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Affordances of flipped learning and its effects on student engagement and achievement

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Abstract

When an increasing interest focuses on the effectiveness of the flipped classroom, it is important to understand how the concept of flipped learning shifts pedagogy. Therefore, the purpose of this literature review was to explore the effectiveness of a flipped classroom model on student engagement and achievement as well as the affordances of a flipped model vs. that of a traditional model. More than thirty peer-reviewed journal articles with a sound research methodology published within the last five years were critically analyzed and evaluated. The major findings reveal that flipped learning can afford students a more engaging environment that can lead to higher achievement and a better preparedness for 21st-century learning and work environments. The recommendations for teachers, administrators and researchers are discussed.

AFFORDANCES OF FLIPPED LEARNING AND ITS EFFECTS ON STUDENT ENGAGEMENT AND ACHIEVEMENT

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Abstract

When an increasing interest focuses on the effectiveness of the flipped classroom, it is important to understand how the concept of flipped learning shifts pedagogy. Therefore, the purpose of this literature review was to explore the effectiveness of a flipped classroom model on student engagement and achievement as well as the affordances of a flipped model vs. that of a traditional model. More than thirty peer-reviewed journal articles with a sound research methodology published within the last five years were critically analyzed and evaluated. The major findings reveal that flipped learning can afford students a more engaging environment that can lead to higher achievement and a better preparedness for 21st-century learning and work environments. The recommendations for teachers, administrators and researchers are discussed.

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Introduction

Flipped learning has been around for 200 years (Bergmann & Sams, 2013). For the majority of the 20th century, content in education has been traditionally delivered the same way. Some even call it "Industrialized Education" (Ash, 2012) where students are required to memorize facts and simply apply them to their desired career fields, much like how workers were trained during the Industrial Revolution period. Since the industrial age of education, English Language Arts teachers have required students to read at home and come to class prepared to discuss and synthesize their learning. This is similar to methods used in a flipped learning model.

However, as the decades crept closer to the turn of the 21st century, work environments began to change. The Internet and mobile computers became more ubiquitous, access to information is abundant, and businesses know this. Information no longer has to be memorized in order to be accessible. The world that exists outside of schools is changing, but the traditional classroom is not. For the most part, students are still required to demonstrate understanding through rote memory. Standardized testing continues to test for knowledge that can be accessed by the lower levels of understanding. This is also evident with the Common Core Standards that are being implemented nationwide. The new standards require students to proficiently demonstrate higher-order skills, but classrooms are still preparing students for 20th century high stakes tests (Roehl, Reddy, & Shannon, 2013).

Recent affordances of technology have made the flipped learning concept more mainstream for educators alike. Because of ubiquitous lecture capturing software and video hosting/distribution sites, lecture content can be more accessible, and almost any subject area can now use class time for more face-to-face interaction with their students.

Since 2007, the learning concept has been coined as "The Flipped Classroom" and has begun to filter down from the undergraduate and graduate levels into secondary and even elementary levels. Two science teachers in Woodland Park High School in Colorado were a driving force of the flipped concept (Siegle, 2014). Jonathan Bergmann and Aaron Sams decided to use screen-capturing software to record introductory lessons and have students watch these lessons as homework. The students would then use class time for more constructive activities. Although the flipped concept was used in education before 2007, those purposes were to primarily teach online courses via Internet. However, in their book, Flip Your Classroom (2012), Bergmann and Sams' note their flipping initiative was slightly different. They began making their videos so they could *increase* the human or face-to-face contact with each student during class. This allowed for more formative assessment, guidance on instruction, and differentiated learning.

Sal Kahn officially started his Kahn Academy in 2008, delivering step-by-step videos on math and science concepts. The idea to create these videos came from tutoring sessions with his niece online. Khan would use the videos to do much of the front-loading of content. He soon discovered that by recording his videos, his niece could pause, rewind, or watch the videos more than once if necessary. Khan began to reconsider what formal education could look and act like in a 21st century. With financial support of several benefactors, including Bill Gates, Khan began to create and provide more lessons for a much larger "classroom" than what has been traditionally known (Khan Academy, 2011).

In recent years, however, the concept has taken a more education-friendly title of "Flipped Learning," where emphasis is put on the learning process that students go through in order to master content (Thoms, 2013). A greater focus has been put on the use of Bloom's

Taxonomy rather than the production and distribution of videos. However, does a flipped learning environment actually work in terms of increasing student engagement and outcomes, or is flipped learning another teaching fad that will soon see a loss in hype?

In the 21st century where a cry for a pedagogical shift is strongly heard, teachers have looked to the flipped learning concept as that possible shift from the traditional format to one that more closely resembles an environment in which the students exist in outside the classroom. But many others have questioned its effectiveness on several levels, one being *student achievement.* It seems that a teaching method worth implementing is based primarily on the increase or decrease of student scores on various tests. Lisa Neilson (2012) has also called into question if it truly is a shift in pedagogy if the concept still relies on lectures to deliver the majority of its content. This similar idea or topic is the central point of discussion for other tech-based shifts in education such as 1:1 initiatives (Lafee, 2013). If the old method of lectures, pencil, and paper are just as effective on student achievement as these other methods that require many hours of preparation and retooling, then why go to the trouble? However, most studies did not focus on just scores (Strayer, 2009; Enfield, 2013; Lage et al., 2000; Davies et al., 2013; Gaughan, 2014; Murphree, 2014; Willey & Gardner, 2013). Many of them included qualitative data that explored student perceptions of the new learning environment as well as their *engagement.*

Meanwhile, not all teachers who flip find success. Some educators have reported attempting to flip their environment to no avail. Those educators who are attempting to flip their class may find it a little difficult at times. This can be due to two reasons (Sams & Bergmann, 2013):

1. The class environment is not properly designed with the flipped learning pedagogy in mind.

2. Original content that once took place during class (i.e. lectures, reading, etc.) is now pushed to outside of class time, and teachers are finding it difficult to fully use that scheduled class time for more meaningful learning.

