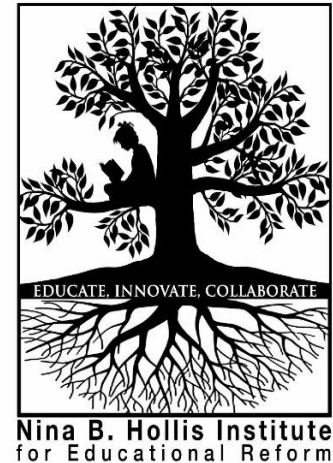


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Flipped Classrooms in PK-12 Settings: Research Review

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Abstract

Flipped classrooms have received more attention in recent years, primarily with a focus on their wide application in higher education settings. This article focuses on reviewing research on flipped classrooms as a potential contributor to educational reform in PK-12 settings. Review of research showed emergent themes within benefits found in classrooms across multiple levels and in many subject areas. Some of the primary benefits of flipped classrooms include student differentiation and improved engagement levels. As with any aspect of technology usage in schools and students' homes, there are challenges to address. Ensuring that teachers and students are prepared to participate in this learning environment is a concern with increased participation in flipped classrooms. Evidence shows researchers need to study widely used flipped classroom platforms to uncover patterns of success and best practices in teaching and learning through flipped classrooms.

Keywords

flipped classrooms, teaching strategies, student engagement, curriculum development

Objective

The objective of this paper is to review existing literature on the flipped classroom, specifically focusing on how it has been and could be applied in PK-12 settings. Through examining articles on the topic of flipped classrooms several themes emerged across the literature. The term “flipped classroom” takes on many different meanings, it is common for education professionals and researchers to misunderstand the purpose and application of this method. The first section provides an overall understanding of flipped classrooms. Several themes related to this model appeared frequently in the literature review. The remaining themes related to defining a flipped classroom, the theoretical framework behind the model, and benefits and challenges associated with flipping a classroom are presented.

Research Design and Methodology

Criteria for Inclusion

For this review, literature focusing on the implementation of flipped classrooms in PK-12 educational settings were selected. Studies that addressed beneficial applications of flipped classrooms were selected for this literature review. Articles addressing what could go wrong with implementing a flipped classroom and ways that students, teachers, and parents can be supported in a flipped classroom were included. Due a limited number of sources, some articles addressing flipped classrooms or blending learning models in higher education were included in this review.

Systematic Literature Search

Relevant studies were retrieved through a systematic literature search procedure. Initially, an electronic search was applied in ERIC, Education Research Complete, ProQuest Dissertations & Theses Global, and PsycINFO. The search included keywords related to flipped classrooms (flipped classroom advantages, challenges, definition; inverted classroom; technology education; active learning; blended learning; learning design) and type of education (early childhood education, elementary education, secondary education). Next, studies were sought out in bibliographies, review articles, and journals to complement the systematic electronic search.

The Flipped Classroom

A relatively new blended learning model considered to be a form of active learning is flipped classrooms. It is not a widely accepted modality of learning due to demands placed on schools for short-term assessment improvements on standardized tests. Additionally, flipped classrooms are often considered a fad in educational reform efforts. Yet, flipped classrooms are continuing to gain popularity (D’addato & Miller, 2016; Sergis, Sampson, & Pelliccione, 2018). Abeysekera and Dawson (2015), used a “lowest common denominator” definition of flipped classroom since there is a lack of a single agreed definition of a flipped classroom approach. A “flipped classroom is a set of pedagogical approaches that move most information-transmission teaching out of class, use class time for learning activities that are active and social, and require students to complete pre-and/or post-class activities to fully benefit from in-class work” (Abeysekera & Dawson, 2015, p. 5). Using a flipped classroom approach involves delivering the content of a course outside of class and flipping what is typically done in class being given as homework, so that class time is used for active learning experiences (Gilboy, Heinerichs, & Pazzaglia, 2015; Van Sickle, 2016). The content from a flipped classroom is presented through a shared video, article, lecture slides, online discussion questions, use of software, or through a class website. The flipped learning approach is a way to implement student-centered instruction.

Pfaffer (2007), stated “schools have a responsibility to give students the skills they need to succeed. [Students’] technical skills should transcend the particular idiosyncrasies of the applications.” With constant technological changes, flipped classrooms allow teachers and students to engross themselves in the development and usage of modern technological tools. Implementing flipped classrooms allows for 21st century skills to develop in 21st century students (Apergi, Anagnostopoulou, & Athanasiou, 2015).

