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## The Instructor and Students' Role in Micro-Flipped Classroom

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**The Instructor and Students' Role in Micro-Flipped Classroom**

by

Yoonjeong Choi

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Submitted to the Graduate Faculty of

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“Today's students as we taught yesterday's, we rob them of tomorrow.”

John Dewey

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## Chapter 1: Introduction

### Introduction and Background

The current generation of students relies greatly on technology. Generation Z and following students learn differently from the traditional classroom. Educators should consider and plan for a technology-rich teaching environment, by not simply adding devices, but by a transition to a student-centered teaching style (Hartman et al., 2019). In addition, higher education is transitioning towards the improvement of skills relevant to the 21st century (e.g., critical thinking and problem-solving skills); the limitations around traditional teaching methods are becoming more evident. According to King and Newmann (2001), students in traditional classrooms spend most of their in-class time listening to lectures, and thus, rarely have the opportunities to apply and practice the theoretical knowledge. Moreover, due to COVID-19 pandemic, a shift to distance teaching and needs for development of technology integration occurred. To improve the quality of digital teaching in higher education, flipped classroom got attention proposing a modified version (Tolks et al., 2020). Rogers (2000) also emphasized technology integration in higher education which follows:

Since colleges and universities produce the k-12 teachers, it only stands to reason that if technology competencies are placed on the primary and secondary schools and teachers, that competencies will have to be placed on higher education professors, as well and not just professors from schools of education, because secondary teachers come from all disciplines. (p.20)

By emphasizing the importance of technology integration in higher education, this study explored a flipped classroom, a method by teachers to invert in and out of class activities and

involve microlearning, another method with shortened learning periods to maximize time efficiency.

The purpose of this research study is to explore the concept of flipped learning; the students study general contents at home using technology while at the same time, engage in an in-depth classroom learning. The concept of flipped learning later emerged to encourage the development of higher order thinking skills in the learners, such as applying, analyzing, evaluating, and creating according to Bloom's' Taxonomy (Bloom, Krathwohl, & Masia, 1956).

Micro-Flipped (MF) learning, as a branch of flipped learning, is a new teaching model aligned with the application of technology trends in education. MF learning takes into consideration the learner's short attention span to increase the students' academic success (Fidalgo-Blanco et al., 2017).

As such, in order to apply a new model, there is an impending need for a different perspective regarding roles for the teacher, as well as for the student in the context of the shifts in teaching and learning approaches. Therefore, this secondary research will explore structures of the MF learning model and summarize the instructor and student roles, especially in an online learning environment in a MF classroom. This study will use the model designed by Fidalgo-Blanco et al. (2017) as the theoretical framework in order to analyze multiple research studies.

### **Research Problem**

According to the concept of the flipped model, by flipping the mechanism of in and out of class activities, students can pursue deeper insights into the learning contents. Though the flipped classroom model was first popularized in secondary education (Bergmann & Sams, 2012), the model can be applied also in higher education as a method to promote the

development of higher order thinking skills (Albert & Beatty, 2014; O'Flaherty & Philips, 2015; Zainuddin & Perera, 2018).

Several reasons contribute to why the flipped approach was brought into consideration but did not lead to the generalization and wide acceptance. First, there were challenges in a flipped classroom, especially related with out-of-class activities can count toward those reasons. According to Lo and Hew (2017), three out of seven studies presented student workload as a significant challenge along with too-long video lectures, which made students bored and passive. As a result, students were not able to manage self-paced lessons, and students have been found to be unreceptive to the structure of this approach. Furthermore, teachers' positive perceptions about flipped classroom were weakened by their concerns about time and effort preparing learning materials. Park and Cha (2015) conducted research focusing on teachers' awareness of flipped classrooms. The research surveyed 156 teacher candidates and 42 teachers to explore the educational feasibility of the flipped classroom. The survey was created by five educational technology doctoral students with experience researching the flipped classroom. The survey included preferences about its usage, appropriate grade levels, suitable subjects, and materials. More than 80% of participant teachers expressed willingness to use a flipped approach and recognized its effectiveness. However, at the same time, the participating teachers expressed the concerns of preparedness and need for guidelines to facilitate effective use of the model. Moreover, according to the research results, the most recommended grade level to apply this approach was higher education, in social studies and science, and the preferred of the pre-class lesson material was video.

Brewer and Movahedazarhouligh (2018) further state that flipped classrooms need to expand exposure to the content prior to the class. The study shows analysis of research on the flipped approach in various aspects including implementation, effectiveness, and qualities in higher education. If some students are not prepared for the class such as watching a video or reading the contents, it will result in an increased learning gap among students. Additionally, the students' attention span is becoming shorter and shorter (Statistic Brain, 2019). Therefore, this raises the need for transitioning towards delivering content with the best possible efficacy. In this regard, microlearning has drawn attention towards mitigating the gap between learners' needs and teachers' support.

The era of technology-enhanced education requires different and evolved roles of the instructor and the student. Students today have more access to learning materials through the Internet anytime and anywhere, which requires autonomous learning skills. However, as Zhang and Zhang (2018) proposed, the purpose of adapting technology in classroom is not to reduce teacher's role, but to increase student's learning experience. Instead, it indicates different roles are required for teachers to meet the students' needs. Teachers actively need to guide students to be at the center of their learning providing diversified supports. In other words, by applying educational technologies, new directions should be provided to strengthen the interaction between teachers and students and to augment the teacher's role in the use of the online platform and students' role.

Fidalgo-Blanco et al. (2017) proposed a Micro-Flipped Teaching (MFT) approach, and the model includes three phases of learning modes, that is, out of class, linking activity, and in class learning. Based on this model, short-sized lectures are recommended to deliver the learning

contents. Towards explores this aspect and develops narrative guidance of the MF model. It will be presented in detail as an exemplary model of the MF approach later.

### **Research Purpose**

This paper will look at models of MF learning in higher education recognizing the needs of its adaption to foster 21<sup>st</sup> century skills, including critical thinking, creativity, communications, and collaboration (Brewer & Movahedazrhouligh, 2018). This focuses on structured guidelines along with the roles of instructors and students. It will critically review the literature of MF teaching models that could facilitate students' academic effectiveness with updated teaching.

Based on the review of the relevant literature, this study will suggest practical guidelines for MF classrooms in higher education. The research questions for this paper are as follows:

1. What is an MF approach and how can the teaching model be used to optimize the effectiveness of instruction?
2. What are the roles of an instructor in the MF classrooms in higher education settings that facilitate cognitive engagement, collaboration and meta-cognition?
3. What are the roles of students in the MF classrooms in higher education settings leading active knowledge construction?

### **Significance of the Study**

The flipped approach in higher education has been discussed to enable seamless learning, outside of the classroom using technology that motivates and develops each student's higher order thinking skills connected with self-directed learning (Zainuddin & Perera, 2018). Additionally, flipped learning has been highlighted in higher education to promote the

students' 21st-century skills including higher order thinking skills (Brewer & Movahedazarhouli, 2018).

Particularly, MF, as a means of constructive learning, which educators help people to actively construct their own knowledge, exemplifies key significance in converting theoretical knowledge to application. By implementing flipped classrooms, the learners can transfer and apply their knowledge to the real world (Pierce & Fox, 2012). It fosters critical thinking, and problem-solving skills. Moreover, students take more responsibility for their learning to become autonomous learners and teachers gain an opportunity to guide these students well to optimally explore their individual learning potential.