An analysis of recent peer-reviewed studies is important to address the effectiveness of the flipped learning pedagogy. Some schools may report gains in student achievement, but a comprehensive look at multiple schools at differing levels will give educators a better indicator as to the effectiveness of such a learning concept, and in turn, determine its longevity.

This review of the literature will address the flipped learning concept. It will describe how its effectiveness has been proven at a graduate, undergraduate, and secondary level and may lead to further implementation in secondary and even elementary levels. The topic of the flipped learning environment and its effectiveness will allow teachers to determine if it is a concept worth implementing in their own classroom as well as how to implement it properly.

This review of the literature will attempt to explore these three questions:

1) What affordances are there in a flipped learning environment vs. a traditional one?
2) What effects does a flipped learning environment have on student engagement?
3) What effects does a flipped learning environment have on student achievement?

Methodology

In researching, the OneSearch through the University of Northern Iowa Rod Library was used. This search engine takes advantage of searching multiple databases at once for peer-reviewed articles including the EBSCO database. The reviewer also used Google Scholar. While searching for quantitative research was the initial goal, it was apparent that the flipped learning topic supplied few studies that focused strictly on quantitative data. As a result, the foundation of data gathered derived from mixed-method and qualitative studies. In addition to primary sources discovered using the two search engines, some other studies were discovered through reviewing the bibliography of these primary sources by using the snowball technique. The reviewer has used all, and even a combination of, the following descriptors: "*flipped classroom*" and *outcomes*, *"flipped learning", engagement, "inverted learning," secondary, and "high school*".

When viewing sources, the abstract was first reviewed for pertinent information regarding "flipped classroom", "flipped learning", or "inverted learning". At this point, the reviewer was attempting to look for similarities. Any sources deemed worthy were designated for further review. Upon further reading of those designated sources, the focus was on quantitative and/or qualitative research methods. In doing so, it was apparent that most studies focused on the effects of the Flipped Classroom on student engagement. Some studies also addressed effects on student achievement, but not all. In all of these studies, however, a change in the way content was delivered also became apparent, resulting in certain affordances of a flipped learning environment.

It was the initial intent of the reviewer to focus on flipped learning at the secondary level, but very few peer-reviewed studies exist at this level. Because of the lack of studies that discuss

data at the secondary level, it was decided to use data that was also found at the undergraduate and graduate levels. Flipped learning concepts used at these levels are the same concepts used at the secondary and lower levels. Therefore, it was determined appropriate to include such data. Data used from the secondary level was case study data that schools self-reported under informal researching.

Initial research sought peer-reviewed quantitative or mixed-method measurements of student engagement. This had to provide the base for the review, which could then build qualitative data. Sample size and variables within each study was carefully considered when determining if the study was reliable. The study had to address possible variables that could have been a factor in the results found. Additionally, qualitative studies were included to obtain in-depth insights about the topic.

The term "flipped classroom" is relatively new, but the concept of inverted learning is not. Earliest studies found go back to 2000. The reviewer used this as the earliest date to consider; however, most studies were conducted in the last five years. Therefore, any studies prior to 2000 were not considered.

Analysis and Discussion

Flipped learning, which is more commonly referred to as "the flipped classroom", is a growing teaching trend. In analyzing this pedagogy, this review of the literature will first review what affordances a flipped environment may provide vs. a more traditional one, followed by what effects there are on engagement, and finally what effects there are on student achievement.

Flipped Learning vs. Traditional Learning

In preparation for analyzing what affordances a flipped learning model may provide vs. a more traditional one, it was important to first define the term *affordances*. Initial research showed *affordance* to be defined as "a visual clue to the function of an object" (Webster Dictionary, 2014). However, further research led the reviewer to an article published by James Greeno (1994) where he cites American psychologist James Gibson (1977) and his theory and use of the term *affordances* to describe, "whatever it is about the environment that contributes to the kind of interaction that occurs within it" (p. 338). This was the definition used to begin analyzing the flipped learning environment.

Moreover, it was equally important to analyze what constitutes a traditional classroom environment. Both environments design classroom learning based upon Benjamin Bloom's Taxonomy for Learning model (1956). The traditional learning environment has not changed much over the course of the last 200 years. Typically, the lower levels of Bloom's Taxonomy - *Remembering*, *Understanding*, and sometimes even *Applying* - are addressed within the classroom. This can include lectures, worksheets, or simply reading from the textbook/book. The top levels of Bloom's Taxonomy - *Analyzing*, *Evaluating*, and *Creating* - are then left for the student to do on his or her own with no other assistance other than parents and the occasional classmate(s). This process is to see if the student can put the work in the lower stages in order to

achieve the top stages. According to Bergmann and Sams (2012) "the weakness of the traditional approach is that not all students come to class prepared to learn" (p. 31). By comparison, in terms of what makes a truly flipped learning environment, the lower levels of Bloom's Taxonomy must be delivered and consumed outside of the regular class time. In most cases, this involves watching pre-recorded videos of lessons prior to attending class.