Heggart and Yoo (2018) mentioned a growing interest in the way that online, or cloud-based tools, and pedagogy could increase student participation and interaction between classmates, and interaction between teacher and students. One common cloud-based system implemented heavily in educational settings is Google Suite of Educational Tools (GAFE). According to Heggart and Yoo (2018), there is a lack of literature on the specific use of GAFE. The researchers acknowledged that this is a difficult topic to study due to constant changes in online learning platforms and research is usually a few steps behind tools utilized in classroom settings. As with any flipped classroom, classrooms using various cloud-based tools allow teachers to capitalize on student preparation and spend more time in class for students to apply content knowledge, teachers are able to ascertain each student's understanding and address individual and class-wise needs (Muir, 2014).

Theoretical Framework

The theoretical frameworks summarized below were found in the reviewed literature. Several theories converge to guide the design of in-class and out-of-class activities and overall structure of flipped classrooms. Flipped classrooms allow for specific aspects of traditional classrooms to be automated through the use of technology and require interaction in the classroom with peers and teachers (Bishop & Verleger, 2013). An overview of frameworks from conceptual studies and empirically supported articles on flipped classrooms is provided in the following sections.

Self-Determination Theory

One commonly cited theory tied to flipped classroom approaches is a pedagogical theory known as self-determination theory. This theory relates to how having a motivation to learn improves students' focus, effort, and performance in a given content area or a specific activity (Abeysekara & Dawson, 2015). Self-determination theory is commonly broken down into the student need for competence, autonomy, and relatedness (Abeysekara & Dawson, 2015; Sergis et al., 2018). Flipped classrooms meet these three student needs through engaging in-class activities and self-paced videos and assignments out-of-class.

Cognitive Load Theory

Cognitive load theory suggests that "working memory is subject to certain types of load and that overloading working memory impedes learning" (Abeysekara & Dawson, 2015, p. 8). Researchers suggest flipped classroom approaches may assist students with managing cognitive loads through moving some transmission of teaching out of the classroom. Additionally, the out-of-class learning can occur at a pace comfortable for the student. Teachers can provide multiple versions of difficult to master content to students to meet their level of understanding and expertise.

Constructivism

Several articles reviewing literature on flipped classrooms note the underpinnings of constructivism encompassed in active, peer, and collaborative learning (Eppard & Rochdi, 2017; Zuber, 2016). Flipped classroom practices demonstrate key components of constructivism. Learning is active and content is provided to assist students in solving problems. The facilitation

of learning and collaboration involved with flipping classrooms requires students to construct their own knowledge (Bishop & Verleger, 2013).

Peer-Assisted and Collaborative Learning

Peer-assisted learning is a form of cooperative learning involving students working in teams while still having individual responsibilities and working towards a common goal. This is not something that is automatic with the implementation of a flipped classroom, however it is still an added benefit when this model is effectively implemented. Through in-class activities teachers can design activities where students solve problems and complete projects in pairs or groups. Discussion boards offer opportunities for peer-assisted and collaborative learning to occur through flipped classrooms (Akçayır & Akçayır, 2018). Students have the opportunity to work with other students while being responsible for their own learning through in-class and out-of-class activities. Small group and partner activities provide students with the opportunity to collaborate with other students and the teacher in a flipped classroom model (Bergmann & Sams, 2012; Tucker, 2012).

Active Learning

Another student-centered component of a flipped classroom is active learning (Akçayır & Akçayır, 2018; Snelling, Karanicolas, & Winning, 2016). This overlaps with other pieces of the theoretical framework associated with flipped classrooms. Active learning can be an activity that is peer-assisted and problem-based, and in-class or out-of-class. In a case study overview of flipped classrooms, Herreid and Schiller (2013) noted, “telling doesn’t work very well. Doing is the secret. Active student engagement is necessary” (p. 65).

Findings

There is not a single model for flipping a classroom, however the general idea is to remove or reduce the overall time spent lecturing and on whole-class instruction. This at least lessens the amount of time a teacher spends as the “sage on the stage” and flips them into the facilitator that can be the “guide on the side” for students. Overall, flipped classrooms alter the way in- and out-of-class time is used (Abeysekera & Dawson, 2015; Sergis et al., 2018). Flipped classrooms almost always require access and use of technology outside of class. The other differences in a flipped classroom model as compared to traditional methods are in the context of flipping activities and assignments typically completed inside and outside of school (Abeysekera & Dawson, 2015; Hussein, Raouf, & Paulmony, 2019).

