysia, Malaysia, sitinaz@uum.edu.my

Noor Aida Mahmor
School of Education, Universiti Utara Malaysia, Malaysia, nooraida@uum.edu.my

The aim of this study is to identify the impact of Group-Based Flipped Learning (GBFL) in improving higher order thinking skills among pre-service teachers. This study involved 17 pre-service teachers enrolled in Postgraduate Diploma in Education programme. This study adopted a qualitative approach within scholarship of teaching and learning research design. The data from instructors' and students' reflective writings and students' works were thematically analysed. Students' reflections were based on their learning experience in Technology and Innovation in Education course. Analysis of students' and instructors' reflections indicated that students experienced meaningful learning through active and collaborative learning activities. In addition, students felt connected to each other through GBFL. Students also valued the GBFL as it enhances their higher order thinking skills in terms of creativity, collaboration, critical thinking and communication. The outcome of this research contributes to the development of GBFL guideline that can be applied in designing meaningful GBFL. Course designers and instructors can integrate GBFL in order to improve students' higher order thinking skill which is important for developing students' 21st century learning skill.

Keywords: higher order thinking skills, flipped learning, group-based flipped learning, technology enhanced learning, thinking skills

INTRODUCTION

Scholarship of Teaching and Learning (SoTL) refers to research conducted on the teaching and learning process in which the results of the studies are used as an intervention to improve teaching and learning. SoTL, also known as 'classroom research', provides opportunities for academics to conduct research that leave an impact on their teaching and learning process (Poster & Kustra, 2011).

Citation: Zain, F. M., Sailin, S. N., & Mahmor, N. A. (2022). Promoting higher order thinking skills among pre-service teachers through group-based flipped learning. *International Journal of Instruction*, *15*(3), 519-542. https://doi.org/10.29333/iji.2022.15329a

In line with the advancement in the 21st century, teaching and learning has also been transformed from the traditional method to blended learning, a combination of face-to-face teaching strategy with online technology. This strategy is the most current digital pedagogical method in the field of education which can contribute to meaningful learning (Zurita, Hasbun, Baloian & Jerez, 2014). This is because blended learning promotes student-centered learning pattern which encourages self-learning and flexibility (Ark, Hudson & Baugh, 2014). In fact, as suggested by Sugiharto, Corebima, Susilo & Ibrohim (2019), the learning process that is guided by teachers via face-to-face and supported by the technology provides new momentum to students, especially at the tertiary level.

Flipped Learning is one of the elements of blended learning. It is an approach to make classes more active, meaningful and effective (Tan, Yangco & Que, 2020). In addition, flipped learning also encourage flexible teaching and learning (Bergman & Sams, 2012) to address the needs of their students. The three main elements emphasized in flipped learning are: (1) student involvement with teaching materials, (2) student involvement in face-to-face activities and (3) student involvement with peers. Flipped learning involves three main phases, namely, pre-class (online), in-class (face-to-face) and post-class (online) (Bergman & Sams, 2012). In this study, the focus of flipped learning approach is given to classroom activities (face-to-face) which can improve critical thinking and problem-solving skills (Priyaadharshini & Vinayaga, 2018), communication (Tazijan, Baharom &Shaari, 2016), creativity (Rodriguez et al., 2019) and collaboration (Gomez-Lanier, 2018) among students.

Problem Statement

Development of students' abilities in higher order thinking skills (HOTs) is crucial in education either in Malaysia or in other countries (Lloyd & Bahr, 2010). There are many approaches and strategies that can be applied to improve HOTs among students. Among others are mind-mapping (Canas, Reiska & Mollits, 2017), inquiry-based learning (Tindangen, 2018) and metacognitive learning strategy (Parlan & Rahayu, 2021). Although various studies have examined HOTs among students in education at various levels, there is still a need to study and identify new methods and strategies to encourage students to think creatively and critically (Silitonga, Panjaitan & Supriyati, 2020). It is vital for teachers specifically the pre-service teachers to grasp the new and emerging methods and technology as they will be the catalyst for creative and critical thinking model for students at lower levels.

Even though the effectiveness of flipped classroom has been empirically proven, studies on classroom activities remain scarce (Bishop & Verleger, 2013) particularly in the context of education in Malaysia (Mohamed Amin & Ebrahim, 2014). Bishop and Verleger (2013) also found that previous studies related to flipped classroom did not explain in detail about the phases involved in flipped classroom, especially the in-class phase. Moreover, previous studies related to flipped classroom concentrate mostly on the implementation of activities in general without focusing on group-based learning methods. While previous studies have shown that students learn better when they worked in groups compared to working individually (Uppal & Uppal, 2020).

The instructors who participated in this study have been teaching Technology and Innovation in Education course/subject for two semesters. The following are their reflections and observations in conducting the teaching and learning sessions for this course:

(a) There are students who came to class without any prior knowledge or knowledge needed to ensure that they are ready to explore new knowledge and apply the knowledge gained in the classroom.
(b) There are students who are less skilled in throwing out new ideas or suggestions when asked by the instructor especially during individual activities. This indicates that students do not read articles or other reference materials to strengthen their thinking skills.
(c) There are students who were not able to relate and implement theories and concepts in this course with their actual situation as educators.
(d) There are students who still show weakness in writing reflections and providing justification for each view given. Furthermore, the reflections made usually do not highlight critical aspects, indicating weak synthesizing skills.

In response to these concerns, this study explores the current teaching and learning practices namely, group-based flipped learning in promoting higher order thinking skills. This study argues that one of the processes in flipped learning, which is the pre-class would prepare students better, where students are first exposed to the initial knowledge in the forms of video or reading materials. Thus, study emphasizes in-class group-based flipped learning activities (i.e., students are grouped for brainstorming activities) to encourage knowledge sharing and generate new ideas while developing HOTs.

Literature Review

Higher Order Thinking Skill (HOTs)

Thinking skills are divided into two levels, namely higher order thinking skills (HOTs) and lower order thinking skills (LOTs). LOTs refers to the low level of knowledge which only requires memorizing, retrieving and understanding. While HOTs begin from the process of application until creation. LOTs contributes to the development of creative and critical thinking, however, critical and creative thinking can only be enhanced through HOTs which involves applying, analyzing, evaluating and creating (Hasanah & Surya, 2017; Silitonga, Panjaitan & Supriyati, 2020).

In Malaysia, critical and creative thinking skills have been emphasized since the introduction of the Integrated Curriculum for Secondary School or *Kurikulum Baru Sekolah Menengah* (KBSM) in 1988 by the Ministry of Education (MOE). Costa and Kallick (2014) suggest that creative and critical thinking makes each person more innovative, creative, ideal, and has high imagination. In fact, these two skills are also emphasized in the Malaysian Education Blueprint (2015-2025) which aims to produce graduates who have high quality thinking skills with the ability to apply knowledge, possess problem solving skills, decision making skills and finally, yielding more innovative and creative graduates. Therefore, the main challenge in the education

system in Malaysia is to ensure that students acquire HOTs, particularly at the tertiary level.

In this study, HOTs include the skills of applying, analyzing and evaluating, based on Bloom's Taxonomy (Anderson et al., 2001). Furthermore, this study will also develop GBFL guideline that can be used to improve students' HOTs.

Flipped Learning

Flipped learning shows a change in learning and teaching method; a pedagogical method that is in line with the 21st century landscape that involves three main stages namely, pre-class, in-class, and post-class (Table 1).