This paper will examine the concept of the MF classroom and specifies the roles of instructors and learners in the classroom, noting that the MF approach as a technology convergence education. By recognizing the challenges of the flipped classroom, this study explores microlearning as a means to lessen student's workload out of the class and to strengthen the flipped approach. Additionally, this study is focused on higher education settings, especially to magnify the overall effectiveness when online learning is performed.

### **Limitations**

The limitations include the ability to obtain articles only from MnSCU system libraries, EBSCOhost, Google Scholar, and RISS (Research Information Sharing Service). Notably, the study could not include articles in languages other than English and Korean. Sources used for this research have been limited to the recent ten years starting from 2010, the year that marked the recognized emergence of the flipped classrooms. A significant number of the studies of micro-lessons focus on industrial settings and the sphere of business, and thus had limited

perspectives related to higher education settings. Finally, since research projects use different variables, including duration of in and out of class activity, level of education, age groups, subjects, and others; the results of these research articles are difficult to generalize.

### **Delimitations**

Delimitation refers to the description for research boundaries. It includes the scope and number of articles chosen. Empirical studies and secondary research articles have been used for analysis purposes in this secondary study. The scope of the study is limited to the higher education context. Articles chosen also are focused on technology-based flipped classrooms since this research aims at the technology-adopted MF classrooms in higher education.

### **Definition of Terms**

***Flipped Classroom:*** The flipped classroom is an approach where the students learn basic contents outside of the classroom before the in-class activity, thus attaining better focus at developing advanced skills. Researchers have suggested the components of the flipped classrooms as transforming students from passive to active learners, enabling technology-adopted classrooms, reversing class time and traditional homework time, and leveraging class time in promoting higher order thinking skills (Albert & Beatty, 2014).

***MicroLearning:*** Kapp and Defelice (2019) have defined microlearning as “an instructional unit that provides a short engagement in an activity intentionally designed to elicit a specific outcome from the participant” (p.11). It is a time-condensed content; however, it is not a piece of a lesson but adopts the structure of a complete lesson itself.

***Micro-Flipped Teaching (MFT):*** It refers to a teaching model of the flipped classroom and to selecting micro learning content as a means to deliver basic knowledge. Fidalgo-Blanco et al.

(2017) have described the MFT model as a teaching method that provides concise online materials for use in the classroom while also encouraging the active participation of students.

***Technology-Adopted classroom:*** It refers to the classroom where advanced technologies are used to enhance learning. The examples of technology in the classroom may include using the Internet, social media, digital learning tools (podcasts, YouTube, etc.), learning management systems, and others.

***Instructor:*** In this paper, the instructor refers to roles encompassing that of teacher, professor, and trainer who intend to teach about a topic and contents.

## **Summary**

This secondary research study is a critical review and analysis of microlearning, flipped classrooms; it also offers guidelines for the MF approach. This chapter presented the background research, the research questions, the definition of terminologies used in this paper, and study limitations. This secondary research study intends to explore what structure a MF approach should have, and how the instructor's and student's role can be evolved to be more effective. This study is significant because it proposes useful teaching guidelines with the technology and addresses the significance of an adequate role of instructors and learners. The secondary data collected from this study can be used by educators and learners in formal educational settings to maximize effectiveness during class time, especially in which online learning has been conducted. Research articles included in this study are limited to those published in English and Korean. The following chapter presents a literature review to address research questions.

## **Chapter 2: Literature Review**

### **Introduction**

The aim of this paper is to explore the MF teaching approach and identify instructor's and student's roles in the classroom. This chapter presents related research, the methodology for the literature review, a summary of research, and research gaps. These research gaps will be used to discuss the MF approach and appropriate roles of instructors and students in detail in chapter four of this paper.

Many researchers have studied the results of the flipped approach, yet it is not decisive of investigating the roles of instructors and students in flipped classrooms. Moreover, as the coronavirus pandemic (COVID-19) limited access of in-person learning, various ways of online education have been highlighted, including flipped learning and microlearning, among the new educational methodologies. As more classes in higher education employ online delivery methods, it is important to gather data about the MF approach and roles of instructors and students to use it effectively. The second chapter reviews the literature on microlearning in schools, the flipped classroom in higher education, the role of instructors and students in the technology-adopted classrooms, and the gaps in research about the approach. The detailed structure of MF classrooms in higher education will be presented in chapter four with a focus on the students' and instructors' roles in its approach. By investigating student's and instructor's roles in a technology-adopted classroom and online learning environment, the results will facilitate the development of guidelines defining the optimal role of students and instructors in MF classrooms.

## **Methodology**

In this research, the information was collected from EBSCOhost and Google Scholar, RISS, accessed via Miller Center Resources at St. Cloud State University in the Minnesota State library system. Using the keywords “microlearning” and “flipped classroom” the search resulted in several academic journals that needed filtered searching. As this review is focused on the instructor’s and student’s role in the micro-flipped classroom, more keywords were added to gather more specific information. The keywords are flipped classroom, micro learning, instructor’s role, student’s role, online learning, and micro-flipped teaching. Also, articles were limited based on access to the full, peer-reviewed text.

This study adopted the literature matrix presented in Table 1, which also summarizes the ten articles by year and variables as explored for all study purposes. Since this research focuses on MF learning, research variables include micro learning, flipped classroom, instructor’s role, student’s role, and technology use in the classroom.

**Table 1***Literature Matrix*

Author	Year	Variables Considered in the Study				
		Micro learning	Flipped classroom	Instructor's Role	Student's Role	Technology use in the classroom
Bergmann & Sams	2012		x	x		x
Albert & Beatty	2014		x	x	x	x
O'Flaherty & Philips	2015		x			x
Borchardt & Bozer	2017	x	x			
Fidalgo-Blanco, Martinez-Nuñez, Borrás-Gene & Sanchez-Medina	2017	x	x	x		x
Lu & Sun	2016	x	x	x	x	x
Mohammed, Wakil & Nawroly	2018	x				x
Zainuddin & Perera	2018		x		x	x
Zhang & Zhang	2018	x	x	x	x	x
Shih, Liang & Tsai	2019		x	x	x	x

## **Variables and Themes**

Five variables and themes have been identified from the above listed research studies: microlearning, flipped classroom, instructor's role, student's role and technology use in the classroom. To investigate the MF learning approach, microlearning and flipped learning were searched as important themes, in addition to a search about instructor's and student's roles in an online learning environment. Since the MF approach delivers learning materials and instructors and students communicate with each other in an online environment, it becomes imperative to investigate their role in technology-adopted classrooms. Amongst the identified research for this paper, two studies focusing on the MF approach were inferred to be particularly relevant to this paper. Related findings are presented based on the main theme and topic, in order of: microlearning, flipped classroom, and the change in instructor and student roles.

