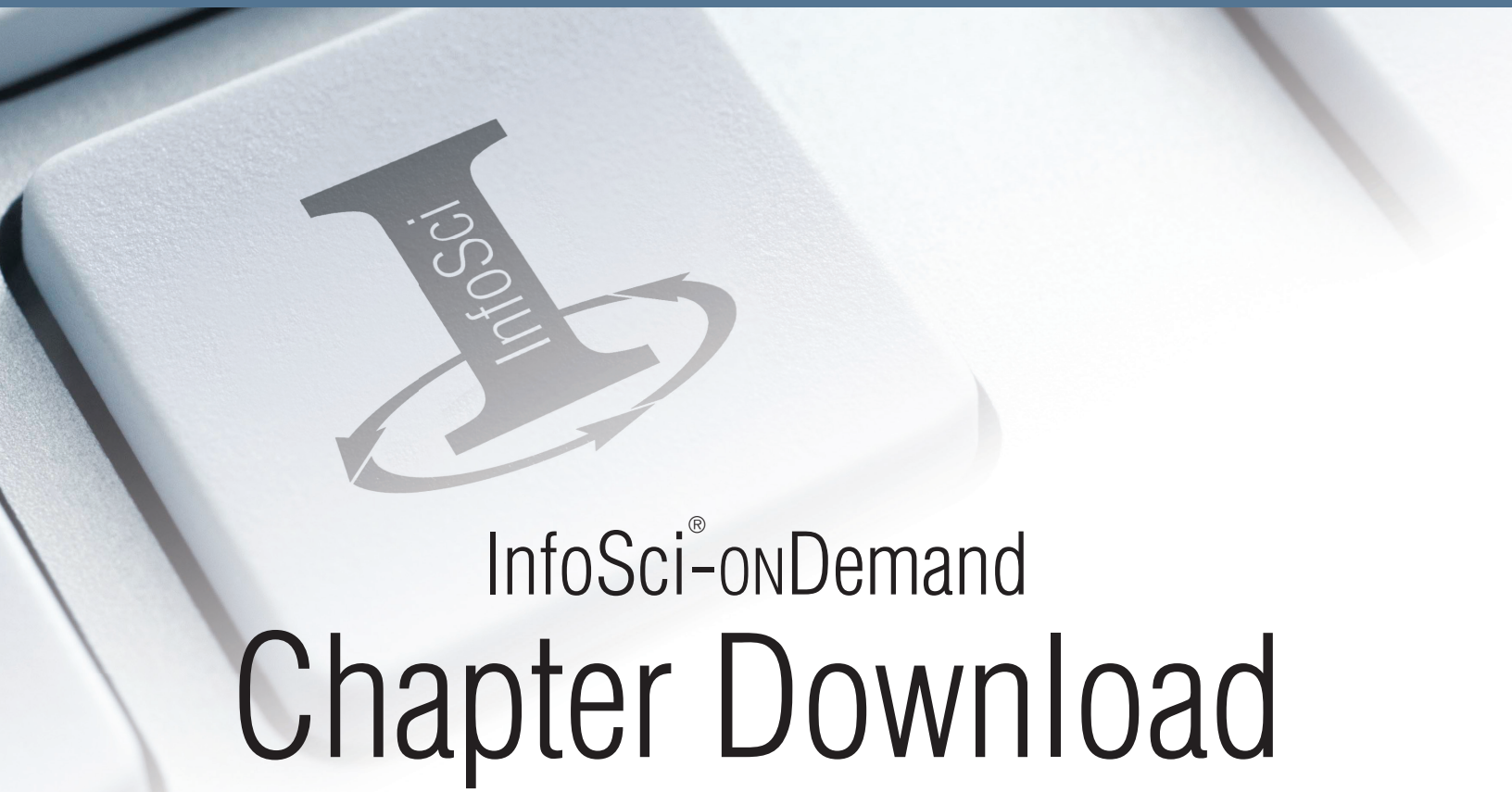

Chapter 15
Promoting Active Learning in Mathematics Teacher Education:
The Flipped Classroom Method and Use of Video Content

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ABSTRACT

Teacher educators have a responsibility to help prospective teachers in their professional growth. It is important that teacher educators not only teach prospective teachers about benefits of active learning in student learning, but that they also prepare future teachers in using pedagogical methods aligned with active learning principles. This manuscript provides examples of how mathematics teacher educators can promote prospective teachers' active learning and professional growth by bringing together the Flipped Classroom method with video content on teaching and learning as well as workplace learning opportunities in a pedagogy course. The professional learning of prospective teachers is framed according to the components of the Pedagogical Content Knowledge (Park & Olive, 2008; Shulman, 1986). Implications for future trends in teacher education are provided.

