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Academic Achievement In Flipped Classrooms

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ACADEMIC ACHIEVEMENT IN FLIPPED CLASSROOMS

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EDCI 590 INDIVIDUAL RESEARCH

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Abstract

Since the inception of the flipped classroom model, the teaching pedagogy has become increasingly popular in both K-12 and collegiate classrooms. In a traditional classroom model, students become familiar in class with lectures and complete additional practice work at home in order to iron out any misunderstandings of the material. The flipped classroom model reverses roles with students becoming initially familiar with the class materials at home and then engaging in further practice in class with the teacher and fellow students.

Although this teaching method is still in its infancy, the results so far reveal the flipped classroom model significantly improves a student's ability to retain and master material. This study seeks to analyze a variety of different studies focusing on K-12 implementation of the flipped classroom model in order to determine overall effectiveness of the model. This study will use meta-analysis methodology to come to a better understanding of the success of the flipped classroom model across a variety of different sample sizes, populations, and research methodologies. While this study will not add any original field data to the study of the flipped classroom model, it will provide a singular source analyzing existing data to draw conclusions about the effectiveness of the pedagogical model.

Purpose

As the flipped classroom model has becoming increasingly popular in K-12 education in recent years, it is important to conduct a comprehensive analysis of its effectiveness across a wide range of K-12 classroom settings. While there is existing literature regarding experimental, quasi-experimental, and case study analyses of the flipped classroom, there are few meta-analyses assessing the effectiveness of the pedagogical model in terms of student engagement with the material and overall student achievement. Therefore, this study seeks to consolidate a variety of different flipped classroom studies at the K-12 level in order to ascertain a better understanding of the utility and effectiveness of the flipped classroom in comparison to more traditional teaching models in common use.

Rationale for the Study

A variety of studies have shown the flipped classroom model is an effective pedagogical model that improves student achievement and success in comparison to the traditional classroom model (Hwang, Lai, & Wang, 2015). Further, as the flipped classroom model has gained popularity in recent years, conducting more studies of its effectiveness across a variety of different classroom settings is important to better assess the benefits and drawbacks of the flipped classroom model.

In the technological age in which we live in today, many of the teaching paradigms common for decades are rapidly becoming obsolete. As Fulton (2012) points out in her analysis, the flipped classroom model is more suitable for an academic classroom with access to significantly superior communication and information technologies than a traditional classroom model which generally does not use new technologies to full potential. As the foundation of the flipped classroom rests upon these new technologies, better understanding the effectiveness of this pedagogical model can provide meaningful insight into a teaching model readily adaptable to the rapidly changing technological world existing today.

Definitions

Flipped Classroom – A pedagogical model that has become increasingly popular since its inception in the early 2000s. It follows a paradigm that reverses the traditional classroom model in that the initial introduction to the course materials is done at home, usually via online work, and then the in-class time is used for the practicing of the material through class exercises and direct engagement with the teacher.

Pedagogical Model – A pedagogical model is a method by which a certain teaching paradigm is implemented. The word, pedagogy, refers the theoretical concepts related to disseminating educational information via some mechanism, therefore, a pedagogical model is a format by which educators instruct their pupils. With this in mind, both the traditional and flipped classrooms are different pedagogical models.

Traditional Classroom – This is the pedagogical model of teaching most often used in classrooms around the world. It follows the basic paradigm of having an instructor introduce concepts to students in class and then having said instructor assign additional practice work for the students to take home and complete, so they become more familiar and comfortable with the concepts introduced during the in-class lectures.

STEM – This refers to the category of academic subjects focusing on the sciences. STEM is an acronym that stands for Science, Technology, Engineering, and Mathematics. These subjects are in contrast to other broad fields such as the humanities or arts.

You Tube – A video sharing website owned by Google containing millions of videos of every variety and contains an extensive library of educational videos. These videos are often used in both the flipped classroom and traditional classroom models as they are able to succinctly and adequately explain complicated concepts.

Problem Statement

The principal goal for this study is to conduct a meta-analysis of the existing research to consider benefits or shortcomings of the flipped classroom teaching model. What impact does this instructional model have on student academic success? This study will analyze relevant studies observing the effects of the flipped classroom model published after 1999 to determine the effectiveness of the teaching model.

