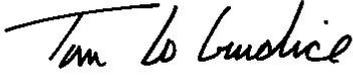


STUDY OF THE EFFECTS OF FLIPPING  
INSTRUCTION IN COLLEGE LEVEL MATH BASIC EDUCATION

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INSTRUCTION IN COLLEGE LEVEL MATH BASIC EDUCATION

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by

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## Abstract

Developmental Education (DE) is constantly under pressure to provide students' with the academic readiness they need to succeed in college bearing credit courses. Flipping instruction is just one method that is beginning to be more widely used in several Technical colleges across Wisconsin and the nation. While Flipping instruction is not a new alternative, the effects of such practices are still widely debated. This study is a cumulative report of the literature on the subject, as well as a summary of teachers' practical views and observations using flipping classroom model. Research on the topic is based on similar practices at different levels of instruction, such as High school and elementary school, due to a very limited number of literatures available on the topic of flipping instruction impact on developmental education. The study concluded that flipping instruction is just a new tool in the delivery of instruction. Also, that there is a great need for research on this topic. With time, it might be more evident if flipping instruction can overtake the traditional way of instruction known as "Lecture". Today, there is no evidence that the achievement gap in student achievement has decreased since the flipping instruction initiative began. New technology, new ideas are being put set forth in education in time the conditions might be ripe for a revolution in learning.

## **Chapter 1 Introduction**

National trends indicate that students who spend more time in remedial courses graduate at a lower rate and drop out of college more frequently. Of these remedial courses, the three main gatekeeper courses are Math, English, and Writing. The success rate for adult students taking college remedial courses is dismal compared to students who do not enroll in remedial courses. The evident lack of progress, often times, puts an end to the aspirations of students of earning a credential that could pave their way out of poverty.

Current best practices in education offer innovative ways to keep students motivated in their careers. Remedial math education needs a robust influx of these ideas and ways to educate students in need of basic skills, in order to make a more significant impact in the academic career of students in math remedial courses. Flipping instruction is just one method that is beginning to be more widely used in several Technical colleges across Wisconsin and the nation. While Flipping instruction is not a new alternative, the effects of such practices are still widely debated. It is currently regaining momentum and is one option that could bestow a better solution for students in remedial math courses.

### **Statement of the problem**

In spite of chronic underfunding and a magnified scrutiny over nontraditional students' success, developmental education is constantly under pressure to provide students' with the

academic readiness they need to succeed in college bearing credit courses. Students in developmental courses often times leave college without completing their intended program or college education. In addition, the price of remedial education is costly for the student as well as the taxpayer. What would be the effects of changing the delivery of math instruction from a passive learning (face to face) to active learning flipped style on non-traditional students in remedial math courses?

### **Definition of Terms**

Flipped Instruction: In essence means reversing the way instruction is done. Lecture is done outside of class through videos; podcasts at home as homework and homework is done during class time. (Flipping the Script k12)

“Lecture: a talk or speech given to a group of people to teach them about a particular subject. Talk used to criticize someone's behavior in an angry or serious way.” (Merriam-Webster).

Developmental Education (DE): Relating to the growth or development of someone or something-the action or process of teaching someone especially in a school, college, or university- a field of study that deals with the methods and problems of teaching (Merriam-Webster)

Under-prepared: Inadequately prepared - Students who after taking the COMPASS test in any WTCS are placed in remedial education courses in preparation for credit courses (Merriam Webster)

COMPASS.- Computer-Adaptive Placement Assessment and Support System. COMPASS is the assessment tool used for students planning to take degree credit classes at Madison College. This computerized, un-timed test includes assessments in reading, writing and math. Most Madison College programs require students to also complete an essay as part of the English portion of the test. (Madison College website)

Remedial Education: Any student who after taking the placement entry exam COMPASS is not ready for College bearing courses or intended technical program.

### **Purpose of the study**

This study is a cumulative report of the literature on the subject, as well as a summary of teachers' practical views and observations using flipping classroom model. The intent is primarily to propose a number of best practices in teaching math using flipping instruction and ascertain if such an approach would enhance instruction retention and success among college students in remedial math courses.

