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## The effectiveness of flipped classroom learning in higher education : a literature review from 2009 to 2014

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## The effectiveness of flipped classroom learning in higher education : a literature review from 2009 to 2014

### Abstract

Some higher education institutes and some individual teachers have flipped their classrooms using the methodology of "lecture out, homework in" thus, enabling students to review lectures before classroom time. Teachers in turn use classroom time for discussion and homework help instead of lectures. This review discusses the relationship between flipping classrooms and students' engagement and achievement. Studies used in this review were published between 2009 and 2014. The scope of this review is to investigate the effects of flipped classroom models on students' engagement and achievement in higher education. Many studies reported successful implementation of the flipped classroom. Results indicate that using the flipped classroom format allows students to have more engagement in the classroom and overall achievement. Recommendations for more future studies to identify the relationship between the flipped classroom and students' engagement and achievement in higher education were made.

THE EFFECTIVENESS OF FLIPPED CLASSROOM LEARNING IN  
HIGHER EDUCATION: A LITERATURE REVIEW FROM 2009 to 2014

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By

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## **Abstract**

Some higher education institutes and some individual teachers have flipped their classrooms using the methodology of “lecture out, homework in” thus, enabling students to review lectures before classroom time. Teachers in turn- use classroom time for discussion and homework help instead of lectures. This review discusses the relationship between flipping classrooms and students’ engagement and achievement. Studies used in this review were published between 2009 and 2014. The scope of this review is to investigate the effects of flipped classroom models on students’ engagement and achievement in higher education. Many studies reported successful implementation of the flipped classroom. Results indicate that using the flipped classroom format allows students to have more engagement in the classroom and overall achievement. Recommendations for more future studies to identify the relationship between the flipped classroom and students’ engagement and achievement in higher education were made.

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## Introduction

Imagine yourself as a teacher of class A and B, and you teach the same subject in both classes. In the first scenario, you enter Class A to teach Chapter One of World Geography. You have 45 minutes for this class. Your students are quiet so that they may listen to your lecture on world geography while talking, you write notes on the blackboard. Students are copying your notes to their notebooks. The bell rings before you finish this chapter. You end the lesson by reminding students to prepare for the quiz that will be given the next day. In the second scenario, you enter Class B, where all the students have already read chapter one of World Geography and completed note taking. You start your lesson by inviting your students to ask and answer any questions on this chapter to clarify their understanding. Next, students work in small groups to have a further discussion on the chapter, and then each group shares the information to the whole class. Finally students take a quiz before the end of class.

Which of these scenarios do you think is more enjoyable to students? Which one has more engagement? Most would say scenario B, which is referred to as a flipped classroom. “The term flipped classroom is defined as a form of blended learning in which students learn new content online by watching video lectures, usually at home, and what used to be homework (assigned problems) is now done in class with teacher offering more personalized guidance and interaction with students”(Barseghian, 2011).

Technology is often accused of separating people from interacting face-to-face. People text, use social media, and do not use their time to meet personally. In the situation of the “flipped classroom”, technology is separating students outside the classroom, each student watches videos individually, and that is normal, but inside the classroom, there is a close and active interaction between teacher and student and among students (Houston & Lin, 2012). The

challenges that educators tend to face, is how to improve that relationship. How to encourage group activities, discussion, and working together. How to make learning enjoyable for students, to encourage them to engage in class time and to have enough time to interact with them. Each class period is 45 minutes at most, and while there is a lot of information to teach, teachers also want their students to be active and engage in the entire class period. Student engagement and achievement increases when the flipped classroom teaching method is used effectively and creatively “Classroom time can be used more effectively and creatively; teachers using the method of flipped classroom report seeing increased level of student’s achievement and engagement” (Herreid & Schiller, 2013, p. 62).

The scope of this review is to investigate the effects of flipped classroom models on students’ engagement and achievement in higher education. Teachers and students often complain that class time does not fit their needs to finish all work on time. This review will examine the needs of classroom time for both teachers and students, explore how to develop ideas to manage that time, and consider how to make that time more productive for students. Using class time appropriately will lead to student engagement and achievement.

This review will explore the flipped classroom, explain how to use it, and discuss the opportunities and challenges of using flipped classrooms. The results of this review can be used by instructional designers, as well as educators to design, develop, and deliver effective teaching that would increase student engagement and achievement in higher education institutes. Educators may become more interested in how instructional technologies and tools could be used to improve learning outcomes by making learning more engaging and more productive for students and teachers.