Flipped Classroom Benefits

Advantages for Students

D’addato and Miller (2016), studied the impact of flipped learning on fourth grade math students in a socioeconomically disadvantaged setting. The data collected was in the form of observations, teacher reflections, and student and parent surveys. One benefit noted by the researchers of this study was that a flipped classroom offers the capability to create an engaging environment. In this flipped classroom, students had the opportunity to take ownership over their learning process. According to Roehl, Reddy, and Shannon (2013), “when the focus of the flipped classroom is on

giving students the freedom to interact with the content according to their own learning style, the flip seems to be more successful” (p. 47). Through flipped classrooms students became more aware of how they liked to learn than students in traditional classrooms.

Researchers in Spain found that a majority of students believe the content offered to them in a science class using a flipped classroom model was more effective at allowing them to achieve content mastery and made the content of the class easier to engage with (Gonzalez-Gomez, Jeong, Airado Rodriguez, & Canada-Canada, 2016). Students in these science courses also noted that their flipped classrooms were more student oriented than their traditional classrooms. Gonzalez-Gomez et al. (2016) commented that surveyed students indicated the flipped learning model implemented in their science courses provided them with more opportunities to work at comfortable speeds, catch up on missing assignments, and go through lessons multiple times when necessary.

In a study of nearly 200 four- and five-year-old children in New York City and San Francisco preschools, children who participated in a flipped model intervention in math demonstrated increased improvements in “ordinal numbers, spatial relationships, and 3-D shapes” when compared to students in the same preschool centers not offered flipped model interventions (Silander, Moorthy, Dominguez, Hupert, Pasnik, & Llorente, 2016). Silander et al. (2016) found evidence to support the claim that home use of educational media can support student learning that is transferrable to school settings for preschool aged students.

Turkish researchers found benefits when implementing flipped classroom models for disadvantaged fourth grade reading students through using digital stories and game-based activities (Girmen & Kaya, 2019). Students with attention disorders and other learning disabilities benefited from the aforementioned activities implemented in a flipped classroom. Another study focused exclusively on student use of online mathematical resources in grades 5-9 in flipped classroom models. Researchers reported students found the content of the resources to be reliable and, in most cases, more effective than relying on a teacher or classmate’s explanation (Muir, 2014).

In most of the literature, the information related to benefits of flipped classrooms centered on enhanced student engagement. Another common benefit was that student differences are better accommodated for in flipped classroom settings. Sometimes this benefit is through students having the chance to pace themselves through content instead of a single speed for the whole class in a traditional classroom, while in others this same benefit was available since teachers were empowered to address specific, individual student needs (Schultz, Duffield, Rasmussen, & Wageman, 2014). Some research sees flipped classrooms as potential areas to increase academic success for low-performing, economically and developmentally disadvantaged students (Sergis et al., 2018).

Advantages for Teachers

Researchers in Greece found that a flipped classroom model has the potential to allow educators to use classroom time more effectively and increase student achievement in elementary history classes. Through using a flipped classroom model in an elementary school history class, Aidinopoulou and Sampson (2017) noted a more effective use of classroom time that moved away

from lectures and stuck to more student-centered activities. Students in the experimental group had better learning outcomes than students in the control group in a statistically significant manner. Researchers mentioned this was due to teachers being able to focus on building historical thinking skills as opposed to memorization of content (Aidinopoulou & Sampson, 2017). With less time spent on whole-group instruction, flipped classrooms change classroom management. Difficulty with student engagement and distractions are met through components of flipped classrooms (Hussein et al., 2019).

Researchers attributed some benefits to teachers being able to quickly provide feedback to students, making content available from anywhere with no time constraints, and a high level of participation in this classroom model through the combination of interactive learning activities (Girmen & Kaya, 2019). Additionally, with a reduction in the amount of time spent on whole-group lessons, teachers have more interaction and opportunities for small group and one-on-one instruction in class (Roehl et al., 2013). This allowed for more time to address and clarify misconceptions.

Many teachers end up either locating or creating short video lessons as a means for flipping a classroom. The process of finding or making these lessons can be time consuming, however teachers become sharper in their content expertise and delivery of instruction (Tucker, 2012). Through this process of creating or finding resources, teachers focus on the essential components of the course and allows for teachers to target specific needs of students (Hall & DuFrene, 2016).