### **Significance of the study**

Flipping instruction is a trend in Wisconsin Technical Colleges. Madison College is not the exception; the college has implemented courses in different areas which have successfully adopted flipping instruction as the primary teaching delivery style. Basic Education is currently lagging behind other departments at the Madison College in exploring, implementing and

comparing the results of flipping instruction with the traditional lecture model. The focus reported here is to ascertain whether flipping instruction could enhance retention, graduation and success of adult, basic, math non-traditional students as compared to traditional methods.

### **Delimitations of the Study**

The research was conducted in and through the UW Platteville Elton S Karrman University Library, over ninety (90) days. Primary searches conducted through the internet using EBSCO host, with ERIC databases and Google/Google Scholar as the primary sources. Key search topics included “flipping classroom”, “flipping instruction”, “remedial education” and “developmental education”. The resources that were found are of a general character, “Academic” references that speak of research studies are not part of the “flipped” literature with respect to the teaching of basic math instruction.

### **Method of approach**

A brief review on literature about flipping instruction will be conducted as well as a review of literature on lecture vs flipping instruction. Conversations and opinions with colleagues who implemented and currently practice flipped instruction was conducted and summaries conclusions and recommendations are made.

## **Chapter Two: Review of Related Literature**

### **Adult Developmental Education (DE) heightened pressure to deliver.**

Community colleges constitute the gateway to higher education, by providing open access for millions of students all across the nation. Nevertheless “access without success is a hollow promise” says Poppe, President of the Extended Learning Campus of Portland Community College. Estimates indicate that roughly fifty percent of the students admitted in a community college do not attain a degree, certificate or transfer within eight years after graduating from high school Farmer (2006).

A weakened economy, diversity of students and graduation from High school without a proper education amplify the Developmental education dilemma. The disproportionate number of students who place in Developmental Math based on diagnostic tests is troubling even more so considering students whose remarks indicate they were taking honor math courses. There are several aspects contributing to this phenomenon which only exacerbates the need for remedial instruction at the college level. Difference in curriculum between high school and college, student’s over confidence, lack of information and preparation, intervals or gaps in math, English and writing sequence and disregard for college. The end result is forty percent of the students at Queens borough Community College require remedial education upon admission says President Eduardo Marti, Farmer (2006).

The COMPASS test is a key factor in determining if a new applicant is ready for college credit-bearing courses at the Wisconsin Technical College System (WTCS). The enormous

number of students, requiring remedial courses confirms, that while students are coping well with High School graduation requirements, the same cannot be said in regard to their preparation for the compass or college entry exam. Minnesota Normandale College President Kathy Hiyane-Brown sees these gaps especially in math and science, according to an article in the chronicle of Higher Education. A disconnection between High School and postsecondary expectations becomes painfully apparent as college aspirants get their assessment results. This high school college difference in expectations is highlighted in different ways. Students are not achieving the level required for college according to national assessments. College applicants are neither well informed nor prepared for college admission exams. In addition they do not understand the implications of poor testing and underestimate their relevance in college admission.

Furthermore, students getting poor results do not consult with college personnel or educators about re-taking the COMPASS exam or any other viable options. According to a report from the Alliance for Excellent Education (2006) adding to the situation is that college prospects are also unaware that a low testing score will prevent them from signing on the courses required for their intended program. Remediation for college new entry students costs the United States more than \$1.4 billion each year. High schools as well as community colleges must send a clear message to college bound students; that community colleges are still higher learning institutions and certain parameters must be achieved upon graduation. Also, colleges should do more informing new aspirants about the college expectations from the COMPASS or any entry exam. Acknowledging that there is a problem is the first step to start looking for solutions. However,

keeping the status quo will only aggravate present trends in which equal access is not translating into equal success for students placing in remedial courses.