This review will explore the following three questions:



1. What are the differences between flipped classroom settings and traditional classroom settings in higher education?
2. What are the effects of a flipped classroom on student engagement in higher education?
3. What are the effects of a flipped classroom on students' achievements in higher education?

## Methodology

The sources for this review were located using multiple tools and search engines to find peer reviewed journal articles. The search engines used for this search included *Google Scholar*, *One Search* from Rod Library through the University of Northern Iowa, and *ERIC (EBSCO)* Elton B. Stephens Company.

The articles for this review were found using the following descriptors/keywords and various combinations of these descriptors: *Flipped classrooms, engagements, students, higher education, blended classrooms, adult education, technology education, and achievements.*

While the number of sources found relating to flipped classroom was big, only those that addressed the three keywords (flipped classroom, engagement, achievement) were selected.

Additionally, to insure that the most recent sources were used in this review, materials published in the last five years were selected.

The sources used in this review contain quantitative or qualitative data that are directly related to this review. Only empirical studies that directly connected to this review were used. Reviews of the abstracts were done to identify each article's relevance to this review. This search only included articles from the last five years.

The five basic criteria for evaluating sources and materials used in this review paper were:

1. Authority: Authority of these sources were judged by both the author and the publisher, authors were available by names with a good reputation in this field. The publishers were university presses, and / or professional organizations
2. Reliability: the context relates to the accuracy and treatment of the information provided. authors of these sources are professionals in their fields and trustful. Most of these sources were cited by other researchers

3. Currency: Sources provided in this review paper are within the last five years. Flipped classroom is a hot topic that is changing quickly. The topic is also considered new, and most resources have been developed in the last five years.
4. Completeness: The information found in these sources is complete, advanced, and supportive of the field of study. The flipped classroom is a popular topic and scholarly, so the intended audience is educators, students, and parents.
5. Relevancy: The information that was found in these sources must be related to this review. The number of the peer-reviewed journal articles found related to the flipped classroom and used in this paper, are thirty articles.

Identified sources are peer reviewed journal articles which were frequently cited by others. A total of 33 articles were identified with a good relation to flipped classroom learning in higher education and the effectiveness of that on student's engagement and achievement. Credibility, reliability, and validity were all taken considered when identifying relevant information. In an effort to narrow the scope of the topic and assure the reliability and validity of the identified sources, some sources were identified and used in the introduction part, others used to define the background of the topic, and almost half identified specifically for review of the relevant research.

In an effort to organize the content, 13 studies were then grouped by factors to define and differentiate flipped classroom setting and traditional setting, and also to investigate the effects of flipped learning on students' engagement and achievement.

Table 1: Factors Relating to Flipped Classroom Differences

Author	Year	Findings
Barseghian	2011	Form of blinded learning
Managan	2013	Lecture at home, homework in classroom
Trucker	2012	It is not about creating videos, but About integrating it.
Arnold-Garza	2014	Invert traditional lecture plus home Work formula
Veleger	2013	Theoretical frame work

Table 2: Factors Relating to Flipped Classroom Engagement

Gaughan	2014	Great and positive learning
Davies, Dean, & Ball	2013	Important factor for engagement
Frydenberg	2013	Challenging and engaging
Enfield	2013	Effective learning experience
Harreid, & Schiller	2013	Positive learning approach
Findlay, & Mombou	2014	Complete assignments in class
Stryer	2012	Engagement and interactivities
Mason, & Cook	2013	Better performance
Toto, & Nguyen	2009	Enjoyable learning

Table 3: Factors Relating to Flipped Classroom Achievement

Alvarez	2012	Grade rates up
Marlwe	2012	Significant differences in grades
Moravec	2010	Increased performance
Ponners	2013	Grade up
Davies, et, al	2013	Achievement and engagement

## **Analysis and Discussion**

Flipped learning is currently a hot topic in higher education. Higher education institutions considering adoption of the flipped classroom learning method may benefit from recent research regarding its effect on student learning. In analyzing flipped learning for this review, first, the concept of flipped classroom learning will be reviewed, followed by the comparison between traditional classroom and flipped classroom in structure. Then it will address the effects of flipped classrooms on student engagement, and the effects of flipped classrooms on student achievement.