Table 1 includes studies that tested for student perceptions between a traditional environment and a flipped one as well as the percentage of environmental preference. To show how scalable and flexible the flipped environment can be, the table also includes the student sample and course content.

Table 1

Students that Prefer the Flipped Model vs. a Traditional Model

Percent	Author	Student Sample	Level/ Course Content
80.00%	Butt	100	Undergraduate/ Actuarial
85.00%	Davies, Dean, & Ball	53	Undergraduate/ Information Spreadsheets
88.20%	Enfield	37	Undergraduate/ Multimedia
Qualitative surveys that grouped open-ended answers thematically showed a significant preference for the flipped classroom.	Findlay-Thompson & Mombourquette	108	Undergraduate/ Business
83.30%	Lemmer	<100	Graduate/ Legal Research
Qualitative surveys that grouped open-ended answers thematically showed a significant preference for the flipped environment.	McLaughlin et al..	22	Undergraduate/ Pharmaceutics
84.00%	Morin, Kecskemety, Harper, & Clingan	473	Undergraduate/ Engineering
Qualitative surveys that grouped open-ended answers thematically showed a significant preference for the flipped environment.	Murphree	106	Undergraduate/ History Survey

Qualitative surveys that grouped open-ended answers thematically showed a significant preference for the flipped environment.	Rowe, Frantz, & Bozalek	25	Undergraduate/ Medical
Qualitative surveys showed comments strongly in favor of the flipped environment.	Strayer	49	Undergraduate/ Statistics
Qualitative surveys that grouped open-ended answers thematically showed a significant preference for the flipped environment.	Tune, Sturek, & Basile	27	Graduate/ Cardiovascular, Respiratory, and Renal Physiology

As early as 2000, Lage, Platt, and Treglia in their study of 40 students in an undergraduate classroom took advantage of the Internet and developed a website with multimedia units that guided learners. In some cases, they even resorted to DVDs/VCRs for students to take home and watch. What Lage et al. discovered in this foundational research is that many inverted learning components offer more affordances to students and made learning more conducive for varying learner types in categories defined by Reichmann & Grasha (1974), Kolb (1981), and Keirsey and Bates (1984). Although the study was limited to economics students, it was paramount in laying down inverted methodologies for future studies. Since then, technology has advanced as well as the production and distribution process.

Reaching all learners. With classrooms that have continued to group students by age, course instructors have struggled to develop effective lessons that reach all levels of learners. They have tried to differentiate the delivery of their content, but have noted that as an instructor, it is often difficult to plan for and execute effectively. Some simply tried to provide various levels of content through differentiating worksheets for upper and lower levels of learners.

One affordance of a flipped learning environment is the ability to reach several different learner types at varying cognitive levels. Like Lage et al., Strayer (2009) conducted a study to see in what ways he could reach more students. In his mixed-methods study involving 49 students at the undergraduate level, Strayer included extensive qualitative surveys in two

separate classes. One classroom was a course taught with a traditional model while another section of the same course was taught with the flipped model. The same content was covered in both sections and the same assessments were used. However, in the flipped model, Strayer offloaded his lectures by recording them and providing them online - a similar method used in all other studies involved in this review. The study's quantitative data revealed that students perceived their personal learning style was being met. This was evident in the *Personalization* section of the CUCEI scale used during the study. Personalization for students in the traditional section scored a mean of 3.74 while the flipped section scored a mean of 4.17. Students remarked similarly in the qualitative discussions that took place at the end of the course with the majority of students strongly in favor of the flipped environment. Enfield (2013) also used two sections of the same course to conduct his qualitative research of 37 students at the undergraduate level. However, Strayer noted that one limitation may be that students may not have been completely honest with their comments due to the fact the researcher was also the instructor for the course.

The affordance of reaching varying types of learners may be due to how a flipped environment is designed. Using a similar method as Strayer (2009), Davies, Dean, and Ball (2013) attempted to find what affordances a flipped environment can provide by using three sections of the same course. Davies et al. compared a flipped environment, a traditional environment, and a completely self-paced online simulation. Like Strayer, each section covered the same content and used the same assessments, but based on the design of the class, certain activities and supplemental instruction could be provided in the flipped environment that could not be in the other two sections. In the qualitative results, the lower-level dependent learners noted that having this access to the instructor during class time helped them in understanding the

material. Students in the strictly online environment noted similarly saying they wish they had more access to an expert, such as the instructor.

This kind of access to the instructor is one key affordance of a flipped environment that cannot be achieved in a traditional one. Moreover, it is the student's perception to this kind of access that makes it most effective. In several studies (Strayer, 2009; Davies et al., 2013; Murphree, 2014; Rowe et al., 2013; Tune et al., 2013) it was initially difficult to implement a flipped environment. Students found the format and design of the class to be somewhat fragmented and were initially reluctant. In addition, students were unfamiliar with this kind of access to the instructor. However, once the students began to view the teacher as a *facilitator* rather than the *instructor* (Strayer, 2009), the students eventually became comfortable with asking questions for further understanding.