To address this aim, this study seeks to answer the following question:

What is the average effect of the flipped classroom model on the student achievement when compared to the traditional classroom model?

Literature Review

The literature review has been broken into several sections. First, the historical background of "flipped classrooms" as a pedagogical method will be investigated. The background provides means to descriptively describe the concept and then consider the actual application of "flipped classrooms." A subsequent section provides an in-depth explanation of "flipped classrooms" as a concept by stating its key elements and parts distinguishing it from the traditional classroom approach. In addition, the review also explores the central significance of the flipped classroom approach as well as the attitudes of both students and educators toward the application of the method in teaching. Finally, the conclusion synthesizes the key points and further identifies research gaps which require investigation to add to the current available knowledge.

The research procured for the purpose of this study was gathered methodically using various databases and search engines. The primary search tools used were EBSCO Education Research Complete and JSTOR between the months of January and March 2019. By using advanced search functions, only studies published after the year 1999 were collected. The keyword inputs into these search tools were "flipped classroom model," "flipped classroom and student achievement," and "flipped classroom implementation." After a thorough search of relevant articles, theses, and studies pertaining to the subject of interest, data to conduct a meta-analysis were collected.

For the literature review, the study will focus specifically on the theoretical background of the model and its use of modern technologies to establish a base for how the model functions and what resources are essential to a proper execution of the model.

Traditional v. Flipped Classrooms

The traditional classroom model is one that follows a common dynamic in which a teacher lectures the students during the class, and the students practice said content from their in-class lessons outside of the classroom to achieve deeper understanding of the material and alleviate any misunderstandings. The flipped classroom model seeks to reverse the order of teaching common in traditional classroom settings for decades with the hope students would be more active in their education and think about their course content more critically (Hwang et. al, 2015). Since its inception in the 2000s, the flipped classroom model has been implemented in a multitude of different classroom settings around the world (Bergmann & Sams, 2012). While some studies have revealed at times some students and teachers have had initially negative perceptions of the pedagogical model, by the end of the trial sessions, most participants have positive experiences (McNally et. al, 2016; Cukurbasi & Kiyici, 2017). The flipped classroom model has become increasingly popular in the academic world due to its wide-ranging benefits (Chung & Khe, 2017).

In her analysis, Fulton (2012, pg. 1) listed the following advantages for using the flipped classroom model: (1) students move at their own pace; (2) doing "homework" in class gives teachers better insight into student difficulties and learning styles; (3) teachers can more easily customize and update the curriculum and provide it to students 24/7; (4) classroom time can be used more effectively and creatively; (5) teachers using the method report seeing increased levels of student achievement, interest, and engagement; (6) learning theory supports the new approaches; and, (7) the use of technology is flexible and appropriate for "21st century learning." These various benefits compared to the traditional teaching model suggest a promising

alternative to traditional methods of teaching which students and teachers often report has

become obsolete and inefficient in the modern world (Fulton, 2012).

Theoretical Background

According to Turan & Goktas (2016), the concept of a flipped classroom emerged in

2000 when a teacher attempted to offer students learning materials for use outside of class and

opportunities to collaborate more when working with their teacher and among themselves during

class. In the same year, Lage, Platt and Treglia (2016) used the same process and developed a

second iteration of the flipped classroom, which they named the "inverted classroom." In their

model, they used videos and PowerPoint slides for an undergraduate class, and the feedback they

received was positive toward academic achievement and overall likeability (McNally et al. 2017;

Turan & Goktas, 2016). They were able to develop a more active classroom environment which

improved student attention leading to increased interaction among their peers and teachers

(McNally et al., 2017; Turan & Goktas, 2016).

This approach was used in public schools in 2007 when two high school teachers in

Colorado, Johnathan Bergmann and Aaron Sams, used a software application which enabled

them to narrate and record their PowerPoint presentations (Galindo, 2014; Hwang, Lai, & Wang,

2015). The tool allowed them to record their lectures which they then posted online as video

tutorials for the students missing classes. After a while, they noticed the published video

tutorials were not only used by those missing classes, but also by those who needed to review

class lectures. This sparked the idea of creating a different type of classroom where the teaching

and learning dynamic was reversed so students spent their class time with the teacher actively

engaging with the material through class activities and clearing up misunderstandings about the content.