### **Background**

The idea behind flipping is not brand new. For over a decade led by National Center for Academic Transformation (NCAT), dozens of colleges have successfully experimented with similar ideas across the board from Math, Science, English, and many other disciplines (Koller, 2011). One example of flipped classroom resources is Khan Academy, which is a popular resources that teachers use to create a flipped classroom for Math. Many teachers and students go back to the Khan Website regularly to review resources so that they can better understand concepts that they did not fully understand in the classroom.

In 2004, the first flipped instruction class was taught by Jonathan Bergmann and Aaron Sams at Woodland Park High School, Woodland Park, Colorado. They found that students who miss class for any reason have a good chance to catch what they missed by watching videos at any time anywhere. Bergmann and Sams are considered pioneers of flipped classroom. They describe that flipped learning starts with flipping instruction and shifting the physical setting of classroom to the interaction setting between teacher and student, that shifts the whole learning process from teacher-centered to student-centered orientation. “The flipped classroom has not

only changed our classrooms, but many teachers from around the world have adopted the model and are using it to teach Spanish, Science, Math, elementary, middle, high school, and adults. We have presented all over North America and have seen how flipping your classroom can change kids' lives" (Sams & Bergmann.2013).

Before discussing the effectiveness of the flipped classroom on student learning, engagement and collaboration in the classroom, it would be useful to compare the learning effects between a traditional classroom and a flipped classroom.

### **Differences between traditional classroom and flipped classroom**

There are an emerging number of studies that address the differences between the learning effects of the flipped classroom setting and traditional classroom setting (Mangan, 2013; Zappe, Leicht, Messner, Litzinger, & Lee, 2009). Mangan identified student-centered learning as a key element of flipping classrooms and a big move from teacher-centered learning. Zappe,et,al reported in her study that the individual work and group activity learning is a major difference between the traditional classroom and the flipped classroom.

The traditional classroom uses a teacher-centered learning model, constructed as follows: The teacher presents a lecture inside the classroom and provides students at the end of the class time with homework. The next day, the teacher collects homework, starts a new lecture, grades the homework and returns it to the students. Students do not have a chance to ask questions, to check their homework, and/or to work with other students inside the classroom. In sharp contrast, the flipped classroom is student-centered learning, the teacher sends lectures out via a technology tool, or even as printed materials, for students to go over whenever they can before class time. Students take notes and prepare questions if they don't understand any part of that lecture (Arnold, 2014; Enfield, 2013; Frydenberg, 2013; Houston, & Lin, 2012). At the

beginning of the class time, students ask questions to clarify understanding. The teacher groups students for active discussion, and asks them to do their homework 'classwork'. Students do their work under the supervision of their teacher. In this situation students are actively involved in their learning process as well as being more engaged in the classroom. In addition, students are at the center of the learning and the teacher is considered a facilitator of that learning. When students are well prepared, they can achieve more learning. In traditional learning, the teacher is the center of learning, and the students are just followers without any engagement inside the classroom. Students do their homework independently without any help especially from teachers (Mangan, 2013; Milman, 2012; Tucker, 2012; Jinlei, Ying, & Baohui, 2012).

Bishop & Verleger, (2013) in their literature review, *The Flipped Classroom: A Survey of the Research*, discussed theoretical frameworks of the flipped classroom that guide the design of in-class activities. The justification of this framework is not using classroom time to deliver lectures, but to use it for activities and discussion, while lectures can be delivered outside the classroom. Bishop and Verleger look primarily to the theories of Piaget 1967 and Vygotsky 1978 that focus on student-centered learning. In particular, they point out that constructivism and collaborative learning stem from Piaget's theory of cognitive conflict, and that cooperative learning stems from Vygotsky's zone of proximal development, both serve as a background for flipped learning. Bishop and Verleger also mention that the relationship between these theories is a historical development, while learning styles serves as a justification for differentiated learning activities. Furthermore Bishop and Verleger developed a table showing the differences between flipped learning and traditional learning styles:



Table 4: Shows the difference between traditional and flipped classroom.

Style	Inside class	Outside class
Traditional	Lectures	Practice Exercises & Problem Solving
Flipped	Practice Exercises & Problem Solving	Video Lectures

Table 5: Broader definition of the flipped classroom.

Inside class	Outside class
Questions & Answers	Video Lectures
Group-Based/Open-ended Problem Solving	Closed-ended Quizzes & Practice Exercises

### Engagement

Gaughan, (2014) at Colorado State University, conducted a quantitative study to investigate the effect of flipped instruction on 40 college students in a history class. He released the video of the history material prior to the class. During class, students worked in small groups to answer questions and discuss the topic. Students worked on class activities individually and in groups.