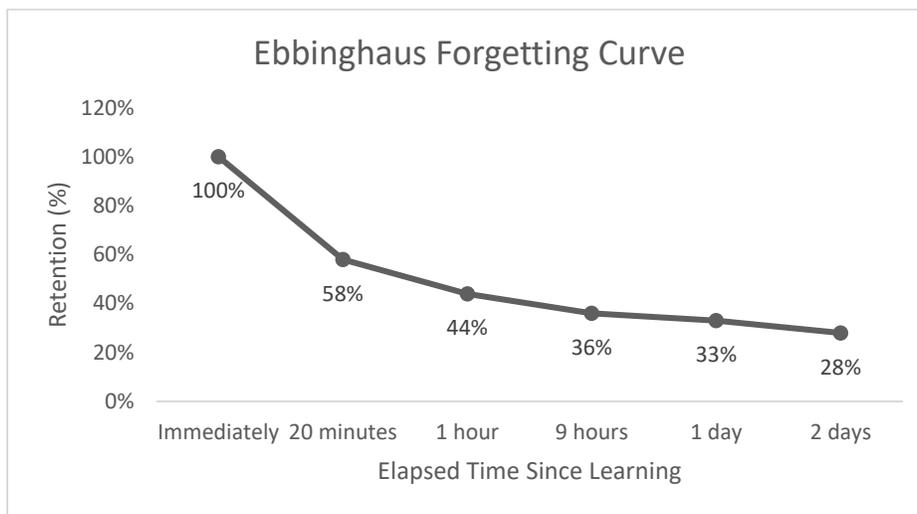
Eight empirical studies and two secondary research studies were used in chapter two. Six of those studies were conducted in higher education settings, two in general, one in primary and one in secondary educational setting. The study that implemented in secondary educational setting was considered since it has been a foundation of flipped classroom (Bergmann & Sams, 2012). Two qualitative research papers conducted experiments of MF classroom in higher educational settings (Borchardt & Bozer, 2017; Fidalgo-Blanco et al., 2017). A paper from a conference (Lu & Sun, 2016) and a literature review paper (Zhang & Zhang, 2018) have significant relevance to MF approach. Four research papers are reviewed related to flipped classroom only (Bergmann & Sams, 2012; O'Flaherty & Philips, 2015; Zainuddin & Perera, 2018; Shih et al., 2019) and one for microlearning only (Mohammed et al., 2018).

Based on the literature reviews in chapter two, the MFT model by Fidalgo-Blanco et al. (2017) will be reviewed in depth in chapter four along with a few more research studies (Bawane & Spector, 2009; Gonzalez, 2009; Gonzalez, 2010, Lamerias et al., 2012; Luo, 2018; Sun & Gao, 2019). To explain microlearning segments, Wiley's (2002) learning object will be demonstrated. Furthermore, since roles of instructor and students in MFT model is a critical element related to the research questions; it is summarized as a table with descriptive analysis in chapter four.

### **Use of Microlearning in Education**

Microlearning is a short burst of focused and condensed content to help learners and educators alike in achieving a specific outcome. It addresses a very specific audience, topic, and content. Attributed to its advantageous feature of conciseness and focus, enabling direct, fast, and pointed delivery, it has grown as an appropriate learning approach in the flipped classrooms model.

The principle of microlearning is contributed from the Forgetting Curve by German psychologist Hermann Ebbinghaus (Ebbinghaus, 2013). Based on the research that learners' retention dramatically decreases after 20 minutes, Ebbinghaus propounded the idea to repeat micro-lectures. Its delivery methods are not limited to video but vary through content, such as infographics, images, charts, text, or gamification. Therefore, learners are exposed to rich interactive media, which can enhance learning achievement. The retention reduction graph by time has been a base for proposing microlearning. The figure 1 graph illustrates the decreases in learners' retention.

**Figure 1***Ebbinghaus's Forgetting Curve*

*Note:* As time flows, the learner's retention decreases especially within 20 minutes. To increase the learner's retention, Ebbinghaus suggested repeating micro-lectures.

The study by Mohammed et al. (2018) shows the effectiveness of microlearning in primary education. Instructors conducted classes in the order of 1. an introduction to microlearning, 2. traditional instruction, 3. micro-lecture, 4. evaluation, and 5. analyzing two different instruction methods. Traditional learning was performed using only books, whereas microlearning used video, flashcards, posters, and infographics. As a result of the analysis, the microlearning group showed an 18% increase in grades when compared to the traditional learning group. Moreover, students were motivated and excited about micro learning resulting in increased ability to retaining information effectively.

The experiment by Javorcik and Polasek (2019) also proved an increase in motivation by microlearning and increased investment in time for learning by college students. In addition, in a

time-efficient manner, microlearning was suggested to acquire knowledge in a shorter period satisfying students' needs.

### **Flipped Classroom in Higher Education**

The flipped classroom was first introduced by high school teachers Jonathan Bergmann and Aaron Sams (2012) to mitigate the gap in students' academic performance. In contrast to a lecture-based, instructor-led model, the flipped approach includes two phases of learning, which are "flipped". In the first phases, students acquire basic content and knowledge provided by instructors via various media formats such as video, podcast, and others (Bergmann & Sams, 2012). The second phase starts by activating students' higher order thinking skills through engaging in and performing activities, such as discussion, problem-solving, experiments, and others. Along with their study, several studies verified the effectiveness of flipped classrooms regarding a student's academic achievement in higher education (Albert & Beatty, 2014; O'Flaherty & Philips, 2015).

In flipped classroom, using technology requires students to have technology skills, but also self-directed learning skills. Its effectiveness has been inferred in several studies in higher education focusing more on developing higher order thinking skills. In another study conducted by Albert and Beatty (2014), the teachers posted online lectures allowing class time to focus on discussion and deep understanding. In the study, researchers suggested the components of the technology-adopted flipped classrooms to be transformative in helping students transition from passive to active learners. Using class time to promote higher order thinking skills by reversing class time and traditional homework time would accelerate positive aspects. Additionally, Lu and Sun (2016) designed a teaching model of flipped classroom based on micro-class and presented

that flipped classrooms that used 5-10 minutes micro-video as the major carrier improved students' language skills in college English courses.

Zainuddin and Perera (2018) conducted a study by interviewing and observing undergraduate students in English as a Foreign Language (EFL) course to investigate the impact of LMS on improving self-directed learning skills in flipped classroom. By blending a LMS with the flipped approach, the majority of students felt empowered by having autonomy in their learning. To the employment of varying communication methods such as posting thoughts, comments, questions, and feedback in an online discussion board, broadened the chance to interact with students in the class. Thus, students felt more engaged and communicative in the flipped classroom.

The following two themes are closely related to the research questions; they will be introduced focusing on the MF classroom in chapter four. In chapter two, empirical studies describing the role of instructors and students in classrooms where technology is adopted are presented in each theme.

### **Instructor's Role in Technology-Adopted Classroom**

As more lessons are delivered using technology, teachers' roles constantly evolve in an online learning environment. Specifically, flipped and microlearning facilitates technologies in instruction where instructors' roles should be redefined.

Albert and Beatty (2014) explored the role of instructors in the flipped classroom at San Francisco State University's management course (MGMT). The study was designed to investigate the impact of flipped classroom compared to traditional classroom. While designing flipped classroom to be successful, several roles for teachers were considered. First, instructors

should provide short video segments video to enable students to control their learning pace. Additionally, instructors need to redesign the content by applying questions, video clips, simulation, and other multimedia materials. Lastly, providing students incentives for participation and creating a sense of ownership and commitment were proposed.