Table 1
Stages in the implementation of flipped learning (Estes et al., 2014; Zain & Sailin, 2020)

Pre-class (online)	Pre-class refers to the activities that students do before they enter the classroom. This activity encourages students to prepare and have an initial overview of the topics to be discussed in class. At this stage, the instructor will upload a video containing animation, quizzes or other elements that help increase students' interest and preparation towards the topic. Web 2.0 tools such *as Powtoon, Biteable, YouTube* and *Screencast-O-Matic* are capable of supporting the development of interactive teaching videos. This activity supports LOTs such as understanding and remembering.
In-class (Face to face)	In-class refers to activities performed during lectures. Among the activities are problem-based learning, project-based learning, gamification, discussion and presentation. These activities could encourage student-centered and collaborative learning. Web 2.0 tools such as *Google Doc, Quizlet, Padlet and EdPuzzle* are able to support the development of student-centered activities. In-class activities supports HOTs such as applying, analyzing, evaluating and creating.
Post-class *(online)*	Post-class refers to activities performed outside the classroom after the lecture. This activity aims to assess learner progress and encourage reflective thinking. For example, students complete their project that has been discussed during in-class and reflect on their learning experiences. Web 2.0 tools that support these activities are *Flipgrid, Padlet* and *Weebly*. This activity support HOTs such as analysing and evaluating.

The three stages in the implementation of the flipped classroom are closely related to Bloom's Taxonomy (Figure 1). LOTs of remembering and understanding are achieved at home during the pre-class stage, while HOTs which are applying, analysing, evaluating and creating are acquired during the in-class and post-class stages.

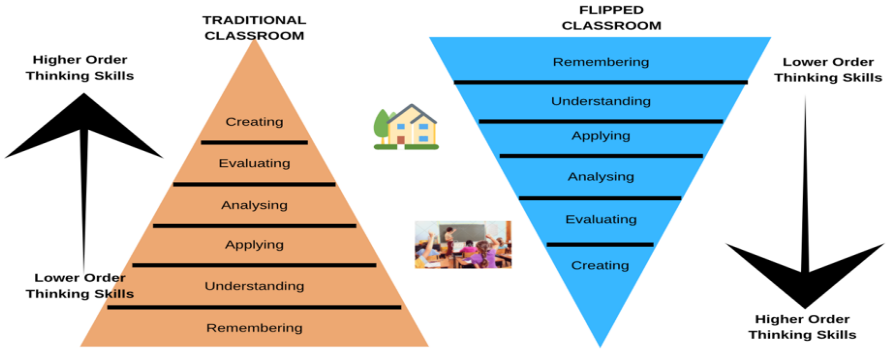

Figure 1
Changes of bloom's taxonomy in flipped learning (Source: Anderson et al., 2001)

Studies on the impact of flipped learning grow every year. In recent studies, students who exposed with flipped learning environment showed higher academic performance than those who received instruction in traditional method (Edward, Asirvatham & Johar, 2019; Asiksoy & Ozdamli, 2016; Kong, 2014; Amresh, Carberry & Femiani, 2013). Besides academic performance, flipped classroom is also effective in enhancing students' self-efficacy (Yildiz Durak, 2018), engagement (Zain & Sailin, 2020; Kanelopoulos et. al, 2017; Graziano & Hall, 2017), motivation (Pfennig, 2016; Graziano & Hall, 2017), joy of learning (Asiksoy & Ozdamli, 2016; Zain & Sailin, 2020), improving critical thinking (Al-Zoubi & Suleiman, (2021) and students' perception (Huber & Werner, 2016). This method also ensure students are prepared for class (McCallum et al., 2015) and contribute to students' higher order thinking skills (Chetcuti et al., 2014; Shahnaz & Hussain, 2016) through active and collaborative learning.

However, some studies indicate that there are still barriers and challenges in implementing flipped learning. For instance, instructors produced poor quality video apart from lack of skills and experience (Shnai, 2017). Le et al., (2015) claim this strategy is useless for passive students especially those in the pre-class phase where students must demonstrate self-directed learning skills to be successful. Previous studies also focused on studying the impact of flipped learning on individual achievement through discussion, presentation and formative assessment activities during lectures (Tan, Yangco & Que, 2020). Based on past experiences, researchers found that this method has less impact on students' high-level thinking skills because students learn individually causing the proliferation of knowledge does not occur. Therefore, this SOTL research suggests group-based flipped learning as an intervention in learning. GBFL can form a cohesive learning group to help students achieve a deeper understanding of the topics that are difficult to achieve through individual learning (Ghadiri et. al, 2014; Uppal & Uppal, 2020). GBFL also encourages the sharing and proliferation of ideas, information, knowledge, experience and skills that can help improve students' thinking skills.

Group-Based Flipped Learning (GBFL)

Group activities are often the focus of the in-class phase during flipped learning. Group activities are used to increase active involvement from students, and improve students' performance (Johnson, et al., 2014). Each student will contribute based on their understanding of the teaching material, and together in groups, they will strengthen their understanding and will be able to form new knowledge. This activity has become a trend in higher education because it offers various benefits to students such as increased student engagement (Haidet et al., 2014), positive attitudes toward collaboration and interaction (Huggins & Stamatel, 2015), promote autonomy (Bailey, Barber & Ferguson, 2015) and enhanced 21st century learning skills (Sweet & Michaelsen, 2012).

Yi Jin and Christi (2020) describes an implementation of the flipped team-based learning pedagogies showed that post scores were higher compared to the post scores in the flipped classroom section. Whereas, (Uppal & Uppal, 2020) highlighted that ninety-two percent students found flipped jigsaw (small group) activity helpful in promoting self-directed learning.

GBFL strategy in this study focuses on the implementation of group-based activities. After students review the learning materials provided before lectures (pre-class), they will work together in a group to brainstorm, discuss and solve the task given during lecture (in-class) with the facilitation of the instructors. Students will then continue to complete the task after the lecture (post-class) and finally, reflect on the learning experiences. However, the implementation of GBFL needs to be carefully planned and designed so that all the learning objectives are achieved, and students are involved in activities that truly encourage higher order thinking skills.

Therefore, this SoTL project proposes GBFL as an instructional strategy to promote students' higher order thinking skills. In particular, the aim of this study is to answer the following research questions:

a. What is the level of higher order thinking skills among pre-service teachers?

b. What are the indicators of group-based flipped learning that can improve higher order thinking skills?

The Theoretical Framework

GBFL is underpinned by the meaningful learning theory within the constructivism (Mayer, 2002; Jonassen, et al., 2003; Howland, Jonassen & Marra; 2012) and connectivism perspectives (Downes, 2010; Siemens, 2005). This strategy will encourage collaborative learning whereby students are able to construct new knowledge from connecting information via online sharing. the characteristics of meaningful learning attributes are intentional, active, constructive, authentic and cooperative. these characteristics of meaningful learning serve as the analytical framework in this current study.

Meaningful learning theory are applied in various studies related to flipped learning (Zain & Sailin, 2020), gamification (Fan & Xiao, 2015), collaboration (Sailin & Mahmor, 2017) and digital pedagogy (Sailin & Mahmor, 2018). Research show that through meaningful learning process, students become active learners (Fan & Xiao, 2015; Zain & Sailin, 2020), enhance their 4C skills (Sailin & Mahmor, 2018), increase learning outcomes (Fan & Xiao, 2015) and improve digital skills (Sailin & Mahmor, 2018).