Advantages for Parents

In a 2016 study conducted by D’addato and Miller, parents of students in a flipped fourth grade math class reported positive outcomes in student attitudes towards mathematics. Another benefit D’addato and Miller (2016) mentioned was that the flipped classroom allowed for technology to enter into homes of students who previously did not have access to computers or internet connection. Further, parents find it challenging to support children in mathematical content as it is constructed today, one study demonstrated using online resources enabled students to get the support they needed at home (Muir, 2014).

Flipped Classroom Limitations

Most of the challenges associated with flipped classrooms come in the form of time concerns and access to technological devices and internet. A challenge that stood out was one mentioned regarding the difficulty education researchers face when attempting to study specific methods of flipped classrooms, such as Google Suites. Researchers have difficulty keeping up with what is currently implemented in classroom settings before the technology has advanced and the research loses some relevance. Another challenge associated with researching flipped classrooms is that there is little consistency between what educators in different schools, subjects, states, or countries consider as a flipped classroom. Some research mentions a few activities that are flipped while others spanned an entire flipped course (Abeysekera & Dawson, 2015).

Obstacles for Students

A few obvious challenges related to flipped classrooms relate to students having access to reliable technology devices and internet at home and school. Also, there are drawbacks in relation to the tech-savviness of the teachers and students, teachers of all experience levels face obstacles when it comes to the amount of technological flexibility and expertise they acquire (D'addato & Miller, 2016).

An Australian study focused on Google Classroom as a means to flip a classroom. The researchers discussed issues with accessibility, specifically with locating messages and discussion posts from earlier in the course. There was a difference in the frequency and quality of student participation in the Google Classroom. This engagement variance could be addressed through a reminder of expectations or through smaller groups for discussion posts to enhance student engagement (Heggart & Yoo, 2018).

Obstacles for Teachers

There are content specific concerns when it comes to implementing flipped classrooms. Aidinopoulou and Sampson (2017) reported that history teachers, specifically, were slow to adopt digital technologies in their classrooms and would prefer to rely on textbooks and traditional lectures. Teacher surveys demonstrated that many teachers are skeptical about how effective technology can be as a content diffuser. Many other teachers report concerns about the amount of time it may take to start and continue a flipped classroom model and obtain enough technological competence to design content and materials to support student learning (Aidinopoulou & Sampson, 2017; Lo, Lie, & Hew, 2018). Researchers suggested teachers should take time to train students on the flipped classroom model they are using from the beginning of the school year, this poses a significant time concern. Parents may also have a difficult time familiarizing themselves with flipped classroom models (Aidinopoulou & Sampson, 2017).

Teachers are still the catalyst of flipped classrooms. Teachers need to be diligent and may have to spend extra time designing the right out-of-class activities to tie along with in-class activities. This could involve breaking away from plans and setting a path that meets the needs of the student. Teachers need to be sure that neither they nor the students view the computers as a replacement for a teacher. Research shows that students become disengaged when a computer is viewed as a teacher by the teacher and/or student (Muir, 2014).

Teacher attitudes are a further challenge (Sahin, Top, & Delen, 2016). Researchers noted that teachers may have negative preconceived notions and experiences with technology, resulting in negative attitudes and limited use of technology in classroom settings. So, if teachers are required to use technology in any form that they do not have an openness to implementing and believe that it could be an ineffective practice, it will be at the detriment of the learners in the classroom. These attitudes are near impossible to shift the longer a teacher holds these beliefs (Sahin et al., 2016). The same researchers suggested that teachers with positive outlooks on implementing flipped classroom practices come up disappointed with the level of implementation due to restrictions on access and usage of school devices.

Obstacles for Parents

One study on implementing a variation of a flipped classroom in selected preschools in urban areas had a preset, one-size fits all flipped classroom curriculum. Families that were randomly selected to receive the flipped model “diverged from the suggested sequence, and their overall use of the resources steadily declined over the course of the study” (Silander et al., 2016). This could suggest a need for individualizing student needs and breaking off from a preset flipped classroom model for students as needed.

One major educational inequity impacting vulnerable students everywhere is the digital divide. According to Lewis (2020), in order for students to have a chance to access learning materials and meet course requirements, high-speed internet access in all homes and communities is required. Prior to implementing a flipped classroom model, teachers must be clear on students’ ability to access online content reliably. The success of flipped classrooms lies with access to computers and high-speed internet away from schools (Roehl et al., 2013).