Student learning outcomes depend on the instructors, and as such, instructors should deeply understand their roles and responsibilities and be flexible within the learning environment. Especially in an online learning environment, the roles of instructors and students are not the same as in a traditional classroom. As such, since flipped classroom embeds technology while administering lectures outside of the classroom, an instructor's perspective on technology integration can directly influence their lesson.

### **Student's Role in Technology-Adopted Classroom**

Several bodies of research indicate the student's role as an essential element of good teaching (Parpala & Lindblom-Ylänne, 2007; Akerlind, 2004). Especially, in technology-adopted learning, learners take more roles than in the traditional classroom, because the learning occurs from not only the teacher's instruction but relying more on each learner's active technology use.

To become an active learner, each student must become an autonomous learner. In the era of education with technology, individualized learning in the flipped classroom could encourage each student to adjust their own learning pace and to adopting their own learning strategies (Zhang & Zhang, 2018). Especially, during the process of sharing online resources supporting the micro-lesson, students become presenters instead of passive recipients. In addition, students can interact with peers and the instructor asking questions or responding in virtual learning platforms such as a Learning Management System (LMS). The more actively they participate in

the activity, the more learning materials they can garner towards more focused learning.

Furthermore, the resources generated from students can be used as continuous new sources in advanced activities.

Shih et al. (2019) designed a research to examine student perceptions and roles in the flipped classroom with technology. Wherein, as many as 576 undergraduates or graduates from 32 different colleges in Taiwan participated in self-regulated flipped classrooms. Participants participated an online Self-Regulated Learning (SRL) and facilitated advanced activities in a physical classroom after SRL. The results showed that different roles are required for students to perceive flipped classrooms as a more beneficial learning method than traditional classrooms, for example creating social relationships between instructors or peers, and being capable of self-regulating in an online learning environment.

### **Gaps in the Research**

This literature review detected an inclination towards more focus on the effectiveness of the flipped and microlearning approaches, but at the same time a failure to scrutinize its structure. Moreover, research articles to explore flipped classroom integration with micro-lectures are few, also examining instructor's and student's roles in this approach. Additionally, the majority of the data collected in the chapter showed the higher affiliation to flipping the classroom itself, but not the way to flip it effectively. For example, the length of time for each phase or the online lecture time, the useful methods when creating pre-class lessons, the role of the teacher and students in a MF classroom should be more detailed for the research questions. Based on the studies of micro learning in formal education settings and flipped approach, this secondary research will elaborate on the structure of the MF classroom. It will pivot on flipped

classroom's each phase, especially when micro-lectures will be delivered, and communication will be conducted through the online medium.

Previous studies bring to light instructors and students struggle with developing and establishing their roles in a new learning environment. To provide guidance in a MF classroom, this research will examine and demonstrate the new roles of teachers and students in comparison to the traditional classroom.

To summarize, in this secondary research study, the research questions will explore more on the structure of the MF classroom and its members' roles by critically analyzing the published research studies. The paper and the study results will integrate into the existing knowledge of micro learning and the flipped learning approach and provide a new perspective on the domain.

### **Summary**

This chapter presented a literature review of topics related to micro learning, flipped classrooms, and the roles of instructors and students in a technology-enabled classroom. The review provided insight on the implementation and execution of the micro learning and flipped classroom in higher education and the related roles of the instructors and students in this approach. The findings show that micro learning as a method of delivering conceptual knowledge is effective in the formal education sphere. In addition, the flipped classroom could improve student's higher skills when the instructor sets up an adequate learning environment. Students are also exposed to an environment that promotes the qualities of being an active creator and an autonomous and individualized learner. The MF teaching model could be best used in higher education settings, since learners adopting technology in the classroom are expected to demonstrate self-directed learning skills. This chapter shared additional insight on

the concepts of micro learning and the flipped classroom since few studies were found to have researched MF model. Going forward, a detailed structure of the model will be introduced in chapter four. The following chapter introduces the methodology for selecting and organizing articles to answer research questions.

## **Chapter 3: Methodology**

### **Introduction**

The purpose of this study is to explore the teaching method of the MF classroom and the instructor and student roles in their new learning environment. The findings of this study are expected to be used in formal educational settings, focused on higher education to guide the application of the MF approach. The study also should be useful for educators in investigating their roles in the MF learning environment and establishing expectations of the student roles. The research questions in this paper focus on navigating MF classrooms and the evolving roles of instructors and students in the context of transitioning away from the traditional classroom.

This chapter presents an outline of the methodology for the study, including selection of articles, organization of data, and conclusions from the research. Primary research databases and article selection are also discussed followed by a detailed discussion on data utilization methods.

### **Institutional Review Board Exemption**

Permission from the Institutional Review Board (IRB) is necessary before commencing research involving human participants. The purpose of IRB is to review and monitor if the research project can appropriate the relevant data from the human research participants. However, the data of this research were not collected directly from human participants. This is a secondary research study in which the data have been sourced from existing research studies. As the result, this study does not require approval from IRB.

### **Methodology**

The related studies from which secondary data were derived have been identified using the keywords such as "microlearning", "flipped classrooms", "teacher roles", "student roles", and

"online learning". The studies have been sourced using the EBSCOhost and Google Scholar; scrutinizing abstract and conclusion were subsequently used to determine the relevancy. The pertinent studies were also searched by reviewing references for each article. Ten studies were chosen to be the most useful and related to the research questions. The number was deemed appropriate to gather the secondary data for this small-scale study.

In this study, ten research papers are reviewed including eight empirical research and two secondary research studies. The studies were focused on higher education settings that are embedding technology usage in flipped classroom and microlearning. The studies were limited to a range of ten years, from 2010 to 2020, since this time range was considered appropriate to find up to date studies of proposed research questions. All of the studies were chosen based on their focus on the main study topics including micro learning, flipped classrooms, teachers' and students' roles in the technology-enabled classroom—all these provided direct insights to the research questions. This can be attributed primarily to the fact that these research works addressed a flipped learning model using microlearning strategies and illustrated explicit ideas of instructor and student roles in their approaches. Some of the articles detailed in chapter two were selected for analysis because of their significant relevance to research questions regarding the structure of the MF classroom.

This secondary research took into account already published studies of microlearning and flipped classrooms. Microlearning strategy was searched for its usage in education and effectiveness. After finding the potentials of microlearning in the formal education domain, studies were selected including the topic of the flipped classroom. Exploring the use of

microlearning contents in the flipped classroom, this research was designed to detail the structure of the MF classroom, teachers' and students' roles in the approach.

Studies were organized by using a computer software such as Google and Microsoft. All the studies have been stored and maintained in a Google Drive folder. A designated and separate folder was created for each topic, and the final chosen articles were moved to another single folder. After reading and synthesizing the articles, the researcher identified the trends, and the summary and the main findings were written in Google Docs and Microsoft Word and saved in Google Drive. The reference list was reorganized into the tables with the categories of author(s), year of publication, titles of articles, the country where the studies were conducted, and the summary of findings.

### **Timeline**

The literature review began in May 2020. The studies were collected and modified whilst browsing the materials. After consulting the chairperson of the committee, the completion date was determined as May 2021. This process progressed by finding gaps and research questions in this study. All the relevant studies to be included in the study were identified and selected by August 2020. In the meantime, the selected research literature review was in process. Chapter 1: Introduction was completed in October 2020. Chapter 2: Literature Review was completed by mid-November and authored in January 2021. By early February 2021, the methodology of the study was determined and authored in Chapter 3. It was initially planned to hold a preliminary culminating project meeting in February. The last two chapters, that is, Findings and Conclusion, were completed in April 2021. Lastly, the final meeting and submission to the SCSU repository will be completed between April and May.