Constructivism theory focussed on students as active learner, be able to construct their own knowledge and understanding by relating and reflecting on the experiences and the environments (Jonassen, et al., 2003; Howland, Jonassen & Marra; 2012). Whereas, within connectivism theory perspective, students must be involved in online sharing (networks), reflect on the learning process and achieve goals through networking and community involvement (Siemens, 2005). These two theories, when combined, can provide students with meaningful learning experience as exemplified when students get involved in the group-based activities to construct their own understanding and knowledge, make sense of their experiences by engaging in GBFL activities, and reflect upon those experiences.

METHOD

This study adopts qualitative approach within SoTL paradigm as a systematic procedure to conduct research in addressing problems involving teaching and learning activities in the educational environment (Cresswell, 2012). This research is developed through several phases of planning, action, observation and reflection. This research begins by identifying problematic situations and issues of teacher concern that require intervention (Altrrichter et al., 2001). This SoTL method is suitable for this study because SoTL research encourages academic inquiry to improve teaching and learning practices within the instructor's own classroom (Felton, 2013).

Reflection is the main element of SoTL. Thus, this study highlights the significance of reflection as part of the teaching and learning process in the effort to enhance students' higher order thinking skills. The practice of reflection applied in this study is based on the Gibbs Reflective Cycle (1988).

Participants of the Study

This study involves 17 pre-service teachers enrolled Technology and Innovation in Education course. Each of them was required to develop an e-portfolio as a tool to keep their reflection of their learning experience. They were also engaged in an innovative group's project, in which they designed and developed an interactive educational game of a particular topic. As to protect students' anonymity, pseudocode was given to individual student by using ST1, ST2 until ST17 in the reporting.

Instructional Design of the GBFL

Technology and Innovation in Education is one of the core courses for the Postgraduate Diploma in Education program which aims to equip students with new and emerging technologies. One of the learning objectives is to design innovative products for teaching and learning that require higher order thinking skills and problem-

solving skills. As scholar teachers, the instructors of the course are always looking for new strategies to facilitate students' learning and to ensure learning objectives are achieved. Thus, based on the previous experience, observation and reflections, the instructors have designed GBFL to improve HOTs among pre-service teachers (Table 2).

Table 2
Instructional design of the GBFL

Phase	Activities/Task/Strategies	Data Collection & Analysis
Identifying Problem	Identifying the level of HOTs among students. Students are given Task 1. In this task, students (in group) are given a topic relating to the course content, "Theory into Practice". In this task, students have to identify one learning theory and discuss how they can apply the theory into actual teaching and learning practise. They have to present their task in-class.	Students' works are analysed using HOTs rubric.
1st Intervention	After identifying the level of students' thinking skills, intervention 1 has been implemented. Intervention 1 is the introduction of group-based flipped learning. In this phase, students are exposed to three stages of GBFL namely pre-class, in-class and post-class. *Google Classroom* is the main learning management platform used in this study. The instructor uploads short videos using *Biteable* for students' initial understanding (pre-class). Then, in-class, students are divided into several small groups GBFL to implement GBFL Task 2. In this task, students are required to plan and design their innovative product. In this task, students go through the ADDIE model to come out with the proposed design. In this process students involved in several higher order thinking skills such as application, analysis, evaluation and creation towards preparing innovative product. *Google Classroom* is also used as a tool for students to collaborate and contribute ideas. After the class (post-class), students need to write a reflection in their individual e-portfolio.	Group work, Students' Reflection 1 & Instructors' Reflection 1
2nd Intervention	2nd intervention was implemented to enhance GBFL. Students also go through three stages, namely pre-class, in-class and post-class. The instructor uploads a short video using biteable for students' initial understanding. Then, during in-class activity, students are divided into several small groups and GBFL Task 3 is implemented. In this task, students are involved in an inter-group discussion within the entire class. In this task, one student is required to represent each group to participate in a forum. Prior to the forum, students have to discuss with their group members to prepare for the forum. After class (post-class), students need to write their reflection in their individual e-portfolio.	Group work, Students' Reflection 2 & Instructors' Reflection 2
Evaluation	Evaluating the effectiveness of GBFL in improving HOTs based on Task 1, Task 2 and Task 3.	Student's work, students' reflection & instructor's reflection.

Data Collection and Analysis

Table 3 shows data collection and analysis to achieve research questions. Data analysis is an ongoing procedure. All data sources were read and re-read carefully to

gain overall understanding of its contents (Denzin, 2005). Finally, they were coded into several themes (indicators) in relation to the aim and theoretical framework of the study.

Table 3
Data collection and analysis

	Data Collection	Analysis
RQ1	Data was collected from students' presentations on Task 1 which allow the researchers to analyse the initial level of student's higher order thinking skill.	Analysed using HOTs rubric to identify the level of higher order thinking skills among pre-service teachers.
RQ2	Data was collected from: (i) students' reflections in the e-portfolio; (ii) students works including presentation; and the interactive educational game (prototype); and (iii) instructors' reflections. Generally, students were asked to write reflection based on several questions to reflect upon the learning process and experience that they had gone through in GBFL based on Gibbs's reflective cycle. Some examples of the questions are: (i) To what extent did the learning materials such as videos, links, images provided before class (pre-class) help you to be prepared for group activity? (ii) To what extent did group activities implemented in-class help you to improve your thinking skills to master the topic? (iii) How did post-class activities help you to enhance your understanding towards the topic? (iv) How can group-based flipped learning improve your thinking skills? (v) What is your role in this activity? (vi) How did you contribute to your group and to entire class towards the implementation of this activity? How did *Google Classroom* facilitate the implementation of group-based flipped learning? The purpose of providing reflection questions are to guide students in their reflective writing, as previous studies highlighted that students' reflection are very limited and not deep, as they might not be able to articulate their thinking if no proper guided questions are provided (Yaacob, et al., 2014). In addition, students need guided questions as they are inexperienced in writing reflection on a specific learning approach or activity (Sailin & Mahmor, 2018).	Data gathered from reflections and students' works were analyzed thematically in order to come up with the indicators of group-based flipped learning that can improve higher order thinking skills among pre-service teachers.

FINDINGS

The findings of this study are divided into two parts as to answer the research questions guiding this study: (i) What is the level of higher order thinking skills among pre-service teachers? (ii) What are the indicators of group-based flipped learning that can improve higher order thinking skills (HOTs)?

Pre-service teacher's level of higher order thinking skills

In this study, students were given Task 1 to identify their level of higher order thinking skills. In this task, students studied the pre-class materials given on *Google Classroom* (3-5 days prior to class). As for the in-class activity, students

were divided into four groups according to their specialization and they were required to choose one of the listed theories. Students discussed further the topic with their group members, and get facilitation from the instructor during the discussion (if needed) in about 30 minutes. Each group prepared a digital map or multimedia power point slides to present the topic to the class (10 minutes presentation for each group). Other class members need to pay attention during other group's presentations and must engaged in a discussion to better understand the topic. Marks were given based on the rubric provided (Table 3).