Student empowerment. Another affordance that a flipped environment provides is student empowerment. This stems from a student's perception to have ownership over some aspect of the learning. In their study of 22 students at two satellite sites, McLaughlin et al. (2013) conducted surveys at the beginning and end of a course and found that students supported learning content prior to class in order to use class time for more applied learning (p=0.01). They believed learning this foundational content greatly enhanced the in-class activities (p=0.001). It was also noted that students had greater perception of control over their learning due to the fact that they were held more accountable for the front-loading of content before coming to class. This front-loading process also gives students more confidence in their ability to learn from outside sources (Enfield, 2013). Using a similar method as Strayer (2009), by doing comparisons of two sections of the same course which were taught using different

environments, Enfield discovered a significantly higher percentage of perceived self-efficacy in the flipped environment (73.5%).

This perceived empowerment is also attributed to the affordance that a flipped environment provides more opportunities for *self-pacing*. In a qualitative study of 100 undergraduate students, Butt (2014) performed surveys that focused on student perceptions of *pacing* in actuarial courses with one course presented in a lecture style and the other flipped. In the lecture style, students found the pacing of the presentations not suitable for everyone present. Students also describe it as a "one-way learning process" (p. 38). In contrast, students in the flipped model that used videos and quizzes prior to class perceived to have more control of when and where they could consume the content. Students also noted the ability to control the video recorded lecture by pausing, rewinding, and fast forwarding when necessary. This went against the traditional environment where students were required to succumb to the teacher's authority and complete the tasks that were laid out for them, usually in linear fashion. However, the study was conducted in two years preceeding one another with two different sets of students. This perceived sense of empowerment lead to a greater sense of preparation for life outside the classroom.

Preparing students. A common theme that presented itself while reviewing the literature was a stronger sense of student preparedness for future learning and work environments (Rowe et al., 2013; Morin et al., 2013; Findley-Thompson & Mombourquette, 2014). In an article for the *Law Library Journal*, Lemmer (2013) shared her experiences and what particular aspects a flipped model provided for her more than 100 graduate law students when preparing for the work environment.

Critical thinking skills. Lemmer's (2013) research course shifted from a linear format to one that attempted to challenge the students more by providing opportunities for critical thinking. This was usually in the form of research opportunities that took place during class time. Enfield (2013), Rowe et al. (2013), Tune et al. (2013), and Murphree (2014) share this same notion that a flipped environment cultivates critical thinking by shifting the use of class time. By pushing the lower levels of Bloom's Taxonomy outside the scheduled class time, many of these instructors were able to provide more meaningful activities that put to practice the critical thinking skills related to their content areas. In most cases, this also led to an increase in student achievement, but that is discussed later in this review.

Judgment and decision-making. Lemmer (2013) cites Bruce, Hughes, and Somerville (2012) and their idea of *informed learning* and how it incorporates informational litercies. In essence, informed learning is "learning through engaging with or interacting with information" (p. 524). With this approach, learning becomes more learner-centric and skills acquired can include:

- determining the extent of information needed
- evaluate information and its sources effectively
- incorporate selected information into one's knowledge base
- understand the economic, legal, and social issues surrounding the use of information; and access and use information ethically and legally (Lemmer, 2013, p. 475)

By allowing time for more higher-order thinking during class, this afforded students to put greater value in judging information and deciding which to include in their research. This results in greater analytical thinking and synthesizing of information. Murphree (2014) found similar qualitative results on judgment and decision-making in his study of 106 students in an

undergraduate History Survey course. With the lower-order thinking skills pushed outside the classroom, Murphree was able to put a greater emphasis on the writing component of the class. Class time was spent more on giving students real-time feedback on their research and writing. Students judged the feedback given and decided whether to continue in the same direction or not. At the end of the course when students were presented with the question, "What was the most effective assignment category in terms of improving your writing?" 63 students (74.1%) selected "In-class essays"; 12 (14.1%) selected "Out-of-class essays"; 7 (8.2%) selected "In-class discussions"; and 3 (3.5%) selected "Out-of-class discussion postings" (p. 215).

Computer literacy skills. In all of the studies reviewed, the tasks that were categorized as the lower levels of Bloom's Taxonomy were designated to be completed outside of class. In all studies, this involved using technological means to deliver their front-loading content so as to be consumed in an asynchronous fashion by all members of the course. Some used a Learning Management System (LMS) to house their videos, quizzes, and other resources. Other course instructors developed their own website. How this is achieved and what studies were involved in both is discussed further in the *Out of class course design and technology* section of this review. In either case, students were required to develop and use digital literacy skills in order to navigate the content, troubleshoot, submit work, post comments, or work collaboratively with digital tools. In a qualitative study of 25 clinical undergraduate students majoring in varying medical fields, Rowe, Frantz, and Bozalek (2013) derived from the surveys that students perceived to be better trained and prepared with use of technology in an ever-advancing professional area. However, in this study, students were only asked to compare their current environment to previous traditional academic experiences, which can vary from student to

student. Nonetheless, the flipped environment afforded more time to work with specialized technology.

Scalable and flexible. Another recurring theme between the results of the studies reviewed was *scalability and flexibility*. *Scalability* refers to the an educator's ability to apply a pedagogy to a variety of class sizes while the *flexibility* refers to the adaptive aspects of the pedagogy to a variety of course subjects. A traditional classroom environment lends very little to the ability to differentiate learning for all students, which was one key factor for Rowe et al. (2013) and Enfield (2013) to conduct their studies on the flipped environment.