**Summary**

Articles using the literature review and analysis have been found in databases including MnSCU system libraries, EBSCOhost, Google Scholar, and RISS. The terms used to find related research articles include "microlearning", "flipped classroom", "instructor role", "student role" and "online education". Articles were limited according to the year of publication and level of education. The data was organized using tables in Microsoft Word. In addition, the chapter included the study timeline. The next chapter will show the results of the data containing information on the study findings.

## **Chapter 4: Findings**

### **Introduction**

The Micro Flipped (MF) approach is a teaching model, in which learners participate actively and take initiative in learning. As a branch of the flipped model, the MF approach uses micro-lecture to deliver teaching content. By leveraging video medium for delivery and activating technology comparatively more than traditional classrooms, the MF model necessitates diverse roles for teachers and students.

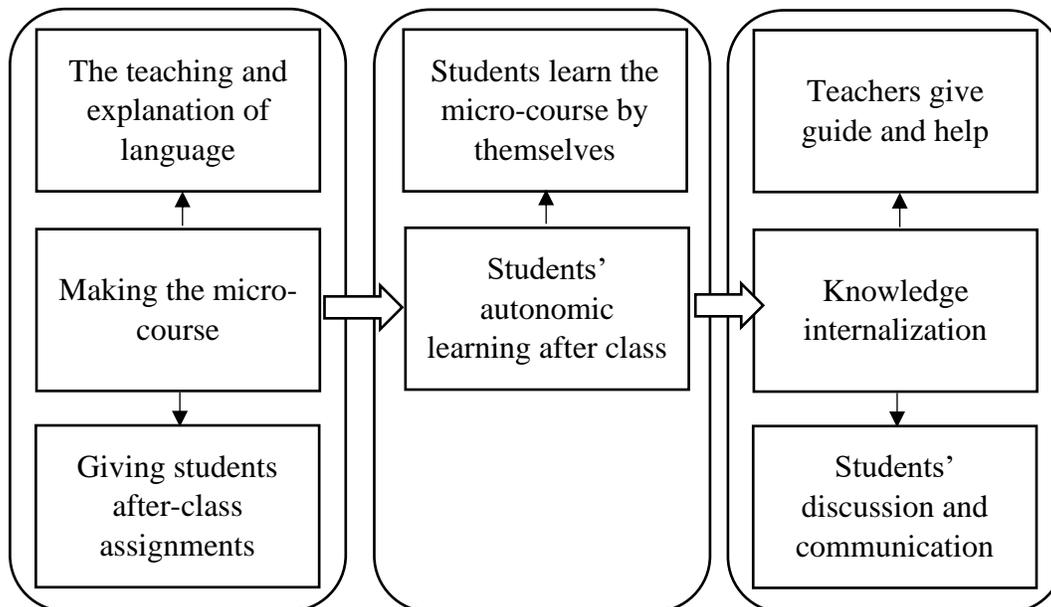
In this chapter, the findings of the secondary research study are presented. Based on the model by Fidalgo-Blanco et al. as the conceptual framework, the paper engages in a critical review of the structure and the respective roles of instructors and learners. Additionally, the Learning Object approach offered by David Wiley (2002) is integrated as an analytical model of microlearning in support of the Fidalgo-Blanco's structure. This chapter is organized under three areas of the research questions: (i) The structure of MF classroom and its utilization, (ii) instructor's role, and (iii) student's role in MF classroom.

### **The Structure of Micro-Flipped Teaching Model**

Lu and Sun (2016) designed a new teaching model combining micro-class and flipped classroom. This model redistributes class time increasing students' learning activities. The feature of the model is that a short lecture video made by teachers transmit lessons, and students have more autonomic learning time to internalize their knowledge. Class time is redistributed as group learning time deepening individual knowledge. The structure of this model is presented in Figure 2.

**Figure 2**

*Lu and Sun's Teaching Model of Flipped Classroom Based on Micro-Class*



*Note:* The concept diagram of the teaching model is adapted from “The Application of Flipped Classroom Based on the Micro-class in College English” by Lu, Y. & Sun, M., 2016.

As presented in Chapter Two, Fidalgo-Blanco et al. (2017) suggested the MFT model and its process, time period, and activities are presented in Table 2. The model facilitates student’s independent learning during the out-of-class time and activates collaborative work with the knowledge in class. Link activity is to lessen the gap between out and in class time by continuously checking students’ understanding.

**Table 2***Fidalgo-Blanco et al. 's Micro-Flipped Teaching (MFT) Model Summary*

The Process of MFT Model	Time Period (min)	Activity
Out of Classroom	10'	Video
	10'	Quiz
Link Activity	30'	Individual Activity (out)
	15'	Task Analysis (in)
In Classroom	10'	Micro Lecture
	25'	Cooperative Work

*Note.* Individual activity in link activity is conducted at the end of the out of class activity; whereas task analysis is implemented before the in-class activity—as reproduced from “Micro flip teaching – An innovative model to promote the active involvement of students,” by Fidalgo-Blanco, A., Martinez-Nuñez, M., Borrás-Gene, O., & Sanchez-Medina, J. J., 2017.

In addition to the structure, the MF model entails three other sections: (i) out-of-classroom, (ii) link activity, and (iii) in-classroom. The total duration of the MF session is approximately 100 minutes and the length of outside class activity is recommended to be between 10 to 20 minutes. Also, the link activity should not be too prolonged since its purpose is to support the lesson, devoid of an independent phase; lastly, the classroom activity continues for approximately 50 minutes.

### ***Out-of-Classroom***

The first section includes a video and quizzes that represent the processes of learning the content and assessment of understanding the learning material. Lu and Sun (2016) designed flipped classrooms based on microlearning, and results showed that recommended time of micro-lectures is limited to within 10 minutes or shorter. Additionally, the lecture is observed to be

more effective when instructors record it by themselves, thereby enabling the students to engage with the most important point (Fidalgo-Blanco et al., 2017). In addition to the micro-video, related resources should be provided to the students in order to ensure that they fully understand the material. Furthermore, to verify their learning, the students take short quizzes, for example in multiple-choice format. Correspondingly, not only the instructor but students can create short videos explaining their learning or leaving a question to be answered by peers through comments can be utilized.

### ***Link Activity***

Link activity facilitates seamless learning between in- and out-of-classroom. It is, essentially conducted after the out-of-classroom activity and before the in-classroom activity. The significance of this activity is that it ensures the students are included in the learning process as active subjects. This form of activity is an individual task that applies the concepts learned in the video and also entails peer interaction. Through online platforms, such as Moodle, Schoology, Google Classroom, Blackboard Learn, and other LMS, students upload questions and answers, as well as their tasks. “Authoring tools will need to operate across different platforms and communicate with other tools used to build learning systems” (Urda & Weggen, 2000, p.15).