The rubric was set to cover higher order thinking skills such as (i) apply which refers to application the theory into actual teaching and learning practise, (ii) analyze which refers to articulation or demonstration of similarities and differences between theory, and (iii) evaluate refers to critique the effectiveness of different theory. There were four categories: unsatisfactory (mark range 1- 3); adequate (mark range 4-6); good (marks range 7-8); and excellent (marks range 9-10). Table 4 shows the scores earned by each group.

Table 4
Scores by each group

GROUP	APPLY (10)	ANALYZE (10)	EVALUATE (10)	TOTAL (30)
GROUP 1	4	4	3	11
GROUP 2	5	4	3	12
GROUP 3	4	4	4	12
GROUP 4	4	5	3	12
GROUP 5	5	4	4	13
GROUP 6	4	5	4	13
MEAN	4.3	4.3	3.5	12.3

Before the implementation of GBFL, it is found that students scored marks for higher order thinking skill within the range of 4-6 marks out of 10 (mean = 12.3). This finding revealed that the student's scores were adequate/moderate. Students are seen to be less prominent in criticizing a given theory. The content of the presentation is based on the literal content only without giving an in-depth explanation of a theory.

Indicators of group-based flipped learning that can improve higher order thinking skills (HOTs)

Six themes have emerged from the data. These are important indicators or elements of group-based flipped learning that can improve higher order thinking skills especially in higher education. These indicators are intentional, active learning, constructive learning, authentic, cooperative learning and fun learning. The first theme is related to the goal-directed and regulatory where students are more well-prepared and feel excited during pre-class, in-class and post-class activities. The second theme is concerned with active learning where students play active roles in GBFL activities and the third theme is about students' construction of knowledge. The fourth theme is authentic tasks and solving real-problem. The fifth theme is related to the teamwork and finally, the last theme is fun learning.

Intentional

Within the meaningful learning perspective, it is very important that the learning activities are goal-directed and could support students' regulatory learning (Jonassen, et al., 2003; Howland, Jonassen & Marra; 2012). This means that students should be aware of the learning outcome/s and they should be able to set their learning goals and plan for their learning pathways. In this study, students were introduced and exposed to the three levels of flipped learning namely pre-class, in-class and post-class at the beginning of the semester so that they are aware of the approaches adopted by the instructors. In this study, it has been found that GBFL approach is beneficial and effective in preparing the students for the in-class activities as the students knew in advance the topics to be learned from the pre-class materials and thus, making them more prepared and responsible for their own learning (ST2, ST4, ST6, ST7, ST8, ST9, ST16, ST17).

> *Watching the video lectures before class helped us prepare for the class activities. It was easier than reading text-based materials. The students learn by explaining concepts to each other, which improves retention. It helps gain better understanding during class activities.* (ST16)

Another student, ST1 in her reflection valued that through GBFL, everybody is more prepared for the in-class activities as they know what to expect from the beginning.

> *we were more focused during the in-class discussion, we already knew what to learn and we want to know more on the different perspectives of the topic.* (ST1)

In addition, GBFL approach also makes students become more excited to get involved in the in-class activities (ST2, ST4, ST5, ST12). As students completed the GBFL activities, they reflected on the learning goals and felt satisfied on what they have achieved and contributed. For example, ST2 mentioned

> *I am excited to know that I actually has shared my ideas and improve my communication skill in the inter-group discussion.*

Active learning

Felder and Brent (2009) suggest that active learning takes place in-class when teachers ask questions, pose a problem, or present some other types of challenge. Students have to work either individually or in small groups to find answers, complete their tasks and invite one or more individuals or groups to share their responses. Therefore, GBFL encourages students to be more dynamic and play an active role in the learning activities.

It has been found that there were continuity of the pre-class activity to the post-class activity. Students reflected that GBFL approach has helped them to understand the topics or content better through active learning as they are the one who have to explore, make critical evaluation and synthesize the information. After the first GBFL learning activity, students start to realize that it is very important for them to become active learners even before the class begins (pre-class) because it will help to improve their performance during the in-class activities. For example, as noted by ST1,

> *…taking part in a discussion (in-class) without any prior preparation will make it less effective because it will make me just say whatever came across to my mind without really making connection to the main topic.*

Most students highlighted that the pre-class preparation is very important in their learning engagement, which indicates the importance of active learning. For example, some students noted that GBFL approach helps them to become more efficient in finding information (ST2, ST7, ST10), and mentally prepared for the in-class activities (ST12). ST1 further continues,

> *GBFL encouraging me into active learning where I need to be well-prepared before coming to class, participate and collaborate during in-class activities and finally formed a meaningful learning throughout the post-class activities.* (ST1)

In addition, the GBFL approach allows students to be more confident to take part in the in-class activities (ST2, ST6, ST13, ST15), and increase their participation during in-class activities (ST3, ST14, ST15). The GBFL approach has encouraged students to become more reflective learners and able to observe results from the learning activities.

> *the role-play discussion has challenged me to speak in front of the audience and I can practice my communication skills.* (ST2)

Most importantly, the in-class activities such as the role-play discussion has helped students to do their revision further and understand the topics in depth, before, during and after the class through active information exploration and discussion.

Constructive learning

As students are aware of the learning outcome/s and understand their own roles as active learner, the GBFL approach is able to promote students' construction of knowledge. Bloom's taxonomy reiterates that student's construction of knowledge involves higher order thinking skills because it requires students to create their own knowledge (Fahrurrozi, 2020). In this study, students are required to design innovative products for teaching and learning that require higher order thinking skills and problem-solving skills. At the end of the course, students were able to create innovative educational products to solve learning problems at schools. Most importantly, in the process of creating the products, students have indulged in an active construction of knowledge through social interaction with peers and the instructors before, during and after the class.

From the students' reflection, it was obvious that they valued the GBFL approach as it helps them better understand about the process of creating innovative products. (ST1, ST2, ST3, ST5, ST7, ST9, ST16)

> *…through the GBFL, we can integrate the knowledge, skills and experience that we gain during the pre-class and in-class activities to come up with our group's project, which mostly we did out of class (post-class).* (ST1)

From the students' reflections also, it is evident that students are able to solve problems with their skills and knowledge. In fact, they are able to identify existing problems and find alternative or solutions to those problems.

> *In-class group activities give more opportunities for us to apply new knowledge in solving problems. Working through problems in class was an effective and enjoyable learning activity. It provided more chances for a variety of instructional practices rather than listening to lectures only.* (ST16)

It was also evident in the students' reflections that GBFL has promoted higher order thinking skills in a way that they were given continuous and ample time to brainstorm their ideas before class, share and discuss their ideas in class through progress presentation and simulation, and they can always get back to their group to improve their products. Students perceived that through GBFL approach, they can expand their critical thinking skills (ST1, ST2, ST5, ST8, ST9, St10, ST15, St16) and encourage them to "think out of the box" (ST3) in order to come up with the product.

Apparently, through GBFL approach, the instructors discovered that students are able to demonstrate their creativity especially during the development of the innovative product. The instructors acknowledged that students' creativity has a big impact on the products produced. Although most of the products were developed based on existing ideas such as "congkak" and monopoly game, students were able to innovate by adding more value to the existing product through the integration of digital technology.