Madison College like Normandale and Queensboro community colleges provide open access to enroll into academic programs. However, prospects are required to satisfy the program admission requirements. Community colleges are the favorite path for nontraditional students to access higher education. Thus the class demographics at these colleges go from the married adult returning student or laid off worker to the most recent GED graduate, the diversity of the student body is palpable in any developmental math course. The one common denominator among them is that these students have not developed the mathematical intellect to succeed in college credit math courses (Garret 2013).

Returning adult students such as these might have graduated from high school ten or fifteen years ago. Returning students refers to adults over 26 who graduated from high school while ago or they completed their GED, most of them are considered nontraditional students. In contrast to young students older adults are willing to spend more time in learning math. However, they also carry numerous priorities and distractions in demand of their time. Every semester some of the most promising students stop attending, returning emails, and turning in assignments placing themselves in the fast line for failure. A good number of these students did not lack the ability to perform math and turn in quality assignments, but because they stop attending and doing any academic work at all the result is the same.

Another segment of the remedial education conundrum classes are students diagnosed with special needs. The achievement factor is dependent greatly on the severity of their

limitations and the quality of the support these students might be able to harness. These students bring to class the resilience and continuity that contrast enormously with some young students' apparent lack of effort. In spite of their work ethic and effort, special needs students are considered at risk students, from the moment they step into the classroom. A de facto open access policy is a practice aimed to provide every one the opportunity to higher education. The performance of individuals with limitations impacts colleges' performance more so than universities and colleges with more restrictive admission policies. Individuals making decisions over funding for colleges and universities must look carefully how they allocate funds taking these factors into account.

According to Income and Poverty and Health insurance coverage in the United States 2009 a report on household income states that 11.8 percent lower for African American than it was in the year 2000 and 2009 household income for Latinos was 7.9 percent lower than it was in 2000 (Webb-Sunderhaus, 2010) . As the level of poverty increases these are the students looking for a way to stay afloat, from the depredations of the economy flooding the remedial math courses.

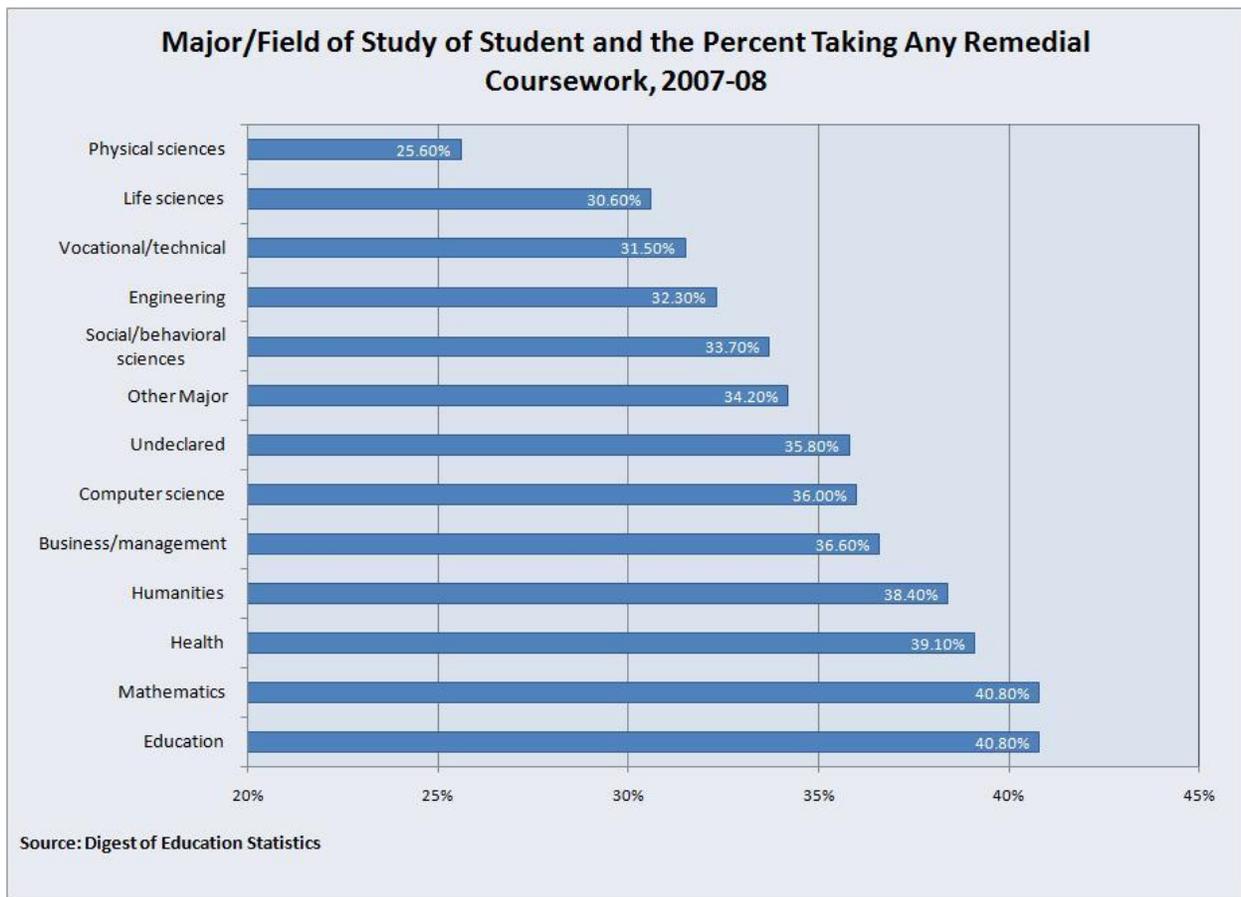
“An uncertain economy and other factors such as returning veterans, and an increased technological and competitive labor market, also fuel the need for adults to walk into Developmental education classrooms in unprecedented numbers” (Boyer, 1991 pp. 78-79).