INTRODUCTION

One of the major goals in teacher education is to help prospective teachers understand, experience, and become proficient at desired methods of teaching that are proven to enhance student learning, such as active learning strategies. Recent developments in research on learning suggest the importance of active learning in transferring factual knowledge learned in school to new settings and developing creative solutions to problems (Bransford et al., 2000). Active learning approach in education recommends that learners have opportunities to participate, actively engage and explore, and become mindful of the learning processes. In order to achieve this goal, teacher educators should provide a strong foundation and learning opportunities for prospective teachers in teacher education programs. Although being proficient

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in one specific pedagogy requires long-term training and experience, prospective teachers who are educated and immersed in similar learning environments have a better chance in becoming teachers who are adapt at incorporating active learning strategies in their own teaching. It is evident that teacher education programs need to be revised and improved by considering the recent recommendations related to benefits of active learning on student learning and changing role of teachers in classrooms (Niemi, 2002).

LITERATURE REVIEW

Active Learning and Nature of Mathematics

Recent research in learning recommends use of several different approaches in learning such as problem-based learning, cooperative learning, project-based learning, etc. (Bell, 2010; Donnelly & Fitzmaurice, 2005). One common aspect of such different approaches is the active role of the learners and their involvement in the inquiry process. Although benefits and challenges of implementing active learning have been frequently discussed in engineering education, there is room for research and dissemination of best practices on active learning in teacher education practices.

Before focusing on practices of teacher education, it is important to explore the nature of mathematics and how it fits the active learning recommendations. In the Standards for Mathematical Practices (Common Core State Standards Initiative, 2010), it is suggested that mathematically proficient students make sense of problems, engage in reasoning, analyze different situations and construct meaningful arguments, model by using mathematical language, use tools in a strategic manner, pay attention to details as well as regularities and patterns in the process of problem solving. In their influential publication about habits of minds, Cuoco, Goldenberg, and Mark (1996) described general habits of mind which will not only serve in learning mathematics but also help become members of a learning society in the following way: being pattern snifters, describers, thinkerers, inventors, visualizers, conjecturers and guessers. It is apparent that such demanding practices and habits of mind will not be improved by traditional lecture where learners are the passive recipients of information. In contrast, learners are called to develop new ways of thinking rather than being consumers of information. A recent pedagogical method that has a potential to bring different aspects of active learning to come together and have an influence greater than the sum of their individual impact is the Flipped Classroom pedagogy that will be presented in this chapter for the particular use in mathematics teacher education.

The State of Teacher Education and Development of Prospective Mathematics Teachers' Pedagogical Content Knowledge

One of the most frequently used theoretical constructs in describing knowledge needed for teaching is "pedagogical content knowledge" (PCK). PCK is described as "the special amalgam of content and pedagogy that is uniquely the province of teachers, their own special form of professional understanding" (Shulman, 1987; p. 8). PCK has been modeled in different ways, and in general it is theorized to include following aspects required for teaching: knowledge of students, knowledge of instructional strategies and representations, knowledge of curriculum, and knowledge of assessment (Magnusson, Krajcik, & Borko, 1999). Although PCK components are closely intertwined with each other, knowledge of students and knowledge of instructional strategies and representations are considered particularly helpful during

teaching as teachers implement strategies and representations based on their knowledge of students' needs, understanding and interests (Alonzo, Kobarg, & Seidel, 2012; Borko, Roberts, & Shavelson, 2008; van Driel, Verloop, & de Vos, 1998).

PCK has been defined as a situative and practical type of knowledge since teaching experience and different school contexts have been found influential in its development. Although beginning teachers also need to be equipped with this type of knowledge as they enter the profession (Wilson, Floden, & Ferrini-Mundy, 2001), teacher education programs which include teaching methods courses and mathematics subject may not be sufficient to help prospective teachers become ready for teaching in real classroom environments (Hasweh, 2005). There needs to be authentic field experiences interwoven in teacher education courses that will help prospective teachers become familiar with understanding and working with students before they enter the profession (Wilson, Floden & Ferrini-Mundy, 2001).