In their reflections, students highlighted that creativity is very important for producing attractive product (ST13, ST1, ST2, ST3, ST12, ST14, ST17). Students see themselves creative because they are able to come up with something innovative and unique for their product. For instance,

> *SCOG is proof that our team members are creative. SCOG has its own values, uses and uniqueness. This is because we are able to come out with a physical product which is wooden made. It is really practicable and fun to play.* (ST2)

It can be noted that students' creativity is mostly related to the gameplay of the products. As noted by ST1,

> *Based on the classic Monopoly Games, we try to create the fun game-based learning that encourage active learning among students. For example, instead of using dice, we come out with colorful spinning wheel to attract student's attention. It is important to avoid the products become dull. Other than that, there is replay value included such as rewards to encourage students are eager to playing more than one.* (ST1)

It is interesting to note that for these future teachers creativity is important not only for developing interesting products but also to incorporate active learning for users of the products.

Authentic

In a meaningful learning, it is pivotal that students are involved in authentic tasks and problems rather than remembering or memorizing abstract concepts and ideas. This

could include providing students with tasks that require solving real-life problems. In this particular course, students are required to come up with innovative educational products to solve learning problems at schools. This can be considered as authentic task as it requires students to go through systematic process of instructional design such as identifying the problems and then coming up with an idea through designing and developing the prototype of the product (Hussain & Al Saaidi, 2019).

It is important to note that the GBFL approach applied in this course has contributed tremendously to the students' performance in the product development whereby they were given resources and examples related to the product development before class. In-class they are able to discuss further with their group members and instructors on any issues and problems as well as mastering skills for improving their product.

ST1, ST7, ST9, ST11, ST12, ST13, ST15, and ST16 agree that GBFL approach, especially the in-class activities have enabled them to master the knowledge better. For example, ST7 and ST11 stated that they can apply the ADDIE instructional design model into their project better after several discussions with their team members facilitated by the instructors during the in-class discussion. Similar response was given by ST9 regarding the in-class activities, where she said that

> *my group members can apply the taxonomy blooms into the innovation product and make it more creative.*

Whereas, ST15 mentions that their group decided to integrate multiple intelligences theory after being engaged in several in-class discussions and obtained ideas and input from other group's presentations. Students also valued the presentation of their progress which had been conducted several times as a mean of formative assessments where they get the opportunities to improve their work from time to time upon completion.

Effective decision-making is not about just making choices but it also involves the process of identifying problems, enumerating and selecting alternatives, implementing and evaluating alternatives and solutions. Students should find out which alternative is better and has the best chance of success (Kasim, Yaakob, & Ab Rahman, F., 2020). In this study, GBFL approach encourages decision-making skill among students whereby they need to find alternatives and find the best solution to a problem.

> *Our initial idea consists of physical board and a smart phone. We will design the physical board by ourselves inspired by the monopoly and application to play will be downloaded from playstore or appstore. But, due to time and money constraint, we removed the usage of application from the playstore and appstore and use another alternative suitable with innovation and technology. Hence, we come up with the new name for our innovation product called 'GoAL Math". 'Go' means strive for, 'AL' is a short form of 'A' in learning and 'Math' is the subject.* (ST16)

Students also responded that the ideas and issues discussed during in-class activities have helped them to make informed decision about the design and development of their product. This design and development activities took place outside the classroom (post-

class). This provides the evidence that in-class activities such as discussions and groups' presentations support students' cognitive development particularly at the application level as suggested by the revised Bloom's taxonomy for flipped learning approach, and students have levelled up to the creation level during post-class activities (refer Figure1).

Cooperative

Another important aspect of meaningful learning is students should be encouraged to engage in cooperative learning where students work with peers to solve problems or complete their tasks through collaborative activities and discussions to learn and apply their knowledge better (Uppal & Uppal, 2020). As mentioned earlier, in this study, students in a group of four to five were required to design innovative products for teaching and learning. Eventually, this task enabled students to work together to complete their project, and as a result, students were highly cooperative, engaged in group's discussions and collaborated with one another in order to come up with their product from the beginning to the end.

Apparently, the GBFL approach in this course especially during the in-class and post-class activities has provided opportunities for cooperative and collaborative learning experience. ST1, ST2, ST3 and ST10, ST12, ST14, and ST17 reflected that the GBFL has encouraged them to collaborate with one another through discussion and share of ideas especially during the development of the innovation of the product.

Students agreed that they have to work in teams, and everyone in the team must participate in the product development especially when there is a lot of things need to be done in a limited time. For example, ST13 noted,

> *The moments of struggling together to face all the challenges really made me realize the importance of collaboration to achieve something. As I said before, time constraint is the main challenge. That is how the participation of each team members is really important to complete the product on time and have a quality as well. Keep stronger together.* (ST13)

On the other perspective, these collaborative activities have instilled positive attitudes among students ST2, ST3, ST12, ST17. For example, as noted by ST2,

> *Although the four of us came from different educational backgrounds, but with a kind of respectful attitude, we were able to build good relationships with team members. Each person has the responsibility to ensure that the product is manufactured within the specified time. The tasks are divided according to their expertise and we will help each other in the event of problems. So there's a 'Scaffolding' element in there.* (ST2)

In addition, from the instructors' observation, it can be seen that at some point, individual student contribution to the completion of the project is based on their individual expertise and capacities. To illustrate this, students were seen to delegate tasks according to their strengths and they also managed to communicate and translate their ideas into product's prototype. Students also reflected that the GBFL approach has encouraged them to develop their communication skills (ST4, ST8, ST9, ST10, ST11, ST13).

> *For me the most important things was communication since we doing this in a group of people. If we lack of communication skills, for sure the process would not run smoothly. We need to communicate to discuss the problem, the idea and also to solve the misunderstanding that occur between group members.* (ST6)

In this study, students reiterate the importance of effective communication and tolerance between groups in reaching to an agreement.

> *I learnt that a group work should have a good communication within the members to convey ideas, opinion and to avoid conflicts. Interactions in terms of communication definitely plays a big role in completing this project.* (ST5)

GBFL approach implemented by the instructors are meant to support students' higher order thinking skills and problem-solving skills, which apparently can be developed through cooperative and collaborative learning activities as exemplified in the group's project. It has been echoed in the literature that cooperative and collaborative learning would deepen students' understanding of the assigned contents and tasks as they engage in thoughtful discussion, brainstorm ideas, evaluate and justify their own decision and learn how to negotiate with each other (Luo et al., 2020; Felder & Brent, 2009; Kasim, Yaakob, & Ab Rahman, F., 2020; Fahrurrozi, 2020)

Fun learning

In the students' reflection, it was obvious that the GBFL has become an interesting and fun especially when combined with digital tools and gamification technique such as *Mentimeter, Quizlet* and *Padlet* for the learning activities. Most students provide an indication towards their agreement that the GBFL is fun in their reflection (ST2, ST3, ST8, ST9, ST11, ST12, ST13, ST15, ST16). For example, ST2 highlighted that the GBFL has driven his interest to learn the topics in a fun way.

> *…it is a simple and fun learning approach and make us pay more attention during the in-class session.* (ST3)

Similarly, ST13 reflected that the use of digital tools

> *make the learning environment becoming more fun, cheerful and without stress.*

In addition, another student highlighted that

> *…throughout the forum activity I was very excited and enjoy as I am able to share my own thoughts as well as from the group members.* (ST2)

DISCUSSION

The present study has highlighted that GBFL approach adopted in this SoTL project is aligned with previous findings about improving higher order thinking skills through meaningful learning experience (Almerich, Suarez-Rodriquez, Diaz-Garcia & Cebrian-Cifuentes, 2020; Meng, Jia & Zhang, 2020; Sukmawati & Setiawan, 2020; Sailin & Mahmor, 2017; Zain & Sailin, 2020). This current study has also supported meaningful learning theory in which the GBFL approach has provided opportunities for students to be involved in active, constructive, authentic, intentional, and cooperative learning.