Separately, Salman Khan, a financial analyst, began creating short video tutorials for his nephew in mathematics which were later posted on Google's YouTube video sharing website. Within a short time, the videos acquired a significant following by other students who needed tutoring in mathematics (Galindo, 2014; Hwang, Lai, & Wang, 2015). Having realized the potential for reaching a wide audience with supplementary educational material, Khan later established an online academy with the main aim being to develop numerous video tutorials for several disciplines in addition to mathematics (Galindo, 2014). The idea of delivering content to students online began to gain momentum in higher education. Educators realized providing content online and outside of class freed up significant class time and resulted in more productive and active learning activities. The new teaching practice was referred to as Flipped Classroom and has since become increasingly popular in both K-12 and collegiate education with a significant number of classrooms beginning to use the methods in regions such as North America and Asia in particular (Chung & Khe, 2017).

Technology

One aspect making the flipped classroom model attractive for teachers is its suitability for the modern information technology era where current and emerging forms of technology and communication allow for a new dynamic to be introduced into the traditional educational paradigm. Technology plays a fundamental role in the flipped classroom model. This pedagogical model reverses the learning paradigm, so students spend the majority of their out-of-class studies introducing themselves to the material and becoming familiar with concepts in order to better engage with in class learning (Hwang et. al, 2015). Bergmann and Sams first

proposed the concept of the flipped classroom by recording their class lectures and providing

those videos online for absent students so they could review them conveniently (Hwang et. al,

2015). Soon they discovered students found these online videos more useful than as simple

substitutes in the case of absences: many students who were in class found them as useful study

and review guides (Hwang et. al, 2015).

As the flipped classroom model originated within the digital world, the use of digital

technologies such as videos, internet exercises, communication technologies, and interactive

textbooks are inseparable from the model. This, in turn, makes analyses of the flipped classroom

model in contexts where technology is inconvenient or unavailable largely futile as they do not

adhere to the original format of the model originally developed by Bermann and Sams and

prevent the full execution of the model's teaching dynamics (Hwang et. al, 2015).

Model Explanation

The flipped classroom is a model in which the teaching and learning format of the course

is reversed. With the flipped classroom model, instruction for the students, usually taught in class

via lectures, is substituted for interactive exercises within the classroom where the teacher either

engages with each student individually or coordinates group activities allowing students to

practice their skills together (Bergmann & Sams, 2012). In this model, the typical time dedicated

to introducing topics and providing an overview of any particular subject is now assigned to

students' time usually allocated for homework (Bergmann & Sams, 2012). Experts have argued

teaching a class in this format establishes a framework ensuring students receive a personalized

education tailored to their individual needs (Bergmann & Sams, 2012). Further, students using

this model were then forced engage with material in class more robustly through the

implementation of this new pedagogical theory instead of sitting in classrooms unstimulated, without active participation (Bergmann & Sams, 2012). While this pedagogy is still in its infancy due to its relatively recent introduction, some studies have indicated a positive relationship between the flipped classroom model and student engagement (Delialioglu, 2012; Yueh, Lin, Huang, & Sheen, 2012). However, there has been a notable amount of research conducted since its introduction documenting positive results in student achievement when the flipped classroom model is used properly (Hwang et. al, 2015). These positive results have been noted across a wide spectrum of different sample populations. Students of different cultures, academic capabilities, ages, and fields were all shown to benefit from the implementation of the flipped classroom model from the studies analyzed (Gökçe, 2017).

Methodology

This study uses meta-analysis to create a systematic analysis of the various studies pertaining to the topic of flipped classroom setting within secondary school education. A meta-analysis is a useful methodological tool that compiles the outcomes of multiple studies to find solutions for the same problem and provides a general result which allow for a uniform analysis of various different studies regarding the subject (Glass, 1976; Lipsey & Wilson, 2001; Scherr, 2004).

Method of Inquiry

Meta-analysis is useful in determining a general trend of effectiveness using the flipped classroom model as the studies currently available regarding the effectiveness of the pedagogical are eclectic across a large number of different academic settings and lack uniformity in regard to

the details of their implementations (Ahn et. al, 2010). A meta-analysis is essentially a consolidation of a variety of different studies to seek to establish a certain set of findings by investigating said studies and providing an additional level of analysis to assess the average results across the studies. Additional conclusions may be drawn to provide a singular and streamlined source for the multifarious sources examined in this study.