Flipped Learning and Engagement

Another major theme that presented itself while reviewing the literature was the topic of *engagement*. Engagement is simply the students' depth of interaction, physically and cognitively, with the content (Butt, 2014). Outside of class time, this took the form of watching videos, assigned readings, small discussion posts, or even small quizzes. In class, engagement with the content took the form of small and large group discussions, analytical writing, research, task problem solving, and project creation.

Table 2

Student Perceptions of Engagement in Flipped Learning

Percentage of students that perceived the outside flipped tasks helped (Quality and Efficiency)	Percentage of students that perceived in-class activities helped significantly (Quality and Efficiency)	Percentage of Students that completed outside flipped tasks regularly (Engagement)	Author	Academic Level
	94.00%	73.6%	Davies, Dean & Ball	undergraduate
80.00%		75%	Gaughan	undergraduate
	100.00%		Lemmer	Graduate

80.00%			Mason, Shuman, & Cook	undergraduate
88.10%	91.60%	79%	Murphree	undergraduate
60.00%	80.00%	80%	Willey & Gardner	undergraduate
	96.00%		Wilson	undergraduate

Student engagement. One motivating factor for the studies listed in Table 2 for testing the flipped environment was to determine what effects it had on student engagement. Gaughn (2014), wished to see if the increased engagement would increase her declining enrollment. In her qualitative study of 36 students in an undergraduate history course, she spent the summer creating videos for her course and developed more engaging in-class activities, most of which included small group discussions and development of writing topics. She conducted a survey at the conclusion of the course that included ten questions that students answered. However, only 63% of the already small sample volunteered to participate in this survey. A few responses that specifically address engagement and worth noting include:

- "The discussions in class helped greatly with learning the material, I was able to memorize more and also link together the different empires/cultures" (p. 239).
- "The discussions were actually the most helpful for me, because there were so many possible ideas that were being thrown around. It helped open up my own mind into what could have happened. The primary documents helped a great deal too, it taught me about what the people believed, and the way they saw their own world, which helped me form ideas for the discussions, and for the papers" (p. 240).

- "What facilitated my learning the most is when we went over a topic in class, not when we were to read it on our own" (p. 240).

These responses align with others from qualitative surveys used by Davies et al. (2013), Findlay-Thompson and Mombourquette (2014), McLaughlin et al. (2013), Murphree (2014), Rowe et al. (2013), Strayer (2009), and Tune et al. (2013). Students noted an increase in perceived engagement mainly due to the redesign of class time. However, the front-loading activities that were to be completed prior to class had mixed responses. Findlay-Thompson and Mombourquette experienced this in their mixed-method study of 108 undergraduate students enrolled in three sections of a business course. One of those sections was a flipped environment while the other two remained traditional. The same content and material was covered, but like other studies, the flipped environment provided videos to be viewed prior to class. Although there was an insignificant increase in the final scores of the class, students from the flipped environment were mixed with their responses:

- "I enjoyed the flipped classroom. I liked going to class knowing I would get things accomplished, which impacted my grades. I also enjoyed the convenience of accessing recorded lectures when I wanted to watch them" (p. 67).
- "...it is easier to talk to your professor in the class. In other classes, we (students) sit and listen. I do not like interrupting or asking questions. In our class, we could ask questions all the time. I did better because of this" (p. 67).
- "I didn't like watching the videos at home and felt the lectures should be in the classroom" (p. 67).

- "I didn't enjoy the class. I want to come to class and learn the material from the professor. This way if I don't understand something I can stop and ask her. In this class, I had to watch lectures and if I was confused I had to email questions or remember to ask in class" (p. 67).

The idea of watching lectures outside of the classroom is what received the most mixed criticisms from other studies (Strayer, 2009; Davies et al., 2013; Murphree, 2014). Students in these studies also reported student completion rates of outside activities ranging in the 70 percentile. However, in a study of 24 undergraduate students in a continuous communications course, Willey & Gardner (2013) reported an outside activity completion rate of 80%. This study was conducted slightly differently than others mentioned in this review. Willey & Gardner taught the course in a traditional format for the first half of the semester, then switched to a flipped format for the last half. The method was chosen so the same sample set of students could experience both environments. In conjunction with this format, formative quizzes were included with the videos that were optional to complete. Even though they were optional, students noted that this motivated them more to complete the front-loading work prior to class. Willey & Gardner cited Sadler (2010), for their reason in providing the quizzes but not including them in the final markings for the course:

> Some students report being unenthusiastic about undertaking out of class preparatory and in class collaborative formative activities as they often don't contribute directly to their final grade. The culture that effort should be rewarded with marks is reinforced by invalid assessment. (p. 4)

While an instructor may have provided such formative assessments that students may have used to self-direct and gauge their own learning, not all students took advantage of such resources due

to the perception that it was not directly counted towards their final markings. However, some students noted that they perceived the outside activities as help in understanding the content for the final assessments that did factor into the final markings: "As the lecturer kept mentioning, these activities were there to point out to us directly what we did or more importantly, didn't understand. I found these activities a great way to test my understanding without losing marks" (Willey & Gardner, 2013, p. 6).

In all of the studies reviewed, it was clear that the overwhelming majority of students perceived themselves to be more engaged with the information in a flipped classroom vs. a traditional model. This can once again can be contributed to Lemmer's (2013) citing of Bruce et al. (2012) and the concept of informed learning which includes

> using information, creatively and reflectively in order to learn. It is learning that draws on the different ways in which we use information in academic professional and community life, and it is learning that draws on emerging understandings of our varied experiences of using information to learn. (p. 475)

It focuses on using information to learn and the learners' awareness of that information as well as their ability to navigate it. Learners in a flipped environment perceived themselves to be more actively engaged with the information and, in turn, perceived the content to be more meaningful. By actively engaging with the information, learners can deepen their informational literacy skills (Lemmer, 2013).