After comparing the pre-and-post course survey data, the post-course data revealed that 70% of students said they watched the videos before the class, 92% indicated that they learned the work of the historian with the help of flipped classroom, and the engagement between students during class activities. Overall, students reported they were more engaged in the flipped learning than the learning in the traditional. Gaughan reported that the overall reflections indicated a positive learning experience for the majority of the students. In this practice, history class students using the flipped classroom method used class time effectively as they reported.

There are two shortcomings to this study. First, Gaughan was the teacher and the researcher at the same time. Second, he did not provide any statistic data to support direct engagement in his class.

Additionally, Davies, Dean, & Ball. (2013) conducted a research study in the Marriott School of Management at Brigham Young University in the winter semester of 2012. Davies, et al., investigated the effectiveness of flipping a college course designed to teach introductory spreadsheet, when compared to the traditional classroom approach, and to measure students' engagement during both classes. For the purpose of this research, the introductory course on spreadsheets was divided into 2 five-week terms. A total of 270 students participated in this study. Participants in the first term were taught in a traditional classroom setting. Participants in the second term were enrolled in the flipped classroom. The summative assessments using pretests and posttests were conducted before and after this course to measure and identify any statistical differences and engagement between flipped learning and traditional learning. Three research questions were asked of the students after they completed this course to collect data: (a) How much did students perceive they learned, (b) how much value did they attribute to the course, and (c) did the course impact their attitudes towards the course and the topic. Davies, et al., used ANOVA to measure differences and engagement during each class. The ANOVA measurement show no s,  $F(2,185) = 1.5, p=0.223$  indicating that scores on the pretest and posttest were statistically similar for participants in both classes. Their findings were not significant for two reason: (1) the introductory spreadsheet is a course that designed to use computer heavily, so, traditional lecturing is minimal in the traditional class, and technology use is almost equal in both classes. (2) The term of the course is only five weeks, it is not enough time to evaluate this process.

However, the findings from Frydenberg's study (2013) about an introductory course on using spreadsheets over one semester are different than Davies, et al. findings. Frydenberg conducted a voluntary online survey method to measure students' satisfaction toward implementing flipped classroom in the introductory spreadsheet class. Sixty-six students participated in this class. This study took place in one semester. The survey results showed that .85 of online survey participants agree that this experience is challenging and engaging. Frydenberg reported that this teaching method had a positive and significant impact on students' engagement. He suggested that students doing activities inside the classroom have a greater learning satisfaction. The limitation of this study were that the survey was voluntary online, and Frydenberg acted as a teacher and researcher.

Enfield (2013) conducted a study using survey questions. Students participated in 40 lessons using instruction outside the classrooms. His study provided a detailed case in which one approach of the flipped classroom model of instruction was applied in two classes at California State University Northridge. Statistics collected from that reported students' responses to survey questions as follow: Two major questions were used in this survey:

*How effective did you find the instructional videos in helping you learn HTML and CSS?*

Students' responds were vary to this question between very engaging and interesting 37.8% (14) 57.1% (8) 37.5% (6) 0% (0), and somewhat engaging and interesting with a higher rate than very engaging and interesting. 56.8% (21) 42.9% (6) 50% (8) 100% (7), while students responded that was not interesting with very low rate of 5.4% (2) 0% (0) 12.5% (2) 0% (0).

The second survey question; *In general, I found the content of the videos to be very engaging?* only 37.8% of students. Not surprisingly, the top performing students were more likely to rate the content as very engaging (57.1%) than the middle performing students (37.5%) and the bottom performing students (0%). Almost all students (94.6%) believed the videos to be appropriately challenging. Students' reports suggest that the approach provided an engaging learning experience, was effective in helping students learn the content, and increased self-efficacy in their ability to learn independently. Additionally, challenges and potential solutions to those challenges are discussed. This is a new study that came up with students' desire to use flipped classroom in a higher education setting.