Recent studies suggest that even teacher candidates' PCK can be improved during teacher education classes in a way to help them become more knowledgeable professionals (Depaepe, Verschaffel, & Kelchtermans, 2013). Among different methods to improve prospective teachers' PCK, incorporating video clips of teaching and learning (Santagata & Angelici, 2010; Santagata & Guarino, 2011) and sharing reflections in the context of online communities in addition to classroom contexts have been found especially useful (Jang & Chen, 2010; Levin, 1999; Nicholson & Bond, 2003). Use of online community reflections provides opportunities for learning from social interactions (Vygotsky, 1978), creates professional peer support and extends classroom discussions by providing opportunities of thoughtful feedback to peers through asynchronous communications. The model introduced in this chapter is aimed at improving PCK in mathematics teacher candidates by using the Flipped Classroom technologies, which incorporate both video viewing and building online and in-class communities for mathematics teachers candidates' learning, which is supported by authentic field experiences as recommended by research.

Use of Video Technology in Teacher Learning

Recent research in teacher learning, which involves reflecting on video clips of teaching as a form of professional development goes back to Goodwin's concept of professional vision (Goodwin, 1994). Professional vision requires the practitioners to be able to use a specialized type of knowledge about their field so that they have the ability to attend to and make sense of significant events particular to their fields. Although video technology in teacher learning is becoming widely popular, teachers may not necessarily be able to develop new visions about their practices solely as a result of watching classroom videos. In some cases of video viewing, teachers may have a tendency to become passive recipients of information and judge the content. In fact, video content can only be a useful tool for teacher learning when its use is carefully planned, guided and scaffolded by facilitators (Coles, 2013; Erickson, 2007).

It is recommended that video viewing practices are incorporated as early as possible in teacher education courses such that prospective teachers are familiar with observations of teaching and learning and develop a professional vision (Santagata, Zannoni, & Stigler, 2007). Studies have indicated the benefits of viewing videos on prospective teacher learning repeatedly (Goudin & Chalies, 2015; Santagata et al., 2007; Seidel et al. 2011). Perspective of the video clips of instruction (Miller, 2011), sources and nature of video clips used (Borko, Koellner, Jacobs & Seago, 2011; Seidel et al., 2005) as well as facilitation strategies (Blomberg et al., 2013; Coles, 2013) are crucial in the effectiveness of video-based teaching that aim to create lasting change and improvement for teachers. Prompts and scaffolding strategies have also been found influential in prospective teachers' reflections. For instance, *the lesson analysis frame-*

work was found to help prospective teachers develop their professional vision in better ways compared to another framework (Santagata & Angelici, 2010). Lesson analysis framework prompted prospective teachers to consider lesson goals of the lesson presented in the video clips, focus on student learning and make connections between teachers' instructional strategies and student learning as evident in the video clip. Additionally, prospective teachers were asked to provide alternative strategies to the ones presented in the video so they were prompted to think and make decisions as if they were the teachers of the classroom in the video.

It is important to select and sequence video clips with the right scaffolding in order to obtain maximum benefits for teachers' learning. Different types of video clips offer different opportunities for reflection. For example, videos that call for inquiry and have rich windows for reflection may be more beneficial to teachers (Borko et al., 2011). Additionally, video content should be in the zone of proximal development of prospective teachers and the context should be neither too complicated, nor too simple. Another distinction that has a potential to create differences in teacher learning is whether the video clips represent exemplary, typical or problematic cases of mathematics teaching and learning. Although exemplary cases offer models of good practices that could equip prospective teachers with effective strategies, they pose challenges in creating an inquiry-focused discussion and lead to evaluation of teacher practices that may not always be productive for teacher candidates' learning (Sherin, 2004). On the other hand, typical cases where video clips demonstrate complexities of teaching and learning, and the best way to handle classroom situations is not immediately obvious may even be more productive for prospective teachers' learning as such cases call for rich discussions and an inquiry-oriented stance (Sherin, Linsenmeier, & van Es, 2009). Teacher educators should present a combination of both exemplary and typical or problematic cases to maximize prospective teacher learning.

There are also debates in effectiveness of conducting field observations versus video analysis, considering several advantages and disadvantages to both sides. During field experience, the mentor teachers and the coordination between the mentor teachers and teacher educators shape the learning opportunities of prospective teachers. It is a problem that not all mentor teachers are as equipped with enough time, knowledge and tools in helping prospective teachers. Furthermore, when mentor teachers teach in traditional manners, prospective teachers don't have exemplary models of teaching to learn from. In contrast, video content can be controlled and organized by the teacher educators, which can produce a better design aligned with learning outcomes. The disadvantage of the video content is that video clips may not be able to offer experiences that are as authentic as field experience. Due to this limitation, teacher educators should provide a context and prompts for reflection with video viewing activities. Embedding video content and deliberately making it conducive to active learning within Flipped Classroom context with addition of authentic learning experiences may have a potential in creating highly qualified prospective teachers.