One of the advantages of the meta-analysis method is it allows for an array of different studies focusing on different aspects to be incorporated into a singular, coherent study which may determine a general finding amongst the available resources (Ahn et. al, 2012). A meta-analysis does not add any original research to the topic area. A meta-analysis analyzes a variety of different studies to introduce a new interpretation and consolidation of the existing research, and therefore, is subject to the inaccuracies of the studies examined without opportunity for corrective or contradictory evidence (Ahn et. al, 2012).

Procedures

After an extensive review of the literature, a series of criteria were developed to assess whether a certain source was adequate for inclusion in this study. This study focuses on the effectiveness of flipped classroom models within the middle and high school students. Further, the model, in the format this study focuses on, was developed in 2000; therefore, any study published before this date refers to other experimental teaching models. Bergmann and Sams (2012) developed this model with the intention technology would be an integral part of out-of-classroom teaching lessons which introduced students to the material they would be engaging with inside the classroom.

     Other factors pertinent to this meta-analysis include the use of student success as a

dependent variable and having a sufficient data size. For the purposes of this study, all studies

including at least one classroom were included. Studies focusing on only a select few students

within a classroom were not chosen as they were not representative of the study purpose.

Ultimately, the goal of the flipped classroom teaching model is to improve overall student

achievement. This meta-analysis will focus on a variety of studies regarding the flipped

classroom model to measure its success. Another factor that prevented a research study from

being included was a small sample size. Case studies and studies focused on specific

demographics within secondary education were also included as they provided additional insight

on the utility of the flipped classroom model within specific contexts.

Table 1

Explanation of criteria for inclusion

Criteria for Inclusion	**Explanation of Criteria**
Topic of Study	Focusing on flipped classroom model
Date of Study	Studies published after 2000
Sampling	Focuses on Middle and High School Students
Student Success	Ultimate Student Success as Dependent Variable
Sufficient Data	Sample size, standard deviation, and mean values for both experimental and control groups

Study Limitations

As this study is a meta-analysis, it serves as a source to consolidate existing research on the flipped classroom model in order to identify some correlations between the flipped classroom model and student success in comparison to a traditional classroom model. As this study focuses on specific, focused populations chosen across a wide area of different demographics, it only serves as a guide to better understand general trends in relation to the flipped classroom model across the globe. This study did not conduct any original experimentation and does not include any research conducted on a large population of greater than a select few classrooms. Therefore, this study cannot speak in regard to the effectiveness of the flipped classroom model in the context of an entire school or district, but rather makes certain conclusions based on select sample populations across a variety of different demographics. Further, this study cannot and does not account for any biases or purposeful skewing of the data which may exist in the studies conducted across the globe.

Analysis of Results

While this theory is still in a state of development due to its relatively recent introduction, most studies have indicated a positive relationship between the flipped classroom model and student engagement (Delialioglu, 2012; Yueh, Lin, Huang, & Sheen, 2012). However, there has been a notable amount of research conducted since its introduction, despite its short period of existence, documenting positive results in student achievement when the flipped classroom model is used properly (Hwang et. al, 2015). These positive results have been noted across a wide spectrum of different sample populations. Students of different cultures, academic

capabilities, ages, and fields were all shown to benefit from the implementation of the flipped classroom model (Hwang et. al, 2015).

This meta-analysis will examine specific aspects of the flipped classroom model by exploring factors such as the importance of technology in a successful execution of a flipped classroom, student and teacher reception of the model, the difficulties of its implementation, its effectiveness increasing student engagement and participation in class, and overall student achievement with the model after a transition from a traditional classroom model.

Attitudes of Students and Educators Towards Flipped Classrooms

As noted by Rabgay (2018), students regarded the model as favorable in most circumstances. Students report they prefer watching video lecturers out of class and appreciated an active approach to learning. Cukurbasi & Kiyici (2017) also found positive views of the pedagogical model, noting students said, "motivation and interest in the lesson increased thanks to the implementation." In Cukurbasi & Kivici's (2017) study the students stated the additional groupwork, idea exchanges, and in general, increased socialization during class sparked interest which caused them to engage better with the topics covered in throughout the course.