Quality and efficiency. As noted in the previous section, class time was used differently in order to increase student engagement. While this was one result from flipping the learning environment, another was an increased perception in content and instructional *quality* and *efficiency*. Because course instructors pushed the front loading of content outside the class, they

could better design lessons that utilized the allotted class time for activities that reached the upper levels of Bloom's Taxonomy on a more regular basis. "Students report greater academic and professional gains when the course emphasizes analysis, synthesis, and higher-order learning approaches" (Lemmer, 2013, p. 480). When students were engaged with information on a deeper level more frequently, this increased students' perception of quality.

In addition, the flipped learning environment allowed students to be more efficient with their learning. By organizing content to be accessed outside of class, students could move through the content at the pace that best suit them. A student could choose what to use and how frequently. In a mixed-method study in an undergraduate engineering course, Morin, Kecskemety, Harper, & Clingan tested the flipped environment in 13 sections of the course each containing 36 students. In the qualitative findings, the majority of students found the delivery of the content to suit their learning needs. One student responded, "All the completing tutorials and working problems pre-assignments have been the most helpful styles to me because it made me actually want to do the pre-assignments and gave me material to look back on later that I could actually use as guidance and a helpful tool" (p. 8). In addition, by making the content easily accessible, students could choose to opt out based on their cognitive abilities as another student noted regarding the videos, "[The class] was really easy... so they were useless" (p. 9).

Rather than expecting students to go at the instructor's pace, in the flipped environment students could better use their time, and in turn, perceived the class to be more engaging. Table 2 compares the studies and the students' perceptions on quality and efficiency.

Flipped Learning and Achievement

Although the focus for the majority of the studies reviewed was student engagement and what affordances a flipped learning environment offered in contrast to a traditional one, there

were a share of studies reviewed that also included quantitative data that measured student achievement (see Table 3). How achievement was measured differed from study to study. Most studies mentioned in this section of the review used summative assessments at midterm and/or semester to determine achievement. Nevertheless, no matter how scientific the attempt, all of these studies acknowledged the possibility of certain variables. While the studies in Table 3 had insignificant positive differences, a handful of isolated case studies have reported much more significant increases in student outcomes from flipping their environments.

Table 3

Student Achievement Increase

Increase Type	Author	Study Type	Academic Level
Increased 32% in Math proficiency.	Pearson	quantitative	Secondary
An increase of 9-19 percentage points across core areas.	Pearson	quantitative	Secondary
Finished 5 pts. higher on final exam than the traditional classroom.	Davies, Dean, & Ball	mixed-methods	Undergraduate
No significant difference.	Findlay-Thompson & Mombourquette	mixed-methods	Undergraduate
The flipped environment performed statistically better ($p = .001$)	Mason, Shuman, & Cook	mixed-methods	Undergraduate
Significant difference was found. ($p = 0.1$)	McLaughlin et al.	mixed-methods	Undergraduate
No significant difference ($p = 0.17$)	Morin, Kecskemety, Harper, & Clingan	mixed-methods	Undergraduate
Insignificant average increase of 5.6 pts on final exam.	Murphree	mixed-methods	Undergraduate
9% increase in final exam scores.	Scherer	quantitative	Undergraduate
Students performed significantly better in the inverted class.	Strayer	mixed-methods	Undergraduate
Students in the flipped course scored significantly higher ($P < 0.05$) by an average of >12 percentage points.	Tune, Sturek, and Basile	mixed-methods	Graduate
Average of 6.73 points higher on final exam.	Wilson	mixed-methods	Undergraduate

Pearson Education Inc. (2013) reported on Clintondale High School and the results the school saw from their flipped initiative. Clintondale was a school with below average pass rates among the core content areas of math (56%), English (48%), science (59%), and social studies (72%). Using the pass rate as an indicator of achievement, Clintondale initially tested the flipped concept in a freshmen at-risk social studies classroom. The exact number tested is unknown. At the end of the course, there was a 100% passing rate reported. Given the results, the high school then expanded the flipped concept to all freshmen classes that following fall semester and saw similar results. The following school year, all 553 students were learning in flipped environments. The school reported an increase of 9%-19% in passing rates from the previous year. The teachers in this case study followed the same flipped format of providing lecture videos outside of class and creating more collaborative and constructive activities within the class. Teachers and students also noted a significant increase in face-to-face time, which they perceived to contribute to the increase in pass rates.

Clintondale's academic struggles are what lead teachers to change their teaching approach. In their case, given their student body, they felt the only way to gain more one-on-one intervention was to flip the teaching environment based on the same principals as noted previously in this review. Byron High School in rural Minnesota also looked to flip their secondary level environments for academic purposes, but budget cuts is what spurred the need for change (Fulton, 2013). With only 30% of the 525 students proficient in math, the school wished to shift the content delivery away from textbooks and use more frugal means to create an impact on achievement, according to a case study report from Pearson Education Inc. (2013). During the course of a summer, all five math teachers met everyday to create their videos and organize the lessons using Moodle, a free online Learning Management System (LMS). One

year of using the flipped concept in all five math courses resulted in a 12% increase in proficiency in Algebra 2, an 11% increase in Pre-Calculus, and a 9% increase in Calculus 1. Surveys sent to all parents and students involved in the flipped courses also reported a 95% favor for the flipped environment over the traditional one.