THE FLIPPED CLASSROOM METHOD

The Flipped Classroom method is an innovative pedagogical method, which provides video materials, readings and exercises as homework outside of the classroom meetings, before the actual class takes place. The Flipped Classroom method allows time for opportunities of active, problem- and project-based collaborative learning during the in-class meetings with the guidance of an instructor (Bishop & Verleger, 2013; Tucker, 2012). The following definition of the Flipped Classroom method by Lage, Platt

and Treglia (2000) provides a rationale for naming of the terminology: "Inverting the classroom means that events that have traditionally taken place inside the classroom now take place outside the classroom and vice versa" (p.32). Although this definition may suggest that use of the Flipped Classroom method involves only changing the order of activities that takes place at home and in classrooms for learners, this method in fact requires incorporation of more sophisticated methods than simply changing the order of activities (Bishop & Verlenger, 2013).

The Flipped Classroom method requires not only changes in the order to activities, but also function of the content, role of the instructor, assessment practices, the learners' responsibility and balancing the power between the instructor and the learner which require demanding phases of preparation and planning for the instructors (EDUCAUSE, 2012). The instructor is responsible for preparing content that is accessible for learners through different types of video clips (either featuring instructor or others, movies, documentaries, research data, etc.), readings and other types of media. When the content is engaging for the learners and applicable to their lives, there is a greater chance that they will be motivated to learn the content. Most importantly, the instructors need to design collaborative group learning activities during class time, which are in line with student-centered and active learning theory (Weimer, 2002). Learners are responsible not only for learning of foundational aspects of the topic before class time, but also assess their own learning and identify their strengths and weaknesses, which reinforces another aspect of active learning: self-regulation. In this manner, students may choose to ask help from their peers or the instructor based on their understanding or they may choose to view video material multiple times based on their individual motivation and needs as learners. Constructing one's own learning by active engagement, and by participating in social interactions have been found influential on theories of learning (Piaget, 1963; Vygotsky, 1978) which are in line with the Flipped Classroom method.

During class time, the instructors are expected to act as facilitators in the sense that they prepare groundwork for meaningful discussion of the ideas presented before class time. One of the greatest benefits of the Flipped Classroom learning is that instructors have time to actually interact with students, facilitate discussions and monitor student learning. Direct instruction to help students remember, understand and apply knowledge (skills that are in the lower end of the spectrum, according to Bloom's revised taxonomy as mentioned in Krathwohl, 2002) is provided mainly in the video materials and partially in the readings delivered before class time, which spares time for achievement of higher order learning skills such as analyzing, evaluating and creating (Krathwohl, 2002). Group work and collaborative learning are encouraged during class time. Because learners come to class with basic knowledge of the topic, through discussion and carefully planned activities, they are expected to enhance their abilities of analysis, synthesis and evaluation. Such processes are expected to help learners develop their critical and creative thinking skills. Assessment and self-regulation are important aspects of both active learning and the Flipped Classroom method. The instructor prepares formative and summative assessments to make sure that learners are able to reflect on their learning and prepare for future classes accordingly.

Using the Flipped Classroom Method in Teacher Education

As learners' needs related to improving of critical thinking, creativity, innovation, collaboration, media and technology skills grow (Partnership for 21st Century Skills, 2011), the need for preparing better teachers in line with such life long learning goals become increasingly evident. In today's society, teacher candidates should be prepared to employ innovative teaching methods and incorporate rich mathematical content within technological environments (Darling-Hammond & Bransford, 2005). However, it is

not realistic to expect teacher candidates to design learning environments that engage learners actively and prepare them for 21st century skills, when teacher candidates themselves have completely different experiences as learners educated within traditional classroom contexts.