In the United States, state and local government devote over 160 billion dollars to higher education. In spite of these disbursements, only about .02 percent is diverted to support Developmental Education (DE) programs (Bailey, Jeong, & Cho 2010). As a result DE

programs are chronically underfunded. Even so, there comes scrutiny over the cost to benefit ratios calling attention to the effectiveness and value of such programs even with such inadequate subsidy (Boyer, 1991, pp 78-79) Educational institutions' response is to disregard developmental education programs, neglecting to invest in maintenance and growth of its programs. What DE lacks in innovation and funds it makes up in criticism and inspection. The outcomes DE produces are and will continue to inspire spirited debates among politicians.

Developmental Education depicts the reality of many underserved Americans. Current trends indicate that the labor force will continue to fall below poverty lines due to lack of educational credentials if solutions are not found or even sought. While politicians argue, for many DE students it is not where access to higher education begins but rather where the dream ends.

The table below represents the student percentage in Developmental courses per area of study. Math, English and Writing are the three core courses of Developmental Education also recognized as remedial education.



*Flipping classrooms is a practice that offers a different approach of instruction for developmental math courses; its impact on retention and graduation is yet to be explored.*

The majority of the literature reviewed to ascertain the impact of such practices in Developmental Education (DE) math courses is based on applications in elementary, middle, high school, and college flipping courses. Although, there is a great need for literature on flipping classrooms, sources and information are very limited for developmental math courses. The findings about this research, however, are a major step in bringing to everyone's attention the need for this kind of research and the critical importance for DE to nurture solutions to a growing trend. Therefore, any innovation in practices adopted by educational institutions must be considered and adapted in order to capture important data and obtain the best possible results.

However, to ascertain whether proposing this shift in the structure of learning, it is imperative to identify what works and what needs to be attuned to the current and future demands of the model of education.