Future Research

One noticeable pattern in the research regarding flipped classroom models is the need for determining if there are certain sub-groups of students, grades, or subjects that have the greatest impact on student achievement. Most of the research evaluated focused on perceptions of teachers, parents, and students with various experiences in using flipped classrooms, there is a need for more quantitative data in the area of student achievement when certain subjects are flipped using a certain internet or cloud-based system (Eppard & Rochdi, 2017; Hall & DuFrene, 2016; Van Sickle, 2016). This data would be useful in positioning students and teachers to have more success in taking part in all that a flipped classroom can offer. Generalizations could potentially be made that would allow for teacher preparation programs and professional development designers to effectively train teachers in the usage of flipped classroom models.

However, even if one method works for one group of students one year, as with any curriculum, a teacher needs to meet the needs of the current students and make instructional decisions that best suit the students in front of them. D’addato and Miller (2016) suggest a need for a “cyclical process of action research to provide quality instruction for students” when fine tuning a flipped classroom. Aidinopoulou and Sampson (2017) mention that future work should include longitudinal studies to provide evidence of the impact flipped classrooms are having on students’ performance and learning to see patterns of certain students. Lastly, researchers need to study widely used flipped classroom internet-based systems, such as Google Suites, to uncover patterns of success and best practices in teaching and learning using flipped classrooms.

Recommendations

It is essential for all users of technology in flipped classrooms to be trained before they use a new form of technology. The barriers related to navigating technology associated with a flipped classroom may be a factor in a teacher’s or student’s lack of success or negative perception of flipped classroom models. As mentioned by Gilboy et al. (2015), research on educational outcomes associated with flipped classrooms are scarce.

Hall and DuFrene (2016), list “best practices” that emerged through interviewing instructors with experience implementing components of flipped classrooms. The following list of recommendations for getting started with flipping a classroom in elementary or secondary school merges ideas and themes present throughout literature reviewed in this article. While not exhaustive, this list of suggestions for getting started summarizes how teachers just beginning or continuing their experience with flipped classroom can situate themselves to experience success and avoid or at least be better prepared to manage common challenges associated with flipped classrooms.

- *Ensure access to necessary technology components.* While many schools offer one-to-one computing and provide students with laptops that can go home, students may not have access to high-speed internet that allows for them to view assigned videos and other content requiring reliable access to the internet.
- *Try out a single course/subject.* Instead of flipping your entire day, flip a single subject if you are self-contained and teach all subjects (i.e. most elementary school teachers). If you teach several courses (i.e. most middle and high school teachers) try flipping a single section as you get comfortable with figuring out what works best for you and your students.
- *Differentiate in-class AND out-of-class components of your flipped classroom.* Many flipped classrooms fall short due to ineffective and over-used assignments or videos. Students enter classrooms and each unit of study with varying levels of background knowledge. Alter who receives certain pieces of content out of class and the modality of the content. Students will engage differently with the combination of readings, games, videos, or presentations. Figure out the formula that works best for each student.
- *Motivate and reward students for completing out-of-class work* (Hall & DuFrene, 2016). This could be through “gamifying” your flipped classroom by tracking and rewarding students for the out-of-class work that prepares students for the in-class activity the next day.
- *Be mindful of the out-of-class time requirements.* Several of the studies cited in this article point out keeping videos to around ten minutes or less. This should be sufficient to cover the content or demonstrate a new skill for students. Students will be more likely to review the material as needed and stay engaged if the time requirement is manageable.
- *Reflect on the process.* Some studies suggest giving your flipped classroom a semester to operate effectively. Regardless, it is important to notice what is working and what needs adjusting in your flipped classroom.
- *Elicit feedback from students and parents.* This could be through discussions, surveys, or direct individual communication. Listen to what parents and students have to say about how the flipped classroom is impacting learning.

While this is not an exhaustive list for implementing a flipped classroom, this list of best practices can help practitioners from all school levels get off to a good start with a flipped classroom. Preparation and prior planning are keys to successful implementation of any teaching strategy. Through implementing the best practices overviewed in this section, teachers trying out flipped classrooms will be ready for a successful experience.

Conclusions

Flipped classrooms are not fresh ideas, nor are they going away. The use of this teaching methodology continues to grow in popularity and stretch down to younger students. Largely, today's students are digital natives. Flipped classrooms provide students opportunities to engage with content in familiar and appealing ways. They offer a means for teachers to leverage students' unique abilities and interests, to help motivate and keep students engaged. This review of literature on flipped classrooms focused on what flipped classrooms are and how they are applied in practice. While there is limited empirical evidence supporting how flipped classrooms address student achievement, there are many findings pointing to its use as an effective and engaging pedagogical tool. As further best practices for flipped classrooms are explored and researched, students and teachers can continue to have a better educational experiences and outcomes.

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