### ***In-Classroom***

Students join the class either online or offline simultaneously, collaborating with teachers and peers while activating the contents of the text. If in-class is held in online, “one way to reduce the limitations of an online scenario such as low retention and engagement rates of students is to use synchronous online meetings” (Tolks et al., 2020, 3.3 para. 1). At this juncture,

the class applies their knowledge base built during learning into practical application. Micro-lectures are conducted in the form of debate, presentation, discussion. Brewer and Movahedazarhouli (2018) emphasized an instructor's ideas to facilitate lessons through asking questions using interrogative words, debates, stationary work, and activities that motivate the learner's metacognition in this section. Thereafter, students elaborate on their learning and instructors inspire them to advance skills through cooperative work. Furthermore, Fidalgo-Blanco et al. (2017) highlight that this section should use the results of the work derived from the students in previous sessions.

### ***Microlearning in MF Model***

Microlearning involves multi-faceted content formats such as images, charts, and short text. Videos are also ideal for effectively delivering intended messages within a short time (Brame, 2016). The model derives from the learning objects, which Wiley expected in 2002 as "any digital source that can be reused to support learning" (p.6). Acknowledging the paradigm shift to technology-based instruction, Wiley researched how instructions should be designed to align with learning objects. In demonstrating the potential for reusability, generativity, adaptability, and scalability, learning objects could be either smaller or larger digital resources. Smaller resources include images, animations, live or prerecorded video, while larger resources contain entire web pages that combine text, image, and other media to deliver instructions. Moreover, metaphorized as Legos™, learning objects are combinable, can be assembled, fun, and simple. Also, explained as instructional components—built in smaller chunks, they should be reused and reassembled to support each individual's learning goals.

### **Analysis of Findings in Roles of Instructor and Students**

To answer the second and third research questions, the researcher selected and reviewed seven empirical studies of roles of instructors and students. Table 3 below summarizes the reviewed studies in terms of author/s, year, academic level, and key results. Addition to empirical studies, presentations about applying MFT model in higher education was explored in this chapter (Shin, 2020).

**Table 3***Summary of Empirical Studies*

<b>Author/s and Year</b>	<b>Academic Level</b>	<b>Data Collection Method</b>	<b>Key Results Summary</b>
Bawane & Spector (2009)	Higher education	Questionnaire, Document analysis	The highest priority role of online teaching contexts was a pedagogical role, followed by a professional, evaluator, social facilitator, technologist, advisor, administrator, and researcher roles.
Gonzalez (2009)	Higher education	In-depth interviews	Teachers should be well-structured, focus on student-teacher interaction, promote discussion, and be facilitators of the learning process. Students' collaborative and independent skills are important factors of online courses.
Gonzalez (2010)	Higher education	Phenomenographic interviews	Teachers in e-learning environments play a role in creating an online space for knowledge and collaboration and guiding and promoting students to focus on learning. Students should be active creators of content and knowledge, sharing and collaborating with peers.
Lameras et al. (2012)	Higher education	Phenomenographic investigation	Extending teachers' roles from knowledge-transfer to knowledge-construction, a)providing feedback, b)designing tasks, c)facilitating debates, and d)collaboration are highlighted. Also, student's roles should shift from responsive to more active forms.
Luo (2018)	Higher education	Observation	Interactive modes of the flipped process between network mode (online) and classroom mode are explored. In network mode, online self-learning, online teacher-student interaction, and online student interaction are included. To increase effectiveness of FC, students should take the initiative in self-study, while teachers provide more opportunities for self-study to them.

**Table 3 (continued)**

Shih et al. (2019)	Higher education	Questionnaire	Interactions between students and teachers, and peer-to-peer interactions, are recognized as useful and positive in flipped classrooms (FC). Students with self-regulation also had a better experience at FC.
Sun & Gao (2019)	Middle-high school	Triangulation (Document analysis, interview, observation)	To succeed in a technology-integrated classroom, teachers should build four new roles: learners, facilitators to student-centered learning, collaborators, and researchers. And there are supports needed from an organization and its leaders.

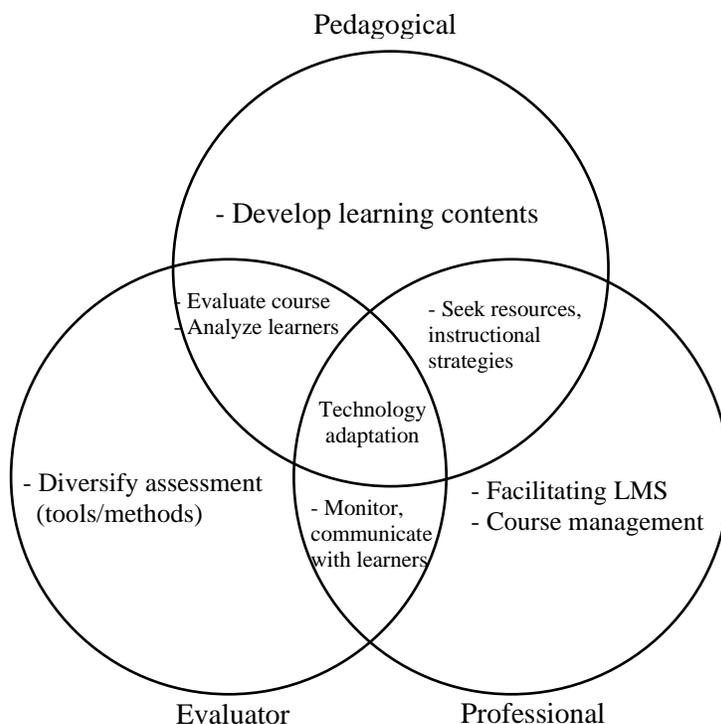
### **Instructor's Role in MF Classroom**

Sun and Gao (2019) proposed a variety of roles of teachers in the flipped classrooms with Information and Communication Technology (ICT). The study was a case study in a Chinese middle-high boarding school that demonstrated a successful application of flipped teaching models supported by technologies for more than five years. The data was collected in triangulation methodology which were document analysis, interviews, and observations. In the identification of the success factors of approach, teacher's development of roles was presented: learner, facilitator to student-centered learning, collaborator, and researcher. Being learners, teachers continuously showed growth in both technological and pedagogical knowledge which is known as the TPACK model. Mishra and Kohler (2006) developed the Technological, Pedagogical, and Content Knowledge model (TPACK) which is a technology integration framework that identifies three types of knowledge. It is recommended that the instructors should combine these three types to successfully integrate education skills. The point of TPACK is to improve students' learning experiences by using technology to teach concepts. Aligned with this model, the school provided professional training related to technological skills, such as creating online instructional videos and the operation of learning management systems. Additionally, the collaborative class preparation group was set up for the teachers to discuss pedagogical contents and concerns in flipped classrooms. Resultantly, all teachers acknowledged that the teachers' role in the MF classroom needs to be transformed into a student-centered classroom, thereby, evolving the teacher's role to observe, organize, and facilitate student's learning. Since teachers should explore possible ways to use new technologies, the researchers' roles also become imperative for this approach. Besides, the roles of school leaders as initiators and strategic

planners who support teachers when adopting new approaches are equally necessary to this approach.