## **History of Lecture**

The lecture type of instruction began centuries ago and has continued to this day to be the main feature in many classrooms' teaching. Economically, lecture is a very efficient way to spread information to a great number of people. The fact that this method has survived for so long is evidence of how intricately it is linked to the student learning and education. However,

despite the efficacy of lecturing for centuries, the learner of today is very different from their predecessors. Unlike their ancestors, learners today use more gadgets than ever before and teachers have to compete for the attention of the student. Often times, instant gratification rules the classroom, attention grabbing devices like iPods, smartphones, social media, online video games grind down the student's cognitive ability to concentrate on the lecture (Steinmetz 2013)

Today sixty percent of students believe half their lectures are boring and another thirty percent believes almost all of their lectures boring. How do students deal with boredom? Seventy-five percent of students day dream, sixty-five percent doodle, and forty-five percent text on their phones (Mann 2009). The impact of lecture on student learning is therefore, called into question. The problem is not isolated to the new millennials generation; non-traditional students such as returning married students, students switching careers and displaced homemakers are also struggling to cope with the new and old school.

The argument, experts assert, revolves around the fact that one lecture does not fit all students. More often than not, the information is presented at a pace that is too fast for some students who lack the prior knowledge they need to make sense of the ideas presented. Likewise, a lecture pace might go too slow for students who already reviewed and know the material. As the class ends, everyone is assigned the homework which many students go on to attempt with frustration and confusion (Goodwin & Miller 2013).

With the changing times comes the extreme realization that lecture as a way of instruction needs to evolve to fulfill the expectations of the new generation of students, if it is to endure.

## **Beyond Lecture**

As concerns about education achievements and the educational gap among students, grows around the US. The popular press joins scholars in discussing the role of lecture in teaching for example, USA today published in May 2012, “Sal Khan’s Academy sparks a tech revolution in education.” Kelman, a quasi-historian of technology in teaching does not agree with the term “Revolutionary”. He has witnessed misuse of this term several times in his career, “breakthroughs,” says Kelman “can actually hold progress back” (Schaffhauser 2013). Kelman, is not the only one with strong feelings about the Khan Academy whose mission is “to provide a free world class education for anyone anywhere”. While some enthusiasts praise Khan’s efforts, it has also touched a nerve with others sparking reactions to Khan Academy that go from disapproval to downright animosity; “someone needs to take down Khan Academy and push it down the well” (Schaffhauser 2013).

In addition to an online free library with tutoring videos, in a variety of academic subjects, perhaps Khan’s most notorious contribution is to push onto the national stage the conversation about math instruction and the role of technology, data, and teachers in the learning process. Kahn’s views on education and recent influences, has convinced some significant people such as, Bill Gates, Arne Duncan, and the producers of 60 minutes that Khan Academy should lead the future of education.

Many also credit the Khan Academy as the basis for the flipped instruction method. Similarly, flipped instruction is at the front of national wide debate and not a few critics think of

flipping as nothing more than a well disguised new version of an old-fashioned practice known as the "Lecture" (Ash 2012)

The prevalent idea this stems from, is that students do not like homework and spending the lecture to answer questions and do practice related to homework will be a better use of time for the teacher, improved learning, and less frustration for the students. Teachers who use flipped instruction report that they spend more one on one instruction and only a small increase in tests results from students. Nevertheless, teachers in general warn that flipping is not for everyone, it is unrealistic to hand the flipped instruction model to an ineffectual teacher and expect to transform the classroom, says Wolf, (Ash 2012).

### **Flipped classrooms: The beginnings**

Initially, teachers at Minnesota Byron High School were motivated to look for new ways to deliver instruction when the funds for books failed to materialize. Another problem was that the current books were so old that they did not meet the criteria set by the state math standards. It was then that instructors stepped up to the challenge of creating a curriculum aligned to the state standards and became committed to find the best possible solution for their students. Sams and Bergman began the undertaking of creating lessons and whiteboard screencasts. Soon, Sams and Bergman realized that students could see these lessons as YouTube videos at home, leaving everyone with free time to do homework in the classroom (Fulton 2012).