One complaint by students regarding the flipped classroom pedagogical model was they felt the material moved too quickly in the out-of-class sessions which resulted in them being unprepared for the active learning sessions during class; this was mainly reported by students who were already underperforming in the traditional class model prior to their participation in the studies (Chung & Khe, 2017). High performing students did not share this complaint about the flipped classroom teaching model. In general, high performing students reported positive opinions about the model without serious reservation (Chung & Khe, 2017). Regardless of

personal opinions about the model, both underperforming and high performing students were found to have achieved higher levels of academic engagement and achievement by the conclusion of the study (Chung & Khe, 2017).

Teachers had mixed opinions about the implementation of the "flipped class" teaching model. Generally, teachers needed to update and reassess their teaching practices significantly, which many found overly burdensome (Hwang et al., 2015). For one, teachers need to become more familiar with the content they are teaching to be able to analyze and develop appropriate classroom exercises pertinent and applicable to the flipped classroom model (Hwang et al., 2015). Further, for a teacher to successfully implement a flipped teaching mode, they must have strong teaching beliefs and the ability to adopt necessary changes and apply such changes appropriately within their classrooms (Hwang et al., 2015). Teachers need to be able to adapt to is the use of technology. In their attempt to compare the beliefs and attitudes of teachers using traditional and flipped models, Unruh, Peters & Willis (2016) noted teachers having a positive experience in the flipped classroom had higher technology and teaching efficacy.

While some teachers may prefer a teaching style largely devoid of digital technologies, the heavy use of technology for out-of-classroom teaching is critical; a teacher apprehensive of utilizing computers, education software, and/or communication technologies limited their students' ability to seamlessly transition from a traditional classroom to a flipped classroom setting (Hwang et. al, 2015). For example, "mobile devices and wireless communication facilitate the continuous flow of learning in different contexts, physical and social spaces," which allows for students to transfer information such as notes and assignment instructions smoothly between multiple learning environments (Hwang et. al, 2015).

Difficulties of Implementation

Some of the main difficulties implementing the flipped classroom include the inability of teachers to properly adapt to the model in terms of readjusting their teaching modes and adequately using instructional and communication technologies (Cukurbasi & Kiyici, 2017). Further, some teachers have contended creating a satisfactory curriculum for their students with the resources available is difficult and inefficient (Herreid & Schiller, 2013). As the flipped classroom model requires teachers to create educational content to introduce their students to course material at home, most have chosen online videos. Unfortunately, finding suitable videos has proven to be an issue for some teachers (Herreid & Schiller, 2013).

Students have similarly expressed apprehension toward the new method of teaching as it is a significantly different mode of learning than what they have been previously exposed to (Herreid & Schiller, 2013). Consequently, they often come to class unprepared and are therefore unable to properly engage with class exercises during the active learning phase (Herreid & Schiller, 2013). Students already underperforming within the traditional classroom setting prior to being introduced to the flipped classroom model reported higher levels of unpreparedness (Chung & Khe, 2017).

Despite occasional setbacks, students revealed once they became accustomed to the teaching method, they were able to quickly engage with the material in a more flexible and comprehensive manner than in the traditional classroom setting (Leo & Puzio, 2016). For teachers, results suggest there is more resistance towards adopting a flipped classroom model, with the two primary factors being reluctance to change routines and an aversion to frequent use of technology (Hwang et. al, 2015).

Student Participation and Engagement to Subject Matter

While adaptation of the flipped classroom may be in diverse ways, the inversion of time and place of homework and instruction remains core to its application leading to increased time for collaboration and engagement with learners (McNally et al., 2017; Turan & Goktas, 2016). According to McNally et al. (2017), flipped classrooms are observable when modes of instruction and learning initially practiced inside classrooms occur outside the classroom and vice-versa. The essential elements constituting a flipped classroom include student opportunity to get exposure to content before the start of a class, a class preparation incentive, a means of assessing the student's understanding, and in-class activities promoting active learning (Fulton, 2012).

While examining the educational efficiency and involvement of students in a flipped biology classroom, Županec et al. (2018) observed the flipped classroom has two main parts: pre-class and in-class activities. Pre-class activities require the learners to view web lectures, links to scientific papers, additional electronic books, read-the-target textbooks and answer formative test questions.