A flipped classroom is most commonly described as a reversed teaching model where the teacher uses various forms of technology such as videos to record the normal classroom lectures and students are required to view these recorded lectures outside the regularly scheduled classroom time. Specifically, in a recent study Harreid and Schiller (2013) surveyed more than 15,000 instructors who have used case studies for teaching STEM (science, technology, engineering, and mathematics). Responding to the survey question whether they adopted the flipped approach in their daily teaching, only 200 teachers (about 1.3 %) reported positively. In addition to the common advantages of the flipped approaches identified by the other researchers as discussed in the previous section, Harreid and Schiller cited additional reasons for including the flipped approaches for STEM teaching, including: 1) spending more time with students on the authentic research; 2) students get more time working with scientific equipment that is only available in the classroom; 3) students who miss class for any reason have a chance to watch the video lectures anytime anywhere; 4) the method "promotes thinking inside and outside of the classroom"; 5) students are more actively involved in the learning process; and 6) they also

really like it. They further explained the two major pitfalls for not including flipped approaches for case study: 1) students' resistance for getting full preparation before the class, and 2) difficulty in teachers finding quality video and how time consuming it is for making teacher-created videos. The researchers concluded that the combination of STEM teaching case study and the flipped approaches is a challenging task, but the core value for taking such a challenge is to combine STEM case study teaching, active, student-centered with content mastery. Because there was a lack of description of a STEM teaching case with the connection of the flipped learning method in this research, it will be necessary to conduct a follow-up research for confirming the research results.

Findlay, & Mombourquette, (2014) conducted a research study in using the flipped classroom teaching method in the fall semester of 2012 at Mount Saint Vincent University in one of the three sections of Business 1112, Introduction to Business Administration class to compare the academic outcomes between two teaching methodologies: a flipped classroom style versus traditional lecture-style, as well as analyzing student opinions regarding their views of a flipped classroom environment. The section 1 class (n=30) used flipped classroom methodology for teaching. The section 2 class (n=42) used regular traditional teaching style and section 3 (n=36) also used traditional teaching style. All three sections were taught two hours and half every week. Students were given the same course outline in each section including assignments, quizzes, and exams with identical weightings for each activity. After the semester ended and the final grades had been published, teachers conducted direct interviews with seven participants. Findlay and Mombourquette believed that the direct interview is useful in gaining a better understanding of participants experience with flipped classroom method. It also allows for the greatest depth and details of information. Open-ended questions were used to encourage

participants to respond freely in their own words. After all data were collected they found out that the majority of the students have positive engagement outcome of using flipped learning method, they reported that the flipped classroom allowed them to engage in group activities, and to complete assignments in the classroom which helped them meet deadlines, access immediate help from their professor and helped to improve their grades. Final grades reported for the three sections as follows:

Section (1) flipped classroom 75.09%

Section (2) non-flipped 73.80%

Section (5) non-flipped 76.42%

Comparing these final grade numbers, there are no grade differences between the three methods of teaching, however, students did report that they enjoyed flipped learning and had a positive engagement during classroom activities, but there is no quantitative evidence in their grade report to support their claim. The researchers acknowledged their lack of experience in using the flipped method, also the time and the number of students played a big role in minimizing students' engagement in classroom activities.

Strayer, (2012) writes that an inverted classroom design, also known as flipped classroom learning, has been around for decades as teachers have required students to read course material before coming to class and engage the concepts at a deeper level during class. Strayer, a teacher of introduction to statistics class at U.S University, conducted a research study to compare two different teaching methods that he used. In the first class (n=26) he used inverted classroom teaching, and in the second class (n=23) he used the traditional lecture-homework method. Both class were evenly split by gender (13f, 13m), (12f, and 11m), and the majority of students in both sections were in their first or second year of university study. Surveys were administered two

weeks before the end of the semester to provide insight into (1) students' perceptions of their actual learning environment and (2) students' opinions of what their ideal (preferred) learning environment would be. Also qualitative methods were used to study the learning environment in both classrooms. Other data were collected at the beginning, middle, and the end of the semester.

Survey data results show that there are significant differences between the traditional and inverted classrooms on the actual version of the survey for the Innovation -0.54, Task Orientation -.071, and Cooperation subscales -.045, with  $p < 0.05$ ;  $p < 0.01$ . Qualitative analysis was conducted to compare the learning environment of an inverted classroom and the learning environment of a lecture-homework classroom. Students in both classrooms completed the College and University Classroom Environment Inventory (CUCEI) to measure their perceptions of their learning environments, which included what students preferred and what students actually experienced. Strayer used students' statements as a reference to qualitative findings. He mentioned two important qualitative differences: Homework; students in inverted classroom connected more to the concepts of the content using in-class activities as assignments, and used a learning system called Assessment and Learning in Knowledge Spaces (ALEKS) to learn new content outside of class. On the other hand, students in the lecture-homework classroom did not experience any complication with changing the teaching method as the other classroom felt. Students in inverted classroom were more willing to work together and engage in activity inside the classroom than the students in lecture-homework classroom.

