

A Study of the Flipped Classroom and Its Effectiveness in Flipping Thirty Percent of the Course Content

Christopher Nwosisi, Alexa Ferreira, Warren Rosenberg, and Kelly Walsh

Abstract—*Flipped instruction or a flipped classroom is 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 teachers offering more personalized guidance and interaction with students, instead of lecturing. This is also known as backwards classroom, flipped classroom, reverse teaching, and the Thayer Method. In our study, thirty percent of the course content was flipped. Results on two of the courses used as pilot will be presented and discussed.*

Index Terms—*Flipped classroom, reverse teaching and backwards classroom.*

I. INTRODUCTION

The traditional pattern of teaching has been to assign students to read textbooks and work on problem sets outside of school, while listening to lectures and taking tests in class.

In Flipped instruction, the students first study the topic by themselves, typically using video lessons prepared by the teacher [1], [2] or third parties. In class students apply the knowledge by solving problems and doing practical work [3]-[5]. The teacher tutors the students when they become stuck, rather than imparting the initial lesson in person. Complementary techniques include [6] differentiated instruction and project-based learning [7]. Teachers are blending the advantages of flipped learning with traditional in-class lecturing through tools like eduCanon that keep students accountable to video lessons at home through time-embedded formative assessments [8].

Flipped classrooms free class time for hands-on work [9]. Students learn by doing and asking questions. Students can also help each other, a process that benefits both the advanced and less advanced learners [10].

Flipping also changes the allocation of teacher time. Traditionally, the teacher engages with the students who ask questions — but those who don't ask tend to need the most attention. "We refer to 'silent failers,'" said one teacher, claiming that flipping allows her to target those who need the

most help rather than the most confident. Flipping changes teachers from "sage on the stage" to "guide on the side", allowing them to work with individuals or groups of students throughout the session [10].

The philosophy behind the flip is that teachers can spend time working with students who need their help in the classroom and students can work together to solve problems rather than sitting home alone with work they might not understand with nobody to ask for help.

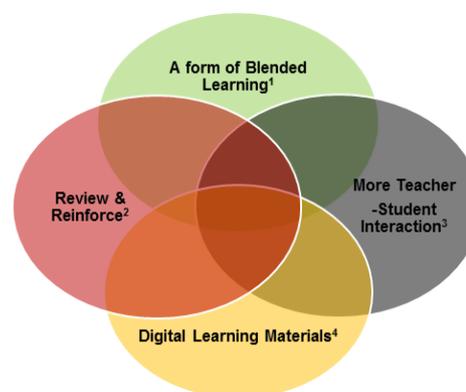


Fig. 1. Flipped instruction.

The purpose of this research study is to analyze the effectiveness in flipping thirty percent of the course content.

The study is organized as follows: Section II provides the literature review, Section III discusses the method and results and Section IV presents the conclusion and suggestions for future work.

II. LITERATURE REVIEW

The Literature review includes the previous findings about Flipped instruction (see Fig. 1) or hybrid courses.

Blended learning courses are defined as "classes in which instruction takes place in a traditional classroom setting augmented by computer-based or online activities which can replace classroom seat time" [11]. Jeffrey R. Young pointed [12], "a growing number of colleges are experimenting with hybrid or blended models of teaching that replace some in-person meetings with virtual sessions". Scida and Saury [11] further argue that hybrid courses "... are becoming more and more the norm in higher education in the United States as earlier predictions of the explosion of completely online courses have not been borne out in practice" (see [13]-[16]). Furthermore, Young [12] argues that hybrid classes are less controversial among university faculty than offering traditional fully virtual courses and that "hybrid courses may be a better way than fully online courses to help busy commuter students".

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C. Nwosisi is with the Computer Science Department, the College of Westchester, White Plains, NY 16006 USA (e-mail: cnwosisi@cw.edu).

A. Ferreira is with the Business Administration Department, the College of Westchester, White Plains, NY 16006 USA (e-mail: afeirra@cw.edu).

W. Rosenberg is with the College of Westchester (The Provost and the VP of Academic Affairs), White Plains, NY 16006 USA (e-mail: wrosenberg@cw.edu).

K. Walsh is with Information Technology Department, the College of Westchester, White Plains, NY 16006 USA (e-mail: kwalsh@cw.edu).