The approach creates a student-centered learning environment where teachers maximize classroom time to guide learners in problem solving and establish abundant social interaction (Hwang et. al, 2015). Engaging with fellow classmates regarding the course materials in class discussions and activities has been shown to greatly improve a student's retention and understanding of the materials (Rabgay, 2018; Županec et al. 2018). The in-class time has also been shown to be more effective for addressing misunderstandings of the material as opposed to having students repeatedly make the same mistakes on out-of-class homework (Ragby, 2018).

Heyborne & Perrett (2016) and Sun & Wu (2016) add the flipped classroom allows what was once considered as "homework" to be done in the classroom and the lecture material, which was taught in class, to be done away from class using appropriate technology.

Significance of Flipped Classrooms

Whereas only limited studies have compared flipped and conventional approaches using either experimental or quasi-experimental approaches, those that have suggest that there are performance gains when using flipped pedagogy; however, some suggested there were only slight gains (Heyborne & Perrett, 2016; McNally et al., 2017). Sun & Wu (2016) explored the effect of flipped classroom and traditional classroom models. Their primary focus was on learning achievement and teacher-student interaction. The findings showed although there were insignificant differences between groups concerning teacher-student interaction, the flipped classroom had higher scoring in learning achievement across multiple tests.

However, flipped classroom discussions enabled the learners to simplify questions in a more collaborative environment than in the conventional class. The same sentiments are echoed by Heyborne & Perrett (2016), noting the system provides the instructor with increased time to engage with students as well as allowing the learners to learn the content by themselves. This allows for more engagement of the content individually and with the teacher, thus leading to higher learning and academic achievement.

For example, when employed to teach biology in secondary schools, the flipped classroom has the potential for improving the academic achievement of the students. After examining the impact cooperative learning methods have on the learning achievement and attitude of students towards biology, Rabgay (2018) noted improvement on the level of interest,

understanding, satisfaction, and individual assessment of the subject as challenging. Another study conducted on the effectiveness of the flipped classroom model in a biology classroom by Leo & Puzio (2016) illustrated flipped instruction had a positive effect on student achievement on comparative testing as opposed to the traditional classroom model.

While the degree of success varied across the studies examined for this meta-analysis, virtually all studies found at least a modest degree of improvement in student success and achievement in mastering the curriculums used for the flipped classroom model studies. Among a wide variety of different contexts, from students with different academic abilities, to students of different ages, to classrooms covering different concepts, to studies conducted on classrooms across a variety of different countries, the general consensus among these studies seems to indicate flipped classroom models do provide significant and tangible benefits in regard to student achievement in comparison to the traditional classroom model.

Areas for Further Study

The flipped classroom is an essential teaching practice as it provides a student-centric learning environment. By replacing the traditional lecture and homework with pre-class activities, the flipped classroom devotes class time to more interactive activities and discussions essential for promoting academic achievement of the students. While it is vital in supporting personalized learning, critical thinking ability, collaborative and accommodating various student learning styles, flipped classroom pedagogy is still in its developmental stage requiring more research to identify the full potential and limitations for achieving academic success.

The following are some of the research gaps. First, it is essential to examine how the flipped classroom influences students' higher order thinking. Secondly, while the method

remains promising, there is a need to analyze the correlation between the digital educational tools the method uses and the effects on the human brain. Future researchers should also investigate the features of video, audio, and text and their effectiveness in a flipped classroom.

Unfortunately, there were several limitations to the flipped classroom pedagogical model research. First, as the method is relatively new, there have been relatively few studies regarding the method as compared to more traditional forms of teaching. Further, all of the participants in these studies have had to adjust from a traditional teaching model to being taught with the flipped classroom model. This has been shown to be a problematic adjustment for some students and may have led to skewed data when comparing the two teaching models (Herreid & Schiller, 2013).

Another limitation to the data is academic institutions have been hesitant to allow full discretion to researchers with their arrangement of classrooms. Academic institutions have generally not allowed for classes to be broken up and students to be randomly sampled. Instead, most of the following studies have been conducted with prearranged classes that have been placed into a flipped classroom setting as a unit.

A third limitation comes from the distribution of teachers involved in the study. Some of the research used for this meta-analysis allowed for teachers to opt into the quasi-experimental teaching paradigms while others did not. This means the teachers who opted into the flipped classroom model were in some way inclined to adopt such teaching practices and were often more able in terms of teaching and technological efficacy. The studies selecting the teachers at random and did not have an opt-in reported higher levels of teacher dissatisfaction with the pedagogical model. To have a better, unbiased understanding of the outcomes of the flipped

classroom teaching model, there needs to be more emphasis put on sampling teachers more representative of the total teacher population.