While this study did not directly address any relation between students' engagement and their achievement with either of the classrooms, the researcher mentioned some major differences between inverted (flipped classroom) and lecture-homework classroom in using time effectively, and describing the classroom environment. Strayer admitted that there were some

limitations that may have affected his findings in his research study, (1) he is a teacher and researcher for both classes, (2) some students were reluctant to be forthcoming with criticism to him as their teacher who has the control of their final grades, (3) students were not randomly assigned to either classrooms, but by their choices. In addition to that, the limitation of the number of students participating in each class ( $n=26$  and  $n=23$ ) also played as a big role of limited findings. Another weakness of the Stryer, research was the minimal amount of data gathered during this study, and no comparison was made directly between students' engagement and achievement in both classrooms. Further studies may include support material to enhance inverted classroom students to assist them to use classroom time effectively in their new learning environment.

In the flipped classroom, more time is often available for providing learning activities for students (Bergmann & Sams, 2012). The additional classroom time allows for more variety in the teaching activities used in the classroom, which offers educators increased opportunities to address different student learning styles. Flipped classrooms provide interactive, creative technological methods of teaching students. "This is not about us in our classrooms any longer. It's about our kids being learners and really having the power to go in the directions that they want to go" (Berrett, 2012).

Mason, Shuman, & Cook, (2013) conducted a study in the Department of Mechanical Engineering at Seattle University, to compare the effectiveness of the inverted classroom to a traditional classroom in three areas: 1) content coverage; 2) student performance on quizzes and exams; 3) student observations and perception of the inverted classroom format. A Control Systems course was taught to a senior student class in the winter semester but in two different years. Both courses were 10 weeks long, four days a week (200 min of in-class time per week),



by the same professor using the same textbook, the same homework, and the same quizzes and exams.

The first year class ( $n=20$ ) was taught using a TC system (traditional control system textbook); classroom times were spent in lectures and solving textbook type problems and only five class periods were used in the computer lab to use technical computing software, MATLAB, to solve some textbook problems. The second year class (20) was taught using an IC system (inverted control system); students used video lectures as primary course material to watch outside the classroom, while the class time was spent solving problems, either individually or in groups. All classes were held in a computer lab where students used MATLAB control system toolbox to solve selected problems.

Evaluation assessments for both courses included quizzes, exams, and a written survey of student perception of teaching. The survey asked students to rate on a five-point Likert scale, the course organization, the instructor's use of class time, attitude and teaching style, the effectiveness of exams or reports, the students' personal effort, and the approximate number of hours per week spent studying for the course.

The evaluation and statistics data showed that the IC group performed better ( $p < 0.003$ ) on problem analysis, the IC group also showed better performance on design problems ( $p=0.001$ ). The assessments evaluation for student perception of teaching for both courses was similar, However, the IC class gave a higher rating on perception of teaching (mean  $M=4.65$ , standard deviation  $SD=0.49$ ) than the TC class ( $m=4.21$ ,  $SD=0.79$ ). Surprisingly the weekly number of hours students used to study was significantly less for IC group than TC group (mean of 2.25,  $SD= 0.84$  corresponds to about 5.5 h per week) TC group (mean 3.37,  $SD=0.79$  converts to about 8 hours per week). For the student performance on quizzes and exams, researchers did

not show any statistics data, but they reported that IC group performed better than TC group on all 17 matched problems, also IC performed better on three out of five types-open loop analysis, root locus-based design, Bode-based design, and problems involving design. Although, this study only included senior students in one course, with no statistics data on students engagement and achievement connected to the inverted classroom (flipped classroom), but reported strong support and positive link between inverted classroom and higher student performance. As Mason, et al. reported, the results of this study are encouraging for more studies to compare the effectiveness of flipped classroom to traditional classroom, and the effects of that on student engagement and achievement.

The flipped classroom provides a wider variety of opportunities for student engagement in the classroom that appealed to the learning styles of more students. Instructors can offer more activities that require supervision in the classroom while maintaining control of the content depth and quality. Students prefer the flipped learning method to the traditional method and believe that they had learned more through the activities and group work offered in the flipped classroom (Galindo, 2014; Bishop, & Verleger, 2013)

Equally important, Toto, & Nguyen, (2009) of the College of Engineering at Pennsylvania State University, conducted an investigation process to explore students' perception of the flipped classroom technique using videotaped lectures as the alternate format. Two sections of Industrial Engineering 327 courses were considered to flip. IE 327 is a first level junior industrial engineering course. There were 89 students overall in both sections of the course and 74 students consented to participate in the study. Instructor is coordinating the balance between a passive teacher-centered model of instruction (e.g. traditional lecture format) and an active student-centered model (e.g. engaging students in active learning).