Both Clintondale and Byron are two isolated case studies, but both use mixed-methods of gathering data in order to determine the flipped learning environment's effectiveness.

Out of class course design and technology. One aspect that contributed to student achievement was the design of the front-loading activities. In order for students to properly prepare for class, it was important to the teacher to make their front-loading lessons available at any moment that was convenient to the students. It was also important to put the front-loading lessons in a format that can be consumed at differentiated rates. By using video, students were able to pause, rewind, fast forward, or watch multiple times in order to fully consume and digest the content.

In order to achieve such distribution, the earliest study (Lage et al., 2000) relied on VHS tapes and other hard copy pieces of technology. Most others in Table 3 used various online technologies to distribute their videos, such as a Learning Management System (LMS) or even *YouTube* (Mason et al., 2013; Talley, 2013; Gaughan, 2014). A reliable LMS that was easy to navigate was important to both students and teacher. LMS's used included *Blackboard* (Talley, 2013; Wilson, 2013), *ALEKS* (Strayer, 2012), *MyITLab* (Davies et al., 2013), *Moodle* (Butt, 2014; Byron High School, 2013) and *MATLAB* (Mason et al., 2013; Morin et al., 2013).

In addition, it was important to the teacher that the videos could be viewed in < 20 minutes (Mason et al., 2013). How the teacher determined 20 minutes as the suitable amount of time was not clear. On the other hand, based on qualitative student feedback, more than 65% of

students found the < 20 minute duration to be an appropriate duration for the given content (Enfield, 2013; Mason et al., 2013). This was the case when videos were edited down to remove pauses and other redundancies. However, students' preferred edited videos that were more concise to videos that were shot in one take (Enfield, 2013). It appeared the students valued production quality when considering its effectiveness for learning.

In conjunction with providing easily accessible videos for students, some instructors also provided quizzes that can be taken for formative assessment (Enfield, 2013; Davies et al., 2013; Murphree, 2014). In a study of 75 students in an undergraduate psychology course, Talley & Scherer (2013) found that by flipping the environment, they were actually able to provide more of the student-paced self-assessments in conjunction with the videos. By using an online resource called Quizlet, students could receive real-time formative feedback on their understanding of the content. In the qualitative survey, students noted the quizzes were an integral part in being more prepared for the in-class activities. As a result, Talley & Scherer (2013) reported a 9% increase in final exam scores. However, these scores were collected from one year to the next with a different sample set of students in each.

Providing quizzes in conjunction with the video lectures boosted student motivation to complete the out of class materials (Talley & Scherer, 2013; McLaughlin et al., 2013; Strayer, 2009). Proper preparation for in-class activities was essential for increased student achievement.

Development of in-class activities. Furthermore, when the lowest levels of Bloom's Taxonomy were assigned as homework, this meant course instructors could design more in-class activities that reached the upper levels: *Apply*, *Analyze*, *Evaluate*, and *Create*.

Class length varied greatly from study to study as well as class size. Authors noted that either of these two variables could have impacted student engagement or achievement (Morin et

al., 2013; Butt, 2014). In spite of these two variables, class time was spent relatively the same. The first part of class time was spent answering questions or mini-teaching key concepts from the out of class materials that were to be reviewed prior. In two studies, particularly those with larger class sizes, the instructor used online quiz systems to formatively gather students' understanding of the front-loading content (Morin et al., 2013; Murphree, 2014). The instructor could then use this data to determine the direction of the rest of the class.

Tune, Sturek, & Basile (2013) used a similar method in their mixed-method study of 27 graduate students in a medical course. The 27 students were split into two sections: traditional model (n=14) and flipped model (n=13). In the flipped model, quizzes took place everyday and were calculated as 25% of their overall grade. These quizzes would then determine the necessary steps for further instruction during the remainder of class time. At the end of the course, when both sections took the exact same final exam, students in the flipped model scored significantly higher ($P \leq 0.05$). However, these results could have also been attributed to the fact that class attendance was emphasized in the flipped model and factored into the final course grade.

How class time was used depended on what learning standards the instructor was wanting to achieve. Murphree (2014) wished to develop research and writing skills, which flipped allowed more time for during class time. Another in-class activity that was developed to increase student achievement was the use of *problem-based learning*. Wilson (2013) incorporated such activities in her undergraduate statistics course. Students were expected to arrive having reviewed the online materials. Wilson then provided the students with several real-world examples and problems to solve where they had the option to work in small groups. With the extra in-class time, Wilson also required students to report out on their findings in a presentation. By reflecting on the information and the process, students performed an average of

6.73 points higher on the final exam. Although Wilson's study was less scientific by using subsequent courses taught from one year to the next, her findings of improved achievement and perceived engagement match those of other studies that used similar problem-based learning methods within the allotted class time (Rowe et al, 2013; Willey & Gardner, 2013; Gaughan, 2014; Davies et al., 2013)

All studies that tested what effects a flipped environment can have on student achievement (see Table 3) saw an increase. Some studies saw insignificant increases while others were more significant.

Conclusions and Recommendations

How students are able to access information has changed in the 21st century, but, how they are being taught has not. Educators have begun to rethink the design of such learning environments and how they can be the most conducive for learning quality and efficiency.