Discussion

Ultimately, the flipped classroom pedagogy was found to be effective in increasing student engagement with the material, and consequently, overall student achievement. While some studies showed negative perceptions to the teaching model, virtually none of them showed negative academic results (Hwang et. al, 2015). The final results of this meta-analysis reveal implementing such a model into a teaching curriculum has a positive effect on student outcomes when compared to a traditional teaching model (Hwang et. al, 2015). Students reported being more engaged with the material and, in general, commented positively on the flexibility a flipped classroom allowed them to better engage with the materials presented (McNally et. al, 2016; Cukurbasi & Kiyici, 2017).

This meta-analysis also reveals the results from the student achievement were positive across sociopolitical, economic, and culturally diverse regions with studies being included from across the world, including but not limited to the United States, Turkey, Hong Kong, and Taiwan (Gökçe, 2017). These results also remained positive across a wide variety of different course materials. This meta-analysis examined research applied the flipped classroom to STEM, humanities, and social science courses. All were found to have higher levels of student achievement, with the most positive results being found in the STEM subjects.

In terms of favorability for implementing a flipped classroom model, both students and teachers were shown, on average, to have experiences with the teaching paradigm, after allowing time for a transition period, that allowed both students and teachers to become more familiar

with the format of the flipped classroom model (McNally et. al, 2016; Cukurbasi & Kiyici, 2017). Despite the difficulties with the initial implementation of the teaching model, participants soon became comfortable with the new method; however, students were found to be on average more receptive of the flipped classroom as compared to teachers (McNally et. al, 2016; Cukurbasi & Kiyici, 2017). Teacher Unfavorability generally resulted from an aversion to adjusting teaching methods and the general use of technology within the classroom as well as difficulties in constructing adequate curricula with available resources. For the flipped classroom model to be successfully implemented in a classroom, the instructor must be willing to adapt to the new demands of the model (Hwang et. al, 2015).

Additionally, the flipped classroom model has shown among both underperforming students and high-achieving students, the implementation of the model improved the overall performance of students (Chung & Khe, 2017). This implies there are benefits for implementing the pedagogical model in a multitude of different educational environments. While underperforming and high-achieving students had different responses to the implementation of the model, they were nonetheless generally positive (Chung & Khe, 2017).

With all things considered, across a variety of different educational backgrounds, the flipped classroom model proved to be effective in its ability to improve student achievement and engagement with the materials of the course. Although there were difficulties in implementing the flipped classroom model with regard to teacher adaption to the new teaching methods and the students' ability to adequately familiarize themselves with the materials before class; in general, the reception to the innovative pedagogical model was positive for both teachers and students.

Conclusion

The aim of this meta-analysis was to investigate the effectiveness of the flipped classroom model in increasing student engagement and achievement. In pursuit of this goal, 25 studies were considered after an exhaustive process of selecting suitable research. From the studies included, most were found to show significant increases in student performance in terms of both engagement and achievement when properly implemented into instruction.

Most studies have noted significant positive outcomes in terms of student engagement and achievement. Hwang et al., (2017) argue student achievement is strongly correlated to how actively they engage with their educational content. The flipped classroom model seeks to maximize engagement between students and the course content by shifting the paradigm of how students are introduced to and practice the material. In their study on high school biology students, Leo and Puzio (2016) consistently found on all post-tests, those students who participated in a flipped classroom model showed increased levels of achievement. The data suggested students benefitted greatly from active learning strategies implemented in the classes requiring them to mentally interact with the material and construct and derive meaning from it with their peers via class exercises (Leo & Puzio, 2016). These promising results have sparked further interest in the model, and it has been gaining further popularity rapidly since its inception in 2000 (Chung & Khe, 2017).

Although the flipped classroom pedagogical model is still in its infancy, the results so far have been nearly completely positive. This reveals the potential of the model to change current teaching practices on a large scale across the world. Regardless, the positive results so far have been significant, and the flipped classroom model is something that should be investigated more so that its benefits can extend to more classrooms across the globe.

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