The Flipped Classroom method can be one important context to help teacher candidates experience how to not only participate but also design environments for their own students that are conducive to active learning. Although the Flipped Classroom method may be demanding and may also pose challenges for instructors, there are many benefits of using the Flipped Classroom method in teacher education (Ray & Powell, 2014). One obvious affordance of this method is to help teacher candidates become accustomed to learning mathematics as well as mathematics pedagogies. In this manner, teacher candidates have a chance to increase their familiarity and motivation to use it in their future classrooms and help with their student's active learning processes such as incorporating collaborative learning and formative assessment practices, preparing video-based content for their students, etc. Another important motivation to use this method is aligned with preparing reflective teachers (Schön, 1996). Opportunities related to using of asynchronous video viewing and creating class time to discuss and reflect on the videos with colleagues by employing this method has the potential to help with teacher learning as proven with previous research related to incorporating video technologies in teacher learning (Ray & Powell, 2014). Just as research recommendations underline the importance of active learning of students, Flipped Classroom method allows for prospective teachers to be immersed in both theoretical and practical aspects of teaching according to learners' individual needs. Teacher candidates will have opportunities to learn delivered lesson material either on their own or within a group of peers, according to their needs and motivations, therefore allowing them to construct professional knowledge both individually and socially (Nizet & Meyer, 2014). The Flipped Classroom method promotes incorporation of video clips of teaching and learning, which has been proven to help prospective teachers in developing professional visions as well as contribute to their pedagogical content knowledge. Watching teaching from the videos may help prospective teachers watch and replay the videos as much as they want and develop professional vision in their own pace.

A MODEL OF A TEACHER EDUCATION COURSE USING THE FLIPPED CLASSROOM METHOD

The Flipped Classroom method of teaching incorporates main principles of active learning: construction of knowledge individually and socially, aligned with individual needs and pace, self-regulated and reflective. In general mathematics teacher education curriculum mainly consists of mathematics content and mathematics teaching methods courses as well as field experience. A mathematics teaching methods course utilizing video technologies in the context of the Flipped Classroom method is provided as an example and motivation for other teacher educators.

This course is aimed at enhancing all aspects of pre-service teachers' PCK and particularly their Knowledge of Students, which has a potential to help prospective teachers make pedagogical decisions during the complexity of teaching (Park & Oliver, 2008). This course is intended for prospective teachers who are in the early stages of the professional continuum, before they start the formal field experience. The experiences in this course have the potential to contribute to prospective teachers' preparation before they are immersed in the K-12 school contexts.

Implementation of Norms

Although the millennial learners are familiar with technology, it may take some time to get used to norms and ways of learning in flipped courses. Implementation of norms are even more important for prospective teachers as learners because they are likely to use the Flipped Classroom method in their future teaching. For learners, one of the requirements of this method is watching the video lectures/video content before coming to the class discussion. Because class discussions are rarely productive when this requirement is skipped, teacher educators may employ different methods to ensure that prospective teachers are prepared for the class discussion (Nizet & Meyer, 2014). Completing online quizzes or delivering an individualized short summary of the video content may be some methods to provide accountability. When such assessment practices are incorporated in the overall course, learners are more likely to engage in insightful discussions about the content that are based on evidence from different resources such as video content, readings and not solely on leaner's opinions. Although leaners' personal opinions are valued in discussion, arguments are encouraged to be evidence based.

It is recommended that instructors have learners sign an agreement such that learners acknowledge responsibilities associated with accessing, viewing and uploading video content as part of the flipped courses (Ray & Powell, 2014). As part of viewing norms, prospective teachers should gain awareness about not sharing the materials with others, especially when clips involve consent from the subjects or copyrighted materials. Additionally, because prospective teachers may tend to evaluate or judge teachers and students in the videos, norms may also involve providing reflections on the videos in productive manners. Typically, a *productive reflection* includes not only description or judgment of events, but reasoning between events, and focuses on significant aspects of teaching, mainly student learning (Davis, 2006; Santagata & Angelici, 2010).

The Design of the Flipped Course

This course not only aims to implement the Flipped Classroom method to encourage active and reflective learning of prospective teachers but also help them engage in authentic learning experiences. The lesson goal is to help prospective teachers develop professional vision and pedagogical content knowledge by engaging in some of the core practices of teaching, and gain awareness of active learning pedagogies using the Flipped Classroom method. Taken into consideration of research recommendations related to teacher learning with video content and situated learning theories, the 14 weeks long course will include the following segments:

Part 1 (5 Weeks): Whole Class Instruction Lesson Analysis

Video Clips of Whole Class Instruction

Teacher educator will provide a variety of video clips of whole class instruction in mathematics teaching, resulting from the TIMSS video study. These lessons and the interactive interface which allows for asking questions, inserting reflections and creating clips from parts of the instruction provides prospective teachers with referents for commonly used mathematics teaching terminology and help to create a shared professional language among peers. Additionally, video clips are not only useful for stimulating

discussion but they also have the potential to introduce new ideas and model types of teaching that prospective teachers have never experienced as learners.