Moreover, the roles of instructors in MF classrooms have emerged at the forefront during the pandemic. Shin (2020), a chairperson of Korean Society of Future Convergence Education (SFCE) and a dental engineering professor at Shinhan University created a fully online micro-flipped classroom during the COVID-19. He organized micro-lectures on his YouTube channel and utilized Naver Cafe as an interactive learning platform. Specifically, he uploaded resources, announcements, and assignments, and communicated with students through comments, emails, or Q&A pages. He emphasized the instructor's role as an active facilitator (Sun & Gao, 2019; Lameris et al., 2012; Gonzalez, 2009) in the classroom. An active facilitator means leading students to the lesson objectives while optimizing interaction for successful delivery and learning. Instructors are not supposed to only provide solutions, but to further extend learning via inculcating thought systems through questions. Additionally, the MF classrooms should maximize students' usage of technology, thereby supporting richer context. For example, a long-term project in which students upload YouTube video content to their channels is one of the evaluations, which can be preserved as a portfolio for the future.

By perusing and synthesizing the studies, three imperative instructor roles are proposed in the MF classroom: 1. Pedagogical role 2. Professional role and 3. Evaluator (specific contents are included in Figure 3). The model designed for this study is based on the TPACK model and research studies of the instructor's role in the MF classroom.

**Figure 3***Instructor's Role in MF Classroom*

*Note.* Three roles are implicated as critical roles which embed technology adaptation skill as seen commonly in classroom settings.

While the instructor's role in online teaching is prioritized as a pedagogical role (Bawane & Spector, 2009), technology competencies are embedded in all factors including development of learning resources, facilitation of participation, and design of educational strategies.

Therefore, the instructor as a technology adapter entails a critical role. In addition, there are a vast number of easy-to-use guided materials available (i.e., YouTube, Google, Pinterest), that instructors can actively explore to identify the best-suited support for the specific lesson. Further information to use software in online learning can be found in Appendix A.

**Student's Role in MF Classroom**

Gonzalez (2009) conducted a research to explore conceptions, approaches, and teaching and learning in online classrooms. He interviewed seven post-graduate lecturers after attending

online courses by asking questions such as how they conducted online courses and how they worked. In the study, he inferred that the level of maturity and engagement in the learning process were important factors in online learning. Moreover, lecturers agreed that students who are sufficiently experienced and independent to take responsibility for their education were the key factor in achieving successful learning in online mediums. In addition, Gonzalez (2010) insisted that a student's role has now changed from a passive learner to an active creator of knowledge in an online environment. In other words, students should build their knowledge, share, collaborate, and communicate as active learners to achieve effectively in a new learning environment.

Lameras et al. (2012) studied to investigate views and values of Virtual Learning Environment (VLE). The interviews were conducted to 25 educators in higher education, and they all had more than one year experience in VLE. Students' roles in VLE are characterized as "receiver of information to 'doer' of set tasks, seeker of feedback and further information, developer of ideas, creator of knowledge, to contributor to the learning of others and developer of personal awareness and skills" (p. 151). Moreover, the study suggested students can develop their level of understanding in an online learning environment through intrinsic feedback such as automated multiple-choice quizzes or scenario-based simulations. In other words, students in VLE requires added responsibilities to control their learning pace, seek information, evaluate themselves, and communicate through online platforms.

Furthermore, interaction among the students was highlighted in a study implemented by Luo (2018). The author researched advantages of MF classroom in college English course in China and highlighted its model as an interactive model. He insisted mutual knowledge checks and discussions among the peers were revealed to promote quality learning both in the micro-

classroom and flipped classroom. In addition, students who learn fast can take a part of teaching during cooperative activities. This helps peer interaction as well as both of their learning interests (Lu & Sun, 2016). A network between teachers and students are formed by knowledge answering such as students' finding problems, students' online submission, and students' online feedback questions.

Overall, students' role in the MF classroom has evolved to an autonomous status in comparison to the earlier characteristics of passive learners and prosumers than consumers of contents. It is highlighted that students' self-regulation ability is the key aspect in the flipped classrooms, especially in the first phase (Shih et al., 2019). Students should develop time management skills since they have responsibilities to complete contextual understanding before the class starts and to interact in an online learning environment during the self-learning time. In addition, "the quality of the interactions with the instructor and peers plays direct roles in influencing students' intentions to attend flipped learning (p.1202)." Accordingly, Shin (2020) facilitated several types of in-class activities which increased interactions utilizing various technology. For example, he activated LMS for communication and learning tools by commenting on peers' questions, uploading their created video content (explaining contexts, interview, simulation, and others), or used Social Network Service (SNS) for assessment tool (sending a voicemail). As a result, students were always found their peers and the instructors approachable, which helped to engage most of the students. Therefore, developing self-regulation skills, communicative skills in online learning environment, being active creators, and teachers are new roles required to students to successfully engage in MF classrooms.

## Summary

This chapter discussed the findings of the secondary research study to answer the research questions. The structure of the MF classroom was introduced following Fidalgo-Blanco et al.'s MFT model, and details were incorporated with additional research studies. Microlearning is explored with the concept of the 'Learning Object' by David Wiley (2002), and each phase in MF approach is demonstrated under the sub-themes. The roles of instructors in MF model are summarized in three forms: pedagogical, professional, and evaluator. Technology adaptation is the convergence skills that enhances and broadens the scale of these roles. Lastly, a student, as a person in charge of the learning, should have self-management skills and an active mindset in a classroom. Learning in a technology-integrated era, students are expected to develop their knowledge by exploring the internet, utilizing LMS, and interacting with peers and instructors. The next chapter will present a summary of the secondary research paper, as well as implications for further research.

## Chapter 5: Conclusion

### Conclusion

The micro-flipped model combines the advantages of microlearning (increase learners' retention time by delivering content in a short time) and flipped approach (allow both instructors and students to use class time more efficiently, making learners the subject of learning and allows instructors and learners to maximize the use of technology) to enhance the learners' higher order thinking skills. Additionally, continuous interaction throughout the courses via online platforms enables seamless learning. It is recommended that instructors and students should be in synchronously either online or offline to effectively incorporate collaborative tasks.

In a MF classroom, instructors and students take different responsibilities compared to traditional classrooms. First, an instructor plays a pedagogical role who develops lessons with expertise in content, a professional role who communicates with students and manages the class in various ways and works as an evaluator who identifies and evaluates learning content. Second, students are suggested to develop self-regulation skills as active learners who take ownership of their learning. In addition, as autonomous learners, students communicate with their peers and instructors on various platforms and share their knowledge.

Acknowledging technology integration is an important part of MF approach, however, there were always concerns addressed about accessibility to devices. Requiring students to do self-study by watching micro-lectures and doing quizzes could cause negative results for whom cannot access to them. However, during the COVID-19, because of urgent needs of digital devices, many non-profit organizations (Education Equity Fund, The OnIt Foundation, Minnesota Computer for Schools, etc.), companies (Amazon, American Family Insurance, Australian Business and Community Network, etc.), and federal government donated free

laptops, and many universities set up free rental services during the school year. Still, there are needs to lessen the gap of digital accessibility.

Higher education aims to develop advanced skills such as critical thinking skills, creativity, problem-solving skills, and others. MF approach is one of the teaching methods which uses technologies in education and can enhance those skills. As this approach is implemented in different settings with traditional classrooms, both instructors and students need to play roles different from the traditional classroom. Students need to be more active while instructors must encourage the students to develop their potential; each has respective responsibilities. As suggested for further studies, continuous exploration of the MF approach in higher education will be imperative in the era of technology-integrated education.