Overall, students perceived that the GBFL is an important and beneficial approach as it focusses on students' learning development, and students' ability and interest within the three phases; pre-class, in-class and post-class. The content of teaching materials provided for pre-class through online videos, access to e-learning materials, internet sources and others make students more prepared and motivated for the in-class activities. This is consistent with previous studies that show students who involved in pre-class activities are well prepared for class (Porcaro et al., 2016) and motivated (Han & Klein, 2019) because they have been informed about the activities that will be carried out during the lecture. This is aligned with the intentional or self-regulatory element of meaningful learning, in which students are aware of the learning outcome/s and thus, they are able to set their learning goals and plan for their learning pathways. The GBFL approach that emphasizes on in-class group-based discussions, presentations and project design allows students to further explore and apply their knowledge and understanding through higher order thinking activities. Whereas the post-class activities are used to increase and sustain students' motivation for engagement outside of class time through GBFL approach.

Most importantly, this study has found that GBFL is able to promote student's higher order thinking skills in various phases of the learning activities, especially during the in-class and post-class activities. Overall, students highlighted the point that GBFL improve their critical thinking when they actively participate and engage in the meaningful learning activities. Students are able to cast on opinions to generate better ideas. In their reflections, students admit that they need to think critically in order to come up with better ideas and solve problems (ST1, ST2, ST3, ST12, ST13, ST14, ST17).

> *Along the way, there are a lot of challenges, problems, and criticism that need to be solve, eliminate and improve. Initial brainstorm already need us to think critically, broad and creative to come out with fresh and interesting ideas. Deciding on what kind of technology to be used also quite a challenge for us especially none of us have an IT background but that is not the reason to give up.* (ST13)

At this juncture, it can be concluded that through GBFL, students are able to make critical expounding, thus demonstrated a higher level of thinking. This is consistent with previous studies on higher order thinking skills that found students were encouraged to analyse, evaluate and think creatively when teachers apply higher order thinking activities (Singh et al., 2020).

Apart from that, it has been found in this study that a new additional theme has emerged from the data which could be added to the elements of meaningful learning, which is fun learning. Fun learning encourages students' involvement and avoids the dreaded 'death by PowerPoint' situation whereby students are tuned out or are listening without actually learning anything (Baid & Lambert, 2010). Among the benefits of fun learning are helping students to understand, focussing their attention, creating a positive attitude, and reducing anxiety (Powell & Anderson, 1985). For instance, (Zain and Sailin, 2020) proposed framework of flipped learning engagement where fun learning contributes as

one of the important elements. Hands-on activities in flipped learning can make teaching and learning more engaging and fun. Furthermore, the use of game-like features can be powerful means to produce more engaging and fun activities in the flipped classroom context (Zainuddin et al., 2020). This finding also consistent with the study by (Jeong et al., 2016) which found that the students attending flipped classroom have positive emotions and remain fun and enthusiastic throughout teaching and learning.

CONCLUSION

This study has identified the two research objectives that are the level of higher order thinking skills among pre-service teachers and the indicators of group-based flipped learning that can improve higher order thinking skills. GBFL provides insights into the ways of facilitating collaboration and thinking in small group and outline the ways of evaluating the perception of flipped learning. GBFL is the opposite of the conventional method where students mainly attend to the learning content of the lecturer in the classroom and do their own exercises at home or in the dormitory. With the right design of assignments, students' learning excitement increases, they become more motivated and eager to share their ideas, experiences and knowledge with their peers (Estes et al., 2014; Hussain & Al Saaidi, 2019).

GBFL can lead to the higher order thinking skills and there are five main stages of GBFL that must be considered before teachers start the class: (1) prepare the pre-class activities through online videos, ensure access to e-learning materials, ensure internet sources and others to help students to be more prepared and motivated for the in-class activities. (2) Focus on group activities and incorporate higher order thinking skills activities to be done in-class. (3) Assure students participate actively, collaborate with team members, and construct their own knowledge. (4) Sustain students' engagement outside of class time through more complex enhancement and reflective activities. (5) Integrate suitable technology tools to support GBFL activities.

REFERENCES

Almerich, G., Suárez-Rodríguez, J., Díaz-García, I., & Cebrián-Cifuentes, S. (2020). 21st-century competences: The relation of ICT competences with higher-order thinking capacities and teamwork competences in university students. *Journal of Computer Assisted Learning*, *36*(4), 468-479.

Al-Zoubi, A. M., & Suleiman, L. M. (2021). Flipped classroom strategy based on critical thinking skills: Helping fresh female students acquiring derivative concept. *International Journal of Instruction*, *14*(2), 791-810.

Amresh, A., Carberry, A. R., & Femiani, J. (2013). *Evaluating the effectiveness of flipped classroomsfor teaching CS1*. Paper presented at Frontiers in Education Conference. Oklahoma City, Oklahoma. doi:10.1109/ FIE.2013.6684923

Anderson, L.W., Krathwohl, D.R., Airasian, P.W., Cruikshank, K.A., Mayer, R.E., Pintrich, P.R., Raths, J. and Wittrock, M.C. (eds.) (2001). A taxonomy for learning and teaching and assessing: A revision of Bloom's taxonomy of educational objectives. *White Plains, NY: Longman*, *5*(1), 25-45.

Ark, T. Vander, Hudson, T., & Baugh, J. (2014). Blended learning: Best practices for empowering students and educator. Retrieved from https://www.districtadministration.com/article/blended-learning-best-practicesempowering-students-and-educators.

Asiksoy, G., & Özdamli, F. (2016). Flipped classroom adapted to the ARCS model of motivation and applied to a physics course. E*URASIA Journal of Mathematics, Science & Technology Education, 12(*6), 1589–1603.

Baid, H., & Lambert, N. (2010). Enjoyable learning: The role of humour, games, and fun activities in nursing and midwifery education. *Nurse Education Today, 30*(6), 548–552.doi:10.1016/j.nedt.2009.11.007

Bailey, S., Barber, L.K., & Ferguson, A.J. (2015). Promoting perceived benefits of group projects: The role of the instructor contributions and intragroup processess. *Teaching of Psychology 42*(2), 179-183.

Bergman, J., & Sams, A. (2012). Flip your classroom; Reach every student in every class everyday. *International Society for Technology in Education/ISTE*.

Bishop, J., & Verleger, M. (2013). The Flipped Classroom: A survey of the research Jacob. In ASEE National Conference Proceedings, Atlanta, GA.

Bloom, B.S. (1956). Taxonomy of Educational Objectives, Handbook I: The Cognitive Domain. New York: David McKay Co Inc.

Canas, A. J., Reiska, P., & Mollits, A. (2017). Developing higher order thinking skills with concept mapping: a case of pedagogic frailty. *Knowledge Management & E-Learning: An International Journal*, *9*(3), 348-365.

Chetcuti, S. C., Hans, J. T., & Brent, J. P. (2014). *Flipping the engineering classroom: Results and observations with non- engineering students*. Paper presented at Proceedings of 121st ASEE Annual Conference & Exposition, Indianapolis, IN.