Although the video content will include both exemplary and typical cases of teaching and learning mathematics, they will most likely not be immediately recognized as either type at the first glance, which will promote inquiry in prospective teachers. Using video clips of different contexts from different countries such as United States, Switzerland, Japan will help prospective teachers understand the importance of culture and traditions on teaching as well. In addition to the international video clips, there should be video clips, which will provide context of familiarity for prospective teachers, such as schools similar to where prospective teachers themselves may also work in the future. These video clips may come from the instructors' research data or typical observations from local classrooms.

Introducing and using Lesson Analysis Framework

Prospective teachers may be prompted to provide reflections without any scaffolding in the beginning of the course, by simply answering the question: "What do you notice about the following video clip? Share your insights". If prospective teachers share their insights on the online discussion board and prompted to comment on others' reflections, they may start to become aware of the difficulty of such an open task due to complexities of teaching. After sharing first reflections on a video, the instructor may prompt the learners to consider differences between the productive and unproductive reflections on the discussion board, which has the potential to help prospective teachers regulate their awareness. Such scaffolding may help prospective teachers realize that judging teacher decisions, focusing on teacher characteristics and physical aspects of classroom may not result in their own development as professionals. The instructor may then introduce the Lesson Analysis Framework, which facilitates use of evidence in arguments (backing up claims on teaching and learning by providing evidence from the video), prompts prospective teachers to focus on student learning in relation to instructional decisions (being aware of relationship between teacher decisions and utterances and student learning and behaviors), and provide alternative strategies to what is observed in teaching (What would you do if you were the teacher of the classroom in the video clip?) (Santagata & Angelici, 2010).

The prospective teachers will be prompted to focus on not the teacher but nature of teaching which reinforces to focus away from personal characteristics of the teachers to their instructional strategies (Stigler & Hiebert, 2009). The prospective teachers will also be encouraged to consider lesson goals for student understanding and results of teacher decisions on the student learning processes, in the cultural activity of teaching. Using the Flipped Classroom approach for such activities ensures that all prospective teachers watch the same content, and they can watch the same content multiple times if they wish to and become more thoughtful in their reflections. The Flipped Classroom method allows prospective teachers to pace their learning based on individual needs and motivation.

Compared to conducting field experience, reflections of prospective teachers can be compared based on the shared language the video clips serve. Since every prospective teacher reflects on the same video clips, it is easier to assess their growth in comparison to each other, which is more difficult for teacher educators when prospective teachers reflect on field experience observations, unique for each prospective teacher. Furthermore, watching such videos as homework saves time for reflection during class time and orchestrating discussion on readings. Classroom activities in this stage may involve introducing similar mathematical tasks from the video materials and role-playing a video case in small groups with peers. For instance, when there is a mathematical discussion in a video material that appears not so productive,

the prospective teachers may be asked to simulate a similar discussion in productive ways as a teacher and a group of learners by actively constructing professional learning within the classroom community. Some prospective teachers will assume the role of learners and others the role of teachers.

Several readings that would be appropriate for this stage of the course include "*The Teaching Gap*" (Stigler & Hiebert, 2009), "*Learning to observe: Using video to improve preservice mathematics teachers' ability to notice*" (Star & Strickland, 2008), "*Empowering the Beginning Teacher of Mathematics in Middle School* (Chappell & Pateracki, 2004)". By the end of this segment, prospective teachers are expected to develop awareness of the importance of focusing on student learning and relationship between student learning and teacher decisions, amidst the complexities of classroom teaching.

Part 2 (5 Weeks): Focusing on Student Thinking in Clinical Interviews

In this part of integrating video clips of teaching and learning into the flipped course, the prospective teachers are asked to focus on student thinking within one-to-one interactions with a teacher or a researcher, most often in the form of clinical interviews (Ginsburg, 1997). Students are informed about the tradition of conducting clinical interviews where teachers or researchers inquire about student thinking within the context of one-to-one interviews with students, without providing guidance to the students with the purpose of mainly understanding their thinking. Teachers may use this technique as a valuable tool in entering the children's minds while researchers may test hypotheses on student thinking of mathematics.

