Chapter 13
Flipping the Mathematics Instruction:
A Critical Overview of Recent Trends in Application

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ABSTRACT

The flipped classroom is a rotational model in which students move between teacher-faced practices in the classroom during the standard school day and out-of-school teaching they receive online for the related concepts. In recent years, with the proliferation of technology-supported education, flipped classroom practices have been used more in mathematics classrooms, and gained the attention of mathematics education researchers. This attention also triggered the studies examining the trends of flipped classroom practices on mathematics education. This chapter introduces the theoretical underpinnings of the flipped classroom and provides a recent literature review of the studies on flipped classrooms in mathematics education from various dimensions. Accordingly, several results obtained from the analyses as well as potential issues for future research are proposed in this book chapter.

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INTRODUCTION

Recent advances in technology and ideology have unlocked completely new directions for educational research. This, in turn, has created great interest in student-centered education, active learning and the integration of technology into education (Gannod, Burge, & Helmick, 2008; O'Flaherty & Philips, 2015; Touchton, 2015). While new discussions about the use of technology in the classroom are at the top, new applications of the technology are widely applied (Fulton, 2014). Studies about technology use in educational settings have indicated that teachers' adaptation of technological tools in their teaching environments has notably increased in the last decades (Carbaugh & Doubet, 2016; Yarbro, Arfstrom, McKnight & McKnight, 2014).

Prensky (2001) introduced the concepts of "digital native" and "digital immigrant" based on the differences in life between generations. While digital natives (born in the 1980s) are a concept used to introduce the new generation that was born in the technology culture, the concept of digital immigrants (born before the 1980s) introduce a generation that tries to integrate technology into their lives and expresses the generation in an effort to adapt to the technology culture (Bayne & Ross, 2007; Prensky, 2001). Among the common features attributed to the members of the digital natives, also called as internet generation (Tapscott, 1998) or the learner of the new millennium (Oblinger & Oblinger, 2005), use technology extensively for communication purposes and they, in turn, develop expertise in technology use (Gros, Garcia, & Escofet, 2012). Education systems lacking in providing technology integration cannot fully respond to the needs of digital natives. Therefore, traditional classes designed by digital immigrant teachers who insist on twentieth-century techniques such as straight narration, where only face-to-face learning is carried out are far from being interesting, intriguing or exciting enough for today's students (Akgündüz, 2019; Dede, 2005). Moreover, the literature indicates that not only digital immigrant teachers, but also teachers who are new to the profession cannot use technology effectively in their teaching processes, and this poses a problem in achieving educational goals (e.g., Gao, Wong, Choy, & Wu, 2011; Ottenbreit-Leftwich, Glazewski, Newby & Ertmer, 2010).

Studies in mathematics education prove the effectiveness of active learning environments over traditional learning settings (e.g., Dolan & Collins, 2015). Moreover, students having responsibility for their learning process and supporting communication opportunities in the settings also beneficial for contributing meaningful learning (Tokmak, Incikabi, & Ozgelen, 2013). Some researchers believe that the use of technology-integrated unique teaching approaches in mathematics education helps to solve numerous problems in mathematics learning, which will in turn enable students to participate and improve their mathematics knowledge with clear and varied measurements. (Yong, Levy, & Lape, 2015).

Along with the increasing importance of technology in education, the concept of "technology integration" has been used more frequently with concepts such as education, learning, teaching, teacher training, professional development (Kim, Kim, Lee, Spector & DeMeester, 2013; Lawless & Pellegrino, 2007). Technology integration in education, in the simplest sense, is to make extensive use of current technology resources in the teaching-learning process to ensure students' learning (Günüç, 2017). Technology integration focuses on the tools that improve students' learning and their integration processes rather than the use of new and advanced technologies (Schofield, 1995). Technology integration can be achieved through technological approach, method, and learning models in which technology is used efficiently and effectively. These can be listed as follows (Akgündüz, 2019):

1. Technological pedagogical content knowledge