Chu, S.K.W., Reynold, R.B., Tavares, N.J., Notari, M. (2017). 21st century skills development through inquiry-based learning from theory to practice. Springer International Publishing.

Costa, A. & Kallick. B. (2014). Dispositions: Reframing teaching and learning. Thousand Oaks, CA: Corwin Press.

Creswell, J. W. (2012). Qualitative inquiry and research design: Choosing among the five traditions (3rd ed.). Thousand Oaks, CA: Sage.

Dewey, J. (1933). How We Think: A Restatement of Reflective Thinking to the Educative Process. Boston: D. C. Heath. (Original work published in 1910).

Downes, S. (2010). Learning networks and connective knowledge. In *Collective intelligence and E-Learning 2.0: Implications of web-based communities and networking* (pp. 1-26). IGI global.

Edward, C. N., Asirvatham, D., & Johar, M. G. M. (2019). The impact of teaching oriental music using blended learning approach. *Malaysian Journal of Learning and Instruction, 16*(1), 81-103. Retrieved from http://mjli.uum.edu.my/ images/vol.16no.1/81-103.pdf

Estes, M. D., Ingram, R., Liu, J. C. (2014). A review of flipped classroom research, practice, and technologies. International HETL Review, 4(7), 1-8.

Fahrurrozi (2020). Increasing the students' ability of high order thinking skill (HOTs) by implementing of blended learning. *Journal of Physics: Conference Series*, Vol. 1539. The 5thHamzanwadi International Conference of Technology and Education 2019, 5-6 October 2019, Lombok, Indonesia.

Felder, R. M., & Brent, R. (2009). Active learning: An introduction. *ASQ higher education brief, 2*(4), 1-5.

Ghadiri, K., Qayoumi, M. H., Junn, E., & Hsu, P. (2014). *Developing and implementing effective instructional stratgems in STEM*. Paper presented at Proceedings of 121st ASEE Annual Conference & Exposition, Indianapolis, IN.

Gibbs, G. (1988). Learning by Doing: A guide to teaching and learning methods. Further Education Unit, Oxford Brookes University, Oxford.

Gomez-Lanier, L. (2018). Building collaboration in the flipped classroom: A case study. *International Journal for the Scholarship of Teaching and Learning*, *12*(2), 7.

Graziano, K. J., & Hall, J. D. (2017). Flipping math in a secondary classroom. In *Society for information technology & teacher education international conference* (pp. 192–200). Association for the Advancement of Computing in Education (AACE).

Haidet, P., Kubitz, K., & McCormack, W. T. (2014). Analysis of the team-based learning literature: TBL comes of age. *Journal on Excellence in College Teaching, 25*(3–4), 303–333.

Han, E., & Klein, K. C. (2019). Pre-class learning methods for flipped classrooms. *American Journal of Pharmaceutical Education*, *83*(1).

Hasanah, M., & Surya, E., (2017). Differences in the abilities of creative thinking and problem solving of students in mathematics by using cooperative learning and learning of problem solving. *International Journal of Sciences: Basic and Applied Research (IJSBAR), 34*(1), 286-299.

Hayashi, Y., Fukamachi, K. I., & Komatsugawa, H. (2015). Collaborative Learning in Computer Programming Courses That Adopted the Flipped Classroom. In Learning and Teaching in Computing and Engineering (LaTiCE), 2015 International Conference on (pp. 209-212). IEEE.

Horton, D., & Craig, M. (2015, February). Drop, Fail, Pass, Continue: Persistence in CS1 and Beyond in Traditional and Inverted Delivery. In Proceedings of the 46th ACM Technical Sym- posium on Computer Science Education (pp. 235-240). ACM.

Howland, J., Jonassen, D.H. & Marra, R.M. (2012). *Meaningful learning with technology.* (4th ed.). Columbus, OH: Merrill/ Prentice-Hall.

Huber, E., & Werner, A. (2016). A review of the literature on flipping the STEM classroom: Preliminary findings. In *33rd international conference of innovation, practice and research in the use of educational technologies in tertiary education-ASCILITE 2016-show me the learning.*

Huggins, C. M., & Stamatel, J. P. (2015). An exploratory study comparing the effectiveness of lecturing versus team-based learning. *Teaching Sociology*, *43*(3), 227–235. doi:10.1177/0092055X15581929

Hussain, R. M. R., & Al Saaidi, K. K. (2019). Students as designers of E-book for authentic assessment. *Malaysian Journal of Learning and Instruction, 16*(1), 23-48

Jeong, J. S., & González-Gómez, D. (2016). Students' perceptions and emotions toward learning in a flipped general science classroom. *Journal of Science Education and Technology, 25*(5), 747-758.

Johnson, D. W., Johnson, R. T., & Smith, K. A. (2014). Co-operative learning: Improving university instruction by basing practice on validated theory. *Journal on Excellence in College Teaching, 25*(3&4), 85-118.

Jonassen, D.H., Howland, J., Moore, J., & Marra, R.M. (2003). *Learning to Solve Problems with Technology: A Constructivist Perspective* (2nd. ed). Columbus, OH: Merrill/Prentice- Hall.

Kanelopoulos, J., Papanikolaou, K. A., & Zalimidis, P. (2017). Flipping the classroom to increase students' engagement and interaction in a mechanical engineering course on machine design.*International Journal of Engineering Pedagogy (iJEP), 7*(4), 19–34.

Karanicolas, S., Mcgrice, H., Kemp, A., Loveys, B., Snelling, C., Riggs, K., & Winning, T. (2016). The Rise of the Flip : Successfully engaging students in pre-class activities through the use of technology and a flipped classroom design template. In S. Barker, S. Dawson, A. Pardo, & C. Colvin (Eds.), *Show Me The Learning. Proceedings ACIKITE 2016 Adelaide* (pp. 312–317).

Kasim, M., Yaakob, M. F. M., & Ab Rahman, F. (2020). Enhancing Decision Making Skills among Postgraduate Students Using Alternative Assessment Approach. *Universal Journal of Educational Research*, *8*(11), 5670-5675.

Kong, S. C. (2014). Developing information literacy and critical thinking skills through domain knowledge learning in digital classrooms: An experience of practicing flipped classroom strategy. *Computers & Education, 78*, 160-173. doi: 10.1016/j. compedu.2014.05.009

Le, X., Ma, G. G., & Duva, A. W. (2015). Testing the flipped classroom approach in engineering dynamics class. In Proceedings of the 2015 ASEE annual conference, Seatle, WA (Vol. 9).

Lin, C., Li, B., & Wu, Y. J. (2018). Existing knowledge assets and disruptive innovation: the role of knowledge embeddedness and specificity. *Sustainability, 10*(342), 1–15.

Lloyd, M. & Bahr, N. (2010). Thinking critically about critical thinking in higher education. *International Journal of the Scholarship of Teaching and Learning*, *4*(2).

Luo, Z., O'Steen, B., & Brown, C. (2020). Flipped learning wheel (FLW): a framework and process design for flipped L2 writing classes. *Smart Learning Environments, 7*, 1-21.

McLaughlin, J. E., White, P. J., Khanova, J., & Yuriev, E. (2016). Flipped classroom implementation: A case report of two higher education institutions in the United States and Australia. *Computers in the Schools, 33*(1), 24–37.

Meng, Q., Jia, J., & Zhang, Z. (2020). A framework of smart pedagogy based on the facilitating of high order thinking skills. *Interactive Technology and Smart Education*.