As a first step, the prospective teachers will be informed about clinical interviews via assigned readings and asked to watch exemplary and problematic examples of conducting clinical interviews. Exemplary interviews are when the interviewers demonstrate appropriate inquiry and listening skills as they pose questions to the students and present tasks that are meaningful and rich. Problematic interviews may be examples when the interviewer does not dig deep into a student's mind and misunderstands what student thinks, i.e. under-hearing or over-hearing student thinking (Even & Wallach, 2003). The instructor will provide scaffolding strategies to help prospective teachers' attend to and interpret student understanding and make claims about student thinking by providing evidence from what is evident in the video clip.

Professional noticing of student thinking skills (Jacobs, Lamb, Philipp, & Schappelle, 2011) will be promoted by helping prospective teachers answer the following questions as they watch videos: What are some of the student strategies you see in the video clip? How do you interpret student understanding based on what you see in the video clip? What would you ask this student in order to help extend his/her thinking, or how would you respond to this student? These scaffolding questions will help prospective teachers use evidence in their claims about student thinking and prepare them in making decisions about how to respond to student thinking in the moment of teaching. Such experiences have a potential to help prospective teachers prepare for building instruction based on student thinking in the complex environment of classrooms (Jacobs et al., 2011).

There are two different videos to facilitate prospective teachers' understanding of student thinking via watching clinical interviews in this stage of the course. Firstly, prospective teachers will be asked to watch rather long (about 25-30 minutes) video clips of clinical interviews. They will be asked to edit the video clip such that it provides a summary of student thinking and constitute as evidence to report overall student understanding of a topic. The longer videos aim to enhance prospective students' professional vision and professional noticing skills: their attending to student strategies and interpretation of student understanding by focusing on the most relevant evidence in the video. This will also enhance their knowledge of using media and technology. The second type of video clips are relatively short (3-5

minutes). In such videos, prospective teachers are asked to consider how they would respond to student thinking based on what students know in the video segment. Viewing and reflecting on such videos have the potential to contribute to prospective teachers' knowledge of students, knowledge of assessment and even knowledge of instructional strategies.

It is important to have videos from one coherent mathematical topic, such as students' algebraic thinking, a major focus on school mathematics. Because prospective teachers' knowledge of students is naturally limited at the early stages of teacher education, readings on how students think about a particular topic like students' general strengths and weaknesses in algebra or another focus topic should be provided in addition to video content. In class activities include:

1. Conducting discussions around student thinking evident in the video clips with the evidence from readings and theory on student learning about a particular topic,
2. Simulation of a clinical interview within groups of two during class time, which provides an opportunity for active learning.

Part 3 (4 Weeks): Conducting Clinical Interviews, Situated Learning

Although videos on both whole class instruction and individual student thinking may provide prospective teachers opportunities of developing professional vision and professional noticing skills, situated learning theories recommend that prospective teachers should become familiar with the context that they will work in and become engaged in practices that will help them grow as teachers such as lesson planning, conducting discussions, asking questions, assessing student understanding, etc. (Grossman & McDonald, 2008). In fact, such practices are identified as "high-leverage practices" that reflect the core work of teaching and necessary for preparing highly-qualified teacher candidates (Borko, Jacobs, & Koellner, 2010; Cummins Hlas & Hlas, 2012). As part of this course, prospective teachers are not solely required to watch and reflect on videos of teaching and learning but also engage in authentic practices of conducting clinical interviews and assessing student thinking. This will ensure prospective teachers have access to active learning opportunities instead of being passive recipients of knowledge about students.

Conducting clinical interviews may help prospective teachers' learning especially in the context of university and school partnerships. For instance, in a study by Reinhold (2016), preparing mathematical tasks and conducting one-to-one interviews with elementary school children and reflecting on this process seemed to enhance prospective teachers' "diagnostic sensitivity" (p. 2900), and learn to inquire deeply in students' ways of thinking and prepare for mastering "diagnostic challenges" (p. 2900) in their classrooms. Furthermore, prospective teachers learned about types of questioning, how to listen students and changing tasks based on children's utterances and work during one-to-one interactions. This practice also has a potential to help prospective teachers understand and become immersed in practices of conducting qualitative research as they make hypotheses, practice how to collect and interpret data as qualitative researchers, and make conclusions by using deduction and/or generalization (Reinhold, 2016).