Flipped Learning: Key Findings

After reviewing 19 studies, I have found evidence that supports the affordances of flipped learning and the positive effects it can have on student engagement and achievement. Flipped learning can provide the students an opportunity to learn in a more differentiated fashion rather than linear and didactic (Butt, 2014; Talley, 2013; Tune et al., 2013; Willey & Gardner, 2013). Students noted several times that they appreciated the ability to digest the content when they deemed necessary, so long as it was done before the next class period. Though the majority of students completed the required outside content on a fairly regular basis, there was always a small portion that did not (Davies et al, 2013; Gaughan, 2014; Murphree, 2014; Willey & Gardner, 2013). To expect 100% of students to complete all outside work would be naive of any instructor looking to flip, especially if the instructor does not assess it or factor it into the final course grade (Willey & Gardner, 2010).

In terms of student engagement, flipped learning received the most positive remarks from students in the qualitative surveys, especially when addressing the use of class time. Students perceived the use of classroom activities that activated higher-order thinking to be more engaging (Davies et al., 2013; Lemmer, 2013; Murphree, 2014; Willey & Gardner, 2013; Wilson, 2013). Additionally, the environment afforded students to remain at higher levels of Bloom's Taxonomy for longer periods of time (Enfield, 2013). The longer students remain in the

higher levels of thinking and problem solving, the more they feel engaged with authentic learning, and the perceived quality of the learning is greater (Wilson, 2013).

In addition, it was clear that a flipped learning environment better prepares students for the work environment. *Informed Learning* (Bruce et al., 2012) was a key piece to students feeling comfortable with *how* to learn. How students took information that is given to them, made sense of it, and learned from it in authentic ways, is what gave students confidence in learning beyond the classroom (Lemmer, 2013). This idea was the premise of every flipped learning environment tested in this review.

Moreover, flipped learning empowered students through more active learning (Butt, 2014; Lage et al., 2000; Findlay-Thompson & Mombourquette, 2014). Rather than having the instructor's interpretation of the material delivered explicitly during class time where students passively took notes and possibly asked questions, the students were held more accountable for the front-loading of content. This more active role is difficult for some students to adjust to (Tune et al., 2013), but it was evident that they do prefer it, especially looking at the percentage of students who prefer a flipped environment to a traditional one (Enfield, 2013; Pearson Education Inc., 2013).

Furthermore, the studies did not conclude one specific method for flipping their content. Some studies used quizzes outside the classroom (Enfield, 2013; Mason et al., 2013; Strayer, 2009) while others used quizzes inside the classroom (Morin et al., 2013; Talley & Scherer, 2013). Some studies emphasized the importance of these quizzes to students and counted them for low-stakes grading (Tune et al., 2013) while others simply provided them as a resource to the students with no grading attached (Butt, 2014; Lemmer, 2013; Gaughan, 2014). In addition, how the outside content was delivered varied as well as the in-class activities. Although the delivery,

activities, and assessment methods varied considerably, it was clear that a *design* method was consistent with all studies. It was the intent of each course instructor to move anything considered lower level Bloom's Taxonomy outside the classroom in order to make room for the higher levels and more formative assessments within the classroom.

Recommendations

Although a review of the studies was able to conclude the above, some aspects of flipped learning are still unclear. It cannot be concluded that a flipped learning environment has a significant impact on student achievement alone. In most studies reviewed, there is an insignificant difference in favor of flipped learning when looking at quantitative data (Findlay-Thompson & Mombourquette, 2014; McLaughlin et al., 2013; Morin et al., 2013; Strayer, 2009; Davies et al., 2013). For some, this may prove to be a conclusion in itself, but given the possible variables in each study, it is difficult to determine with certainty. It is recommended that more work be done in isolating such variables, which includes a student's socioeconomic status prior to taking part in the flipped environment (Pearson Education Inc., 2013). Though the studies reviewed showed insignificant differences, there are isolated case studies that could quantitatively show significant improvements in student achievement (Pearson Education Inc., 2013; Mason et al., 2013; Murphree, 2014; Talley & Scherer, 2013; Tune et al, 2013; Wilson, 2013).

For future research, I recommend more study designs similar to Willey & Gardner (2013). By teaching the first half of the course traditionally and the second half flipped, the study will use the same set of students. This may provide the best qualitative and quantitative results. If this design method is not possible, I recommend concurrently teaching two sections of the same course. Creating similar demographics for both would also be ideal.

Based on the studies reviewed, it is also my recommendation for teachers and administrators to spend time training staff and students on the flipped learning concept prior to implementation. Proper preparation is key to successful flipping. Training for students must include very clear guidelines for what will be expected of them. The biggest difficulty that instructors faced was shifting students' passive disposition to a more active one that included students taking on more responsibility for their own learning.

Given the qualitative and quantitative data in the studies reviewed, it is in my opinion that flipped learning can be a viable pedagogy for shifting classroom design to enhance meaningful learning in the 21st century. While there may be aspects of flipped learning that are still unclear, it is favored by students and instructors at varying levels of academics. The benefits of flipped learning mentioned above heavily outweigh the drawbacks. Most of the struggles that occurred at the undergraduate and graduate levels of the reviewed studies dealt with the students' adjustment from passive learning to active learning. If flipped learning is more frequently used in the lower levels (e.g. secondary), then this transition would not be as difficult.

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