Milman, N. B. (2012). The Flipped Classroom Strategy. What is it and how can it best be used? *Distance Learning*, *9*(3), 85–87. https://doi.org/10.1097/NNE.0000000000000096

Mohamed Amin Embi, dan Ebrahim Panah. (2014). Blended and Flipped Learning : Case Studies in Malaysian Higher Education Institutions. Selangor: Centre for Teaching and Learning Technologies UKM

November, A., & Mull, B. (2012). Flipped Learning: A response to five common criticisms.*November Learning*, 1–5. Retrieved fromhttp://scholar.google.com/scholarhl=en&btnG=Search&q=intitle:Flipped+Learning+:+A+Response+To+Five+Common+Criticisms#0

Parlan, P., & Rahayu, S. (2021). Students' higher order thinking skills (HOTS) in metacognitive learning strategy. In AIP Conference Proceedings, 2330 (1). AIP Publishing LLC.

Pfennig, A. (2016). Inverting the classroom in an introductory material science course. *Procedia: Social and Behavioral Sciences, 228,* 32–38.

Porcaro, P. A., Jackson, D. E., McLaughlin, P. M., & O'Malley, C. J. (2016). Curriculum design of a flipped classroom to enhance haematology learning. *Journal of Science Education and Technology*,*25*(3), 345-357.

Potter, M., & Kustra, E. (2011). The relationship between scholarly teaching and SoTL: Models, distinctions, and clarifications. *International Journal for the Scholarship of Teaching and Learning, 5*(1), 1-18.

Powell, J.P., Andresen, L.W., 1985. Humour and teaching in higher education. *Studies in Higher Education 10* (1), 79–90.

Priyaadharshini, M., & Vinayaga Sundaram, B. (2018). Evaluation of higher-order thinking skills using learning style in an undergraduate engineering in flipped classroom. *Computer Applications in Engineering Education*, 26(6), 2237-2254.

Rodriguez, G., Diez, J., Perez, N., Banos, J. E., & Carrio, M. (2019). Flipped classroom: fostering creative skills in undergraduate students of health sciences. *Thinking Skills and Creativity*, 33, 100575.

Sailin, S. N. & Mahmor, N. A. (2018). Improving Student Teachers' Digital Pedagogy Through Meaningful Learning Activities. *Malaysian Journal of Learning and Instruction*. 15 (2), 143-173.

Shahnaz, S. M. F., & Hussain, R. M. R. (2016). Designing instruction for active and reflective learners in the flipped classroom. *Malaysian Journal of Learning and Instruction, 13*(2), 147-173. Retrieved from https://files.eric.ed.gov/fulltext/ EJ1134740.pdf.

Shnai, I. (2017). Systematic review of challenges and gaps in flipped classroom implementation: Toward future model enhancement. In *European conference on e-learning* (pp. 484–490). Academic Conferences International Limited.

Siemens, G. (2005). Connectivism: A learning theory for the digital age. *International Journal of Instructional Technology & Distance Learning, 2*, 3-10.

Silitonga, H. T. M., Panjaitan, M., & Supriyati, Y. (2020). Problem solving based physics learning strategy to enhance students' higher order thinking skills. Journal of Physics: Conference Series

Sing, C., & Kong, C. S. (2017). Professional Learning for 21st Century Education. *Journal of Computers in Education, 4*(1), 1–4.

Singh, C. K. S., Gopal, R., Ong, E. T., Singh, T. S. M., Mostafa, N. A., & Singh, R. K. A. (2020). Esl Teachers'strategies To Foster Higher-Order Thinking Skills To Teach Writing. *Malaysian Journal of Learning and Instruction, 17*(2), 195-226.

Sripongwiwat, S., Bunterm, T., Srisawat, N., & Tang, K. N. (2016). The constructionism and neurocognitive-based teaching model for promoting science learning outcomes and creative thinking. *Asia-Pacific Forum on Science Learning and Teaching, 17*(2), 1–33.

Sugiharto, B., Corebima, A. D., Susilo, H., & Ibrohim. (2019). The Pre-Service Biology Teacher Readiness in Blended Collaborative Problem Based Learning (BCPBL). *International Journal of Instruction, 12*(4), 113-130. https://doi.org/10.29333/iji.2019.1248a

Sukmawati, A., & Setiawan, T. (2020, June). Developing assessment of higher order thinking skills in physics learning based on local wisdom. In *Journal of Physics: Conference Series* (Vol. 1567, No. 4, p. 042045). IOP Publishing.

Sweet, M., & Michaelsen, L. K. (2012). Team-based learning in the social sciences and humanities: Group work that works to generate critical thinking and engagement. Stylus Publishing, LLC.

Tan, R. M., Yangco, R. T., & Que, E. N. (2020). Students' conceptual understanding and science process skills in an inquiry-based flipped classroom environment. *Malaysian Journal of Learning & Instruction*, *17*(1), 159-184.

Tazijan, F. N., Baharom, S. S., & Shaari, A. H. (2016). Building communication skills through flipped classroom. *Proceedings of ISELT FBS Universitas Negeri Padang*, 4(1), 289-295.

Tindangen, M. (2018). Inquiry-based learning model to improve higher order thinking skills. *Asian Social Science*, *14*(7), 39-46.

Uppal V, & Uppal N. (2020). Flipped jigsaw activity as a small group peer- assisted teaching learning tool in Biochemistry Department among Indian Medical Graduate: An experimental study.Biochemistry and Molecular Biology Education. 1–7. https://doi.org/10.1002/bmb.21355

Yildiz Durak, H. (2018). Flipped learning readiness in teaching programming in middle schools: Modelling its relation to various variables. *Journal of Computer Assisted learning*, *34*(6), 939–959.

Yi Jin & Christi Harp (2020): Examining preservice teachers' TPACK, attitudes, self-efficacy, and perceptions of teamwork in a stand-alone educational technology course using flipped classroom or flipped team-based learning pedagogies. *Journal of Digital Learning in Teacher Education*, DOI: 10.1080/21532974.2020.1752335

Zain, M. Z. & Sailin, S. N. (2019). Flipped Classroom: Implementasi aplikasi Web 2.0 dalamRekabentuk Pengajaran. Seminar Wacana Pendidikan 2019 (SWAPEN 2.0). eISBN 978-967-13352-8-4. Pp. 126-137.

Zain, M. Z. & Sailin, S. N. (2020). Students' experience with flipped learning approach in higher education. *Universal Journal of Educational Research*, *8*(10), 4946-4958.

Zainuddin, Z., Shujahat, M., Chu, S. K., Haruna, H., & Farida, R. (2019). The effects of gamified flipped instruction on learner performance and need satisfaction. *Information and Learning Sciences*.

Zurita, G., Hasbun, B., Baloian, N., & Jerez, O. (2014). A blended learning environment for enhancing meaningful learning using 21st century skills. In G. Chen, V. Kumar, Kinshuk, R. Huang, & S. Kong (eds.), Emerging issues in smart learning. Lecture notes in educational technology. (pp. 1–8). Berlin, Germany: Springer.

Yaacob, A., Walters, L. M., Md Ali, R, Shaik Abdullah, S. & Walters, T. (2014). Reflecting on Malaysian teacher trainees' journals. *Malaysian Journal of Learning and Instruction*, *11*, 1-21