The first question to answer by investigating this process as Toto and Nguyen mentioned was: “How can the instructor engage students more in the classroom, provide opportunities for them to get a real world sense of tools? The second one is to accumulate data that would provide an indication of the strengths and tendencies of this group of students related to their learning in this academic setting. The assessment evaluation of this process consisted of 20 likert-type questions specific to the flipped session content. Finally, at the end of the semester, a final survey was administered to gather data related to students’ general perceptions of the classroom flip as an instructional strategy in the context of the course as well as how they utilized and perceived the use of the videotaped lectures in the course. Data results indicate that students’ learning style in this course tended to be more active (56%), sensing (75%), visual (74%), and sequential learners (72%). Three significant correlations were found regarding the active learning process. The more active students are, the more likely their understanding of course topic improves due to the additional time spent on problem solving in class ( $r = 0.296$ ,  $p = 0.027$ ); The more active students are, the more likely they feel prepared to complete problems in class after listening to the video content ( $r = 0.294$ ,  $p = 0.028$ ). The more reflective students are, the more likely they feel that more time needed to be spent at the beginning of the class reviewing the video content ( $r = 0.403$ ,  $p = 0.027$ ). Along the Sensing-Intuitive dimension three significant correlations were found between this dimension and 1) student agreement that the 1st topic flipped was a good topic for this strategy i.e. the more sensing students are, the more likely they thought that topics chosen were good topics for this class format. ( $r = 0.356$ ,  $p = 0.007$ ); 2). Students along this dimension agreed that more time needed to be spent at the beginning of the class reviewing the video content i.e. the more sensing students are, the more likely they feel more time needed to be spent at the beginning of the class reviewing the video content. ( $r =$

0.429,  $p = 0.018$ ); and 3) students along this dimension agreed that the videos were enjoyable to watch i.e. the more intuitive students are, the more likely they think the video lectures were enjoyable to watch ( $r = 0.467$ ,  $p = 0.019$ ).

### **Achievement:**

Engagement and achievement often go hand by hand when connected to teaching and learning. Many studies report that more engagement in classroom lead to greater achievement (Marlowe, 2012; Davies, Dean & Ball, 2013; Moravec, 2010), and the correlation relationship between the flipped classroom and student achievement is measurable. “Flipped learning is a 180 degree shift in how we approach learning and teaching. Many teachers around the globe report having smashing success with the flipped model. D students become A students. Educators on the edge of burnout find their passions towards teaching rekindled” (Ponners, 2013, p. 42).

Alvarez, (2012) reported that Clintondale High School (CHS) in Clinton Township, Michigan, freshman class passing rate changed as follows after adopting flipped classroom in 2011 – 2012.

Table 6: Clintondale High School Freshman Class Passing Rate.

Subject	2011- 2012	
	Traditional	Flipped
English arts	48%	67%
Math	56%	69%
Science	59%	78%
Social Studies	72%	81%

Representing an increase of 9 to 19 percentage points across the subjects.

Marlowe (2012) conducted a study at Dubai American Academy, to measure the impact of flipped learning as a new learning strategy on student achievement and stress levels. Nineteen students participated in this study. The pretest showed that 77% of students often state they find little value in homework because they are forced to rely on peers when assistance is required because the content level exceeds their parents' knowledge. Marlowe used two questions to measure students' understanding and achievement as follows: (1) Does the use of flipped classroom, in which students watch video lectures for homework and complete traditional homework assignments in class, allow for increased understanding of concepts? and (2) Does independent learning allow for students to complete work in class with teacher assistance. Formative assessments of pretest, posttest, and questioners are conducted as well as summative assessments such as unit tests and end of course exams to measure and evaluate achievement level. Marlowe found that implementing the flipped classroom model was successful. The grades from semester one and semester two were significantly different, with the majority of students seeing an average increase of three points in semester grades. Students showed an increase in content knowledge an average percent change of 58% in the content vocabulary (N=19). Marlowe reported the difference in semester grades was examined and a statistically significant difference was determined (N=19,  $p=0.02$ ). While the overall change in semester averages increased from an 82% to an 86% indicating a class average of a 4-point increase. Before the flipped classroom, 89% of students responded they completed all assignments all of the time. At the end of the school year, 100% of students responded they completed all of these assignments. That is a significant improvement in student achievement. Completing homework assignments in class with a teacher's assistance increases students' understanding of concepts, as well as content knowledge, which was clearly observed in class activities and group discussions.