In the flipped course proposed here, it would be ideal if prospective teachers have a chance to visit classrooms before their formal student teaching experience and conduct diagnostics assessments/clinical interviews with students on a regular basis. Every prospective teacher is assigned to one student and work with the student for four weeks outside the classroom. The prospective teachers are then asked to prepare a diagnostics report at the end of this experience, which not only serves as their assignment for the teacher education course, but also help classroom teacher in understanding student thinking in a detailed

manner. As the classroom teacher and the prospective teacher exchange ideas about the particular student thinking, both parties benefit as professionals. After completing their report on student understanding of a specific topic or several tasks, prospective teachers present their own clinical interview performance on the online discussion platform and open it for scrutiny. Additionally, prospective teachers prepare and deliver a presentation about their clinical interview experience during a class meeting as a final project. Each prospective teacher is asked to provide constructive feedback on their peers' clinical interview performance. This practice has a potential to help prospective teachers learn from each other and make arguments about student thinking in a collective manner by relying on evidence from the video clips.

This course being a flipped course format enables prospective teachers to have more time to conduct observations, select a student and interacting with the student within the context of clinical interviews for a period of four weeks, videotaping, editing and creating a video clip that will help not only for their own learning but also for the professional development of partner school teachers. Observing students in their own classrooms and providing feedback for the teacher of the student ensures that this task is meaningful for the prospective teachers, which may enhance their motivation as future teachers. After this experience, it is expected that pre-service teachers have the opportunity to understand student thinking not only in a clinical way, but also in a situated manner, co-constructing professional knowledge with the help of peers, practicing teachers, teacher educators and children they work with. Prospective teachers may also gain a perspective as novice researchers and such experiences may motivate them to conduct research in the field.

CONCLUSION

This chapter presented a model for teacher learning using the innovative approach Flipped Classroom method and video content. Course is supported by incorporation of online communities and work place learning within the context of conducting one-to-one clinical interviews with K-12 students. Teachers who have been trained by way of the Flipped Classroom method in their teacher education courses may find it easier to implement similar methods in K-12 classrooms compatible with active learning and the goals of Partnership for 21st Century Skills (2011).

This chapter aimed to provide motivation to use the Flipped Classroom method and research based strategies in implementing this method for active teacher learning. It is important to emphasize that the Flipped Classroom method or incorporating video technologies do not lead to immediate active learning and learner engagement. In fact, in some cases leaners may prefer to only passively view the video content without involvement in the material, when there is no analysis or decoding of the materials requested by the instructor. The instructor's role is to design experiences that are authentic, meaningful and relevant for the prospective teachers where they are asked to actively engage and interact with both the given materials and peers. Also, assessment practices should be incorporated before, during and after classroom meetings in multiple ways to encourage learners' involvement. Only then, the Flipped Classroom can be a method that can truly prepare prospective teachers for teaching 21st century skills, especially for teaching mathematics.

There is a need for teacher educators using innovative approaches and conduct research on pre-service teachers' learning and share their experiences. This type of practitioner research may help disseminate good practices and insights on the most effective ways of implementing the Flipped Classroom method.

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KEY TERMS AND DEFINITIONS

Clinical Interview: One-to-one interviews conducted with students in order to gauge their understanding, which could be used both for assessment and research (Ginsburg, 1997).

Flipped Classroom Method: Inverting in class and out of class activities such that there is more allocated time for active learning and teacher facilitation of meaningful discussion during class time. Homework is in general in the form of viewing video materials (which maybe supported by audio materials and readings) and becoming familiar with the foundations of the content before coming to the class.

Professional Noticing: Learning to notice important aspects of classroom instruction is considered an important area of expertise for teachers. van Es and Sherin (2002) describe three significant aspects of noticing that constitute a basis for the conception of professional teacher noticing: 1. Identifying what is important or noteworthy about a classroom situation; 2. Making connections between the specifics of classroom interactions and the broader principles of teaching and learning they represent; and 3. Using one's context to reason about noteworthy events (p. 573).

Professional Vision: Using specialized professional knowledge to attend to and interpret events related to one's profession (Goodwin, 1994).

The TIMSS Video Study: "The TIMSS 1999 Video Study was a study of eighth-grade mathematics and science teaching in seven countries. The study involved videotaping and analyzing teaching practices in more than one thousand classrooms. Goals of TIMSS 1999 Video Study: investigate mathematics and science teaching practices in U.S. classrooms, compare U.S. teaching practices with those found in high-achieving countries, discover new ideas about teaching mathematics and science, develop new teaching research methods and tools for teacher professional development, create a digital library of images of teaching to inform U.S. educational policy, stimulate and focus discussion of teaching practices among educators, policymakers, and the public" (TIMSS Study, http://www.timssvideo.com/about-site).

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