### **Recommendations for Further Research**

There was a limited number of research articles directly focused on the variables considered for this study. The specific structure of a micro-flipped teaching model and roles of instructors and students were rarely studied. However, there are many papers published about the academic effectiveness of flipped classrooms. Furthermore, there were limited empirical research articles examining students' perspectives in MF classrooms, mostly from teachers' perspectives.

For further research studies, it would be beneficial to gather primary data in higher education settings to develop a conceptual framework with a larger database. In addition, it would be valuable to diversify the roles supporting instructors when utilizing the MF approach in higher education. As Sun and Gao (2019) examined in the research studies, diverse roles in institutions and their interaction are critical in instructional reform. Specifically, the executive vice principal, administrators, director, technology coordinator and teachers played different roles. Therefore, it is suggested to explore various roles in university settings, and by specifying

their roles to support the approach, it would help instructors to focus more on developing quality content.

Lastly, exploring current online platforms which can be utilized in each section would be beneficial for instructors who decide to use the MF approach. Today, vast social media and online platforms and search engines are making it difficult to select appropriate tools. Thus, guidelines or summarized information of diverse tools which can be used in MF classroom could help future instructors implementing MF courses.

### **Summary**

In this secondary research study, the MF model and the roles of instructors and students in the MF classroom have been discussed.

The study sought to answer three research questions:

1. What is an MF approach and how can the teaching model be used to optimize the effectiveness of instruction?
2. What are the roles of an instructor in the MF classrooms in higher education settings that facilitate cognitive engagement, collaboration and meta-cognition?
3. What are the roles of students in the MF classrooms in higher education settings leading active knowledge construction?

Based on the literature review, the research suggests that flipped classrooms in higher education are effective in improving students' engagement and higher order thinking skills. In research studies, instructors and students acknowledged the successful impact of these classrooms on academic performance and had positive recognition. However, the burden of preparedness to create or watch long video lectures were considered as a barrier. Consequently, microlearning is added to the flipped approach called the MF approach.

The research findings present an MF model structure and the roles of instructors and students in the MF classroom. Fidalgo-Blanco et al. showed an MF model structure that included three components: out-of-class, link activity, and in-class. The out-of-class activity incorporates micro-lectures and quizzes, and it moves on to link activity which enhances learning through individual work and tasks. In-class is then implemented by conducting cooperative and interactive activities. During a course, micro-lectures are recommended to deliver a lesson within 10 minutes to increase retention time, since students are having a shorter attention span than before (Statistic Brain, 2019). From lectures to assessments, the MF model utilizes various technologies, and therefore, instructors and students need technical knowledge to address their roles.

Drawing on the relevant empirical literature, this study suggests three roles of instructors in MF classrooms especially in higher education settings: pedagogical role, professional role, and being an evaluator. These components indicate that instructors should not be limited to their traditional abilities such as content development, course management, and communication skills. They must also have technological adaptability to diversify assessments, manage LMS or create materials, and stand as facilitators making students become independent learners.

Students in MF classrooms should act as ‘doer’ than ‘receiver’ and ‘seeker’ than ‘user’. To be an autonomous learner, students need self-regulation skills along with the ability to monitor their learning progress and self-amplify their knowledge. For example, students will build foundational knowledge through micro-lectures, quizzes, and additional materials and then actively participate in collaborative tasks with their peers by applying that knowledge.

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## Appendix A

### Software in Online Learning

#### *Learning Management System*

<b>Software</b>	<b>Features</b>
Google Classroom	<ul style="list-style-type: none"> <li>- Common in primary or secondary education</li> <li>- User-friendly platform</li> <li>- Generates web-conferencing room linking with Google Meet</li> <li>- Highly integrated with G suite (Google Docs, slides, jamboard, etc.)</li> <li>- Free for schools</li> </ul>
Blackboard	<ul style="list-style-type: none"> <li>- Focused on higher education institutions</li> <li>- Advanced in document management (syllabus, handouts, projects, and assignments)</li> <li>- Includes robust assessment tools: peer assessment, self-assess</li> </ul>
Canvas	<ul style="list-style-type: none"> <li>- Able to link with inclusive video platform (Canvas Studio)</li> <li>- Easily upload and share videos</li> <li>- Includes web-conferencing function</li> </ul>
Moodle	<ul style="list-style-type: none"> <li>- Flexible in designing own curriculum</li> <li>- Cloud-based platform (MoodleCloud): easy to access materials</li> <li>- Various assessment tools: Quizventure (gamification of quizzes)</li> <li>- Others: wordcount, group choice, attendance tracking</li> </ul>
D2L Brightspace	<ul style="list-style-type: none"> <li>- Integrate with Microsoft Office 365 and Google Apps for Work</li> <li>- Flexible in creation of courses and assessment</li> <li>- Various customizing options</li> <li>- Allow large capacity of students (more than 1000 students)</li> </ul>

#### *Synchronous Meeting Tools*

<b>Software</b>	<b>Features</b>
Google Meet	<ul style="list-style-type: none"> <li>- Automatically meeting information is recorded and reported to the host (The length of the meeting time, attendee's check-in, check-out time)</li> <li>- User-friendly</li> </ul>
Zoom	<ul style="list-style-type: none"> <li>- Compatible with various programs</li> <li>- Easy-to-use</li> <li>- Have annotation session: text, draw, arrow</li> </ul>
Adobe Connect	<ul style="list-style-type: none"> <li>- Common in companies, higher education settings</li> <li>- Co-host available</li> <li>- Able to pause the webcam</li> <li>- Different types of surveys, file shares, Q&amp;A, whiteboard</li> </ul>

*Searching Engine*

<b>Software</b>	<b>Features</b>
YouTube	<ul style="list-style-type: none"> <li>- Search videos by keywords</li> <li>- Communicate or Q&amp;A in comments area</li> <li>- Upload created video and utilize it as assessments</li> <li>- VR view is available</li> </ul>
Google	<ul style="list-style-type: none"> <li>- Search for websites, academic paper, videos, or images</li> <li>- Ask questions or leave answers</li> <li>- Facilitate various features in Google in the classroom such as Google docs, Google classroom, Google Jamboard, Nearpod, Google slides, and etc.</li> </ul>
Pinterest	<ul style="list-style-type: none"> <li>- Focused on image searching</li> <li>- Share ideas or search of certain topics</li> <li>- Showcase created work during the activities</li> <li>- Leave comments or provide feedback</li> </ul>

*Communication Tools*

<b>Software</b>	<b>Features</b>
Whiteboard.fi	<ul style="list-style-type: none"> <li>- Online whiteboard software</li> <li>- Able to export teacher's whiteboard to all</li> <li>- Able to import student's whiteboard to all</li> <li>- Lots of emojis: Communicate with using them</li> <li>- Mathematical notation, symbols</li> </ul>
Padlet	<ul style="list-style-type: none"> <li>- Collaborative board</li> <li>- Import video, images and sounds</li> <li>- Able to take selfie</li> </ul>
AnswerGarden	<ul style="list-style-type: none"> <li>- Online feedback app</li> <li>- Students' answers appear as a mind map</li> </ul>
Google Jamboard	<ul style="list-style-type: none"> <li>- Whiteboard + Slides</li> <li>- Able to draw, type texts, import images, select background</li> </ul>