Shifting from doing the homework at school and studying the lesson at home is what is termed today as a flipped classroom instruction. Students do the learning of the lesson at home via videos or internet and then they go over the homework in class when the teacher is present and can go around class helping students master the material by providing immediate help.

The results of one survey sent to 453 teachers who flipped their classrooms, reported 67 percent increased test scores and 99 percent said they would flip their classrooms again next year (Flipped Learning Network, 2012).

### **The conflicting views of flipped classroom instruction Proponents' View**

Flipped classroom instruction inception started in 2012. Three years later this method has been introduced or implemented in many states across all of the US. No doubt the method offers users important solutions over the traditional teaching method.

Proponents of flipped classrooms state that this method allows students to move at their own pace. Individual instruction is a key factor, everyone learns at their own pace students can re-wind the video with the content as many times as needed or quickly move to the next topic. In addition, students working at a slower pace do not impact the rest of the class. Flipping classrooms allows for students to bring questions to the class and have the expert provide the answers (Fulton 2012).

By moving around the classroom teachers using flipping classroom get a true understanding about the students' difficulties with the content and learning styles. Since lessons

are provided via internet content is available to students 24/7, this is a remarkable way to deal with absenteeism due to sickness or any other reason. Students coming to class are prepared and ready, they cannot argue that they did not know what the lesson was about.

Promoters of flip instruction, claim that time saved from lecturing can be used for one on one instruction and other creative ways, teaching and facilitating move to the center of the stage and lecture is relegated in the priority list. In general terms well monitored in class homework and teacher immediate feedback had a positive progress effect of nearly four times, as compared to traditional lecture, where teachers had few opportunities to assist the student practice (Beesley & Apthorp 2010; Goodwin & Miller 2013).

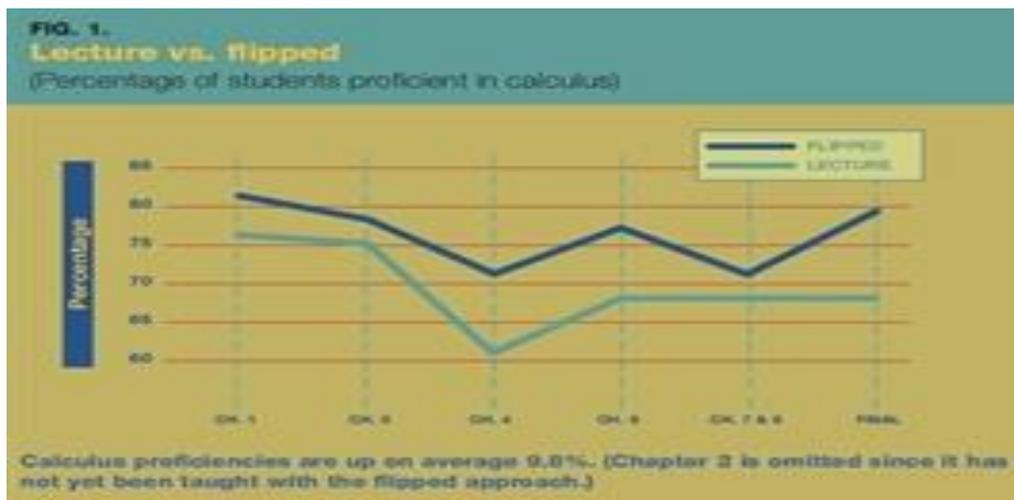
The benefits of a flipping classroom extend beyond class, teachers can use their videos to learn from each other and redesign and flip professional development curriculum. Virtual visits allow teachers to participate in peer observation and feedback which offers rare opportunities in real time due to schedule conflicts.

The popularity of flipping instruction is shared by parents. Before flipping instruction willingly or not parents were the designated volunteers to help their students with homework. Flipping instruction has changed that and parents have come to appreciate it with strong rating approval. By contrast with traditional practices; with flip instruction parents have the opportunity to join the lesson with their student. This option allows parents to review and refresh their own skills, instead of having to recall facts they learned long ago and might have forgotten; to assist their students decipher the school assignments. Also, since homework is carried out in the classroom parents don't have that pressure over their shoulders.