Moravec, (2010) adopted flipped teaching partially in an introductory biology course. Students were required to watch narrated PowerPoint videos and complete a worksheet before class time. In class, students participated in alternating ten-minute mini-lectures and five to seven minute active learning exercises. Moravec reported that students' performance increased by 21% on exam questions related to the topics introduced outside class with videos. While these results are encouraging, there are several shortcomings to this study. First, in-class activities still carried a lecture component, even though time was provided for interactive activities. Second, the duration of the treatment was very short, and topics on both sides of the flipped topics were still taught with traditional methods.

## Conclusions and Recommendations

Teaching has been the rock of learning since the beginning of human history, but teaching styles and materials have been changing since then. Educators are continuously developing new teaching styles, materials, and tools that fit their students' needs. The flipped classroom is an alternative model of instruction to shift learning from group learning space to individual learning space using digital technology as a tool

This literature review attempts to answer the following questions:

1. What are the differences between flipped classroom settings and traditional classroom settings in higher education?
2. What are the effects of the flipped classroom model on student engagement in higher education?
3. What are the effects of a flipped classroom on students' achievement in higher education?

Most of the studies mentioned in this review found that the flipped classroom has positive effects on students' engagement in higher education settings (Enfield, 2013). The change is happening in everything around us. Students in this century are not the same as ten years ago. The tools and materials that they use for living are very different when compared to only a couple years ago. This change has led educators to be creative and to develop teaching materials that cater to the tech generation.

The teacher is able to provide students with a wide range of learner-centered opportunities in class for greater teacher-to-student mentoring and peer-to-peer collaboration, increasing the possibility for engagement (Roehl, Reddy, & Shannon, 2013). This is actually explaining a student-centered learning process.

Flipping classrooms is about swapping homework and lectures. Students read and watch lectures outside of the classrooms, anytime, anywhere, as much as they need to understand. On the other hand, they use classroom time for homework, asking questions, or asking for help from their teachers (Reddy, Roehl, & Shannon, 2013); (Brunsell & Horejsi, 2013). Students learn more and get more involved with a topic when they research it on their own, rather than getting lectured over the topic. Researchers found that flipping classrooms allows teachers and students to use time more effectively and creatively, and thus increases student engagement and achievement (Fulton, 2012, Herreid & Schiller, 2013; Koller, 2011).

The greatest positive outcome of flipping classrooms is gaining more classroom time for discussion among students, increased discussions between students and the teacher, and time for homework inside the classroom under the supervision of the teacher. Studies show that using classroom time effectively produces more time for engagement. In addition to that, some studies using students' surveys found that students reported that the approach provided an engaging learning experience, and allowed instructors to be more effective in helping students learn the content, and increase self-efficacy in their ability to learn independently (Enfield, 2013; Milman, 2012).

Why should educators care so much about the flipped classroom model? The primary reason is because it forces teachers to reflect on their practice and to rethink how they might reach their kids. Having the flipped classroom model is important and has been found to improve instruction. It provides the teachers an opportunity to correct their mistakes and to rethink the ways they teach and connect with their students.

Flipped learning changes the way teachers teach and the way students learn. The flipped classroom model has received favorable reports from teachers. It can change students from



receiving information, to eventually sending it to other classmates. It can also make teachers passionate about how they teach.

This review used studies published between 2009-2014. With the popularity of this teaching style, in the last three years alone we have seen a threefold increase in research on flipped classroom. More studies should be done in the coming years to research the effectiveness of the flipped classroom and to explore more positive sides of the flipped classroom.

**Recommendation:**

My recommendation is to create future studies to find out the relationship between the flipped classroom and student engagement in higher education, and for educators to try a flipped classroom in order to aid in finding out the effectiveness of using it, and to give a chance for students to experience the self-efficacy learning style. At the present time, the effort of managing a flipped classroom needs some direction and some standardization to move forward. Educators need to start now to evaluate their teaching styles, because the movement of technology will leave the traditional teachers behind if they don't act and take the first steps to join this movement.

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