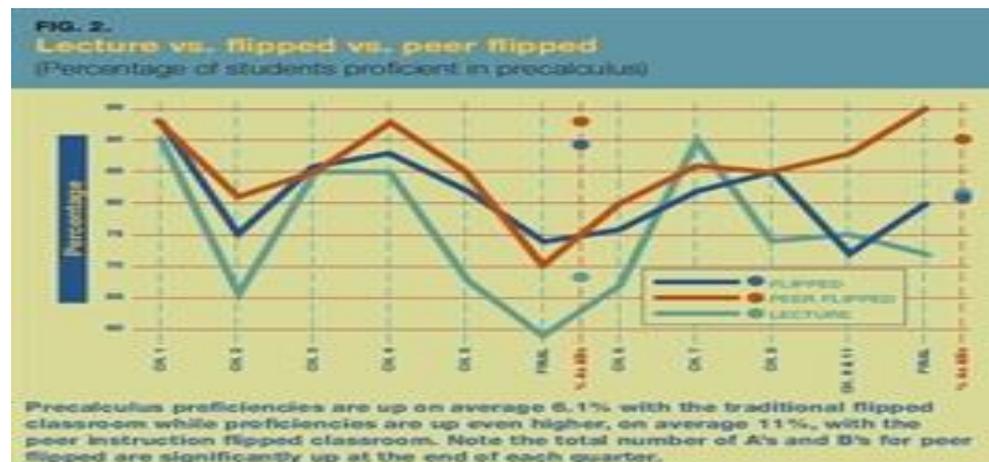
Yet another essential component of instruction nowadays is its' reliance on technology. Supporters of flipping instruction believe that using technology makes the style more appropriate to the present times and incorporates any devices or technology the students already own such as iPods, laptops, tablets and smartphones (Fulton 2012).

In the early stage of implementing flipping instruction promising results achieved by students, have been directly correlated with students' proficiency and achievement which in turn improved student's interest and engagement in higher level math. With all these gains it seems hard to argue against the positive outcomes of such model.

The following chart highlights the difference in student achievement between students in flipping classroom instruction vs students in a traditional lecture in Calculus after the first chapter.



The chart below compares the outcomes of Lecture; vs flipped vs peer flipped instruction. The course is pre-calculus and the chart shows that on average peer flipped instruction is up by 6.1% and even higher for peer flipped instruction by 11% .



Fulton, K. P. (2012). 10 Reasons to Flip. *Phi Delta Kappan*, 94(2), 20-24.

### The conflicting views of flipped classroom instruction Critics' Views

In spite of the praise for flipping classroom not everyone coming across the flipped classroom instruction is enchanted immediately by its revolutionary potential. Flipped classroom critics have taken a stricter look at flipping instruction and responded with a number of concerns to the ostensible advantages presented by the flipped model proponents. Critics claim that to the present no scientific research can explain exactly how well flipped classrooms work (Goodwin and Miller 2013). A student watching a video at home is not that much different than being in class. At home, there is not teacher student interaction, no inquiry or collaboration these characteristics are not active learning; they remind you of a high tech version of the lecture

(Wadell 2013). Students act on free will, if they are not convinced the bottom line remains unchanged, just because the teacher decided to flip the classroom does not mean that students will watch the videos (Ash 2012).

Finally not every home can support a flipped classroom. Implementing a mandatory use of technology would impact negatively on the already critical achievement gap among low-income students. Until the issue of equal access broadband is resolved the flipped classroom will separate an important segment of the students while their more affluent peers continue to get ahead (Wadell 2012). While a vast number of instructors are willing to adopt the new curriculum to be consistent with flipping instruction, it requires teachers to change their well-established practices to become adept to a new style requiring technology proficiency to provide facilitation and assistance to students. In spite of the perceived attractiveness of flipping instruction, it is important not to rush into a solution that has not totally being contested by the economic impact on students, time, and solid results.

*Madison College is a leader in education with over one hundred years of existence it is one of the main pathways for students to access a four year degree at the University of Wisconsin.*

With about hundred and forty four programs and hundreds of college transfer courses Madison College is in constant innovation “change is the only constant” was touted by the president’s college in a convocation theme only two years ago. Invitations for teachers to participate in workshops to flip their classrooms among other academic endeavors are the norm.

Although many instructors are aware of the flipping classroom model, more instructors in basic education need to adopt and use it even if not as the primary method to deliver instruction. Conversations with some colleagues provided the following descriptions. (Note the names used are pseudo-names. Permission to use these descriptions has been provided)

Richer, a Writing and ESL instructor at SAA (School of Academic Advancement) currently teaches using the flipped instruction model to deliver part of the content of writing and ESL. Richer believes that not all topics are suited for the flipping model and not all students are ready for the personal responsibility required to maintain the model. Anyone thinking about flipping must give careful thought to the topics as well as the preparedness of the students in the class (Richer in discussion Oct 2014)

Belington, a Biology instructor in A&S, did not indicate a clear preference. After adapting two chapters of his biology course, commented that in a small survey from seventeen students who indicated they felt they learned better with the flipped format, only ten indicated that they prefer it. Belington believes that flipping instruction is another tool, but it is not the

solution for at risk students or students already achieving no higher than a C grade. Students getting A's will find a way to succeed in either method, whereas struggling students find themselves underperforming somehow (Belington in discussion, Sep 2014)

Brown, a Science and Math instructor, began flipping her classroom for the first time. Brown reports that class is more dynamic and students are more engaged. Next semester, she plans to continue using the flipped model of instruction. When asked if it was time consuming to put all the curriculum and lessons together, she said that most of her style includes online websites, tutorials or PowerPoints she collected over time and she added only one video. The most difficult part is fitting the timing for new material just right in order to keep everyone working at the same pace. In general, Brown is satisfied with the students' performance she is attaining with this new model (Brown in discussion Sep 2014)

### **Chapter Three: Recommendations and Conclusion**

Pressure from technological changes, the media and the public perception that education in the US is lagging behind are driving the changes in education. Developmental Education compared to other branches is not a significant priority to the US department of education. The cost of DE is subsidized in part by the state but more heavily by the student and taxpayer. Today's bleak situation of DE demands more funds to do research and development in education. Even though, there is greater demand for remedial education, there is not a certainty that it will bring necessarily more needed funding.

The following is a list of recommendations which constitute one step in finding the solution to this problem:

- Developmental Education (DE) needs to promote, adopt, and implement actively new ideas set forth by other learning institutions as well as its own.
- DE must engage in formal testing and experimental use of flipped classroom instruction.
- Other models should be explored, use of new technology, flipped peer to peer instruction, MOOCS or any other means. The objective is clear, DE must take firm steps in addressing the needs of the new generation of students, whether, adopting flipping instruction or not, but more importantly developing successful models of instruction.
- Historically, DE students are the most prone to drop out of school before achieving a technical or college degree. While colleges across the nation have

done an outstanding job with access, it is possible that some students are not ready for such task. A minimum knowledge entry exam into DE courses must be studied. Open access policy must be revised.

- Technological changes also offer new means to deliver education. Flipping instruction is one of these options. However, today flipping instruction is a tool not the solution.
- DE should implement changes in flipped instruction even if they are not supported by scientific research. Scientific research takes time and if no changes are made waiting for scientific support. The idea here is doing something is better than waiting doing nothing.

### **Conclusion**

Flipping instruction is a new tool in the delivery of instruction. With time, it might be more evident if this method can overtake the traditional way of instruction. It is also too soon to declare it a major advance in instruction. Today, there is no evidence that the achievement gap in student achievement has decreased since the flipping instruction initiative began. New technology, new ideas are being put set forth in education in time the conditions might be ripe for a revolution in learning. The future of many students depends on it, and more so non-traditional struggling students in developmental education.

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