Many proponents of hybrid courses say their main motivation is to improve the educational experience for students and to relieve limited resource pressures on college campuses, pointing to research that demonstrates that using blended learning improves student success rates in learning outcomes and retention [17] and that hybrid courses alleviate campus classroom shortages and enrollment pressures [12]. Chuck Dziuban, director of the Research Initiative for Teaching Effectiveness at the University of Central Florida, says that his office's research shows that student success rates in hybrid courses on the Central Florida campus are "equivalent or slightly superior" to face-to-face courses, and that the hybrid courses have lower dropout rates than do fully online courses. Furthermore, Chris Dede, professor of learning technologies at Harvard University's Graduate School of Education, stated, "A strong case is beginning to be made on the basis of research evidence that many students learn better online than face-to-face, and therefore a mixture is the best way. What proportion that mixture should be would vary from course to course [12]. Over the past decade, there have been many advances in the technology and pedagogy of hybrid, or blended learning, courses. Moore [18] and Moore and Kearsley [19] have looked at the role of blended learning within the distance education landscape and Staker [20] has examined the role the disruptive innovation of online learning in the world of education. Additionally, [21] looked specifically at emerging technologies that are continuing to enhance student-centered classrooms and [22] have looked at the recent practices and trends in blended learning from a global perspective. [23], [24] emphasized the role of community building and development of a community of inquiry in order to increase effectiveness and success of online teaching and learning [25] found significant relationships among teaching presence, cognitive presence social presence, and students' perceived learning and satisfaction in the course. Finally, [26] argue that "The power of the hybrid course model is its flexibility and pedagogical effectiveness. Because it emphasizes active learning techniques, it increases student interaction with other students and the instructor."

III. METHOD AND RESULTS

A. Overview

Several CW Instructors submitted proposals for a Flipped Class Competitive Grant proposal that was made available to teachers with courses in the Winter Day 2014 term. Two of the proposals were accepted based on their merit and various criteria regarding room for improvement in average grades and completion rates of the respective courses in which they proposed to use "flipped" teaching and learning techniques.

The two specific courses that were to be delivered in this manner were:

NET125 - Cisco Networking Basics, which was a foundation course of the four series of courses required in the curriculum and for the CCNA certification. To master networking concepts, it requires some of collaboration among students and Instructors. This course offering had 109 total students during 2012–2013, averaging of 9 students per class,

with an average passing grade of B-, plus 2 Fs and 2 Withdrawals. GEN330 - Adult Development in the Workplace, this course offering had 203 total students during 2012–2013, averaging of 13 students per class, with an average passing grade of B, plus 8 Fs and 9 Withdrawals).

The instructors were required to define and document their approach. Each chose to flip roughly every other week's content, providing a variety of digital learning materials (videos, podcasts, docs, web based tools) to be consumed outside of class, coupled with in class exercises, projects, collaborative group work and work on assigned labs, individually and in groups.

Online Class Components: For this study, students are expected to have already completed several online assignments before attending a class. The students are required to watch video lectures of instructions, typically totaling 50 minutes that cover a particular topic. The students are also required to read the assigned book chapter. Once this is completed, the students are encouraged to contribute to the online homework discussions and come to class with questions. Homework is not graded until two days after the in-class session so as to clarify any misconception they may have about the material.

In Class Session: In each class session, the Instructor provides an overview of the course content. Ideally, students would have completed most of their outside requirements and would be prepared with any questions that they needed to ask. Once the questions are answered and the Instructor feels reassured that the students have proper understanding and clarity, the Instructor would then facilitate an in-class Lab activity to reinforce the student learning. The students would work on their Labs but are encouraged to collaborate with each other. Simultaneously, the Instructor provides assistance with the Lab as he moves from group to group and by answering any questions. After completing the Labs, students are expected to be proficient on that particular concept and are prepared to take the quiz at that time.

Technologies Adapted: Moodle and Packet tracer are the main online technologies used in the Cisco Networking Basic pilot course. Students watch their online lectures through Moodle as well as submit their completed Labs which was done with Packet tracer. Moodle and Packet tracer are great resources to use outside of the classroom because of the many different approaches they use to assist students to complete assignments. As the students work through their homework, each problem that they encounter has links to various resources that students can use as an example. A given problem may have a link to a similar problem that shows step by step what to do. These solutions help, along with other tools, that give students the resources that they need to understand the particular course content.

B. Assessment

Quantitative and qualitative assessment techniques were designed and incorporated in the study. Quantitative techniques include a comparison of final grades in the flipped course section to average grades and completion rates in prior offerings of the same courses, as well as possible comparisons of performance on assessments related to the flipped portions of each course to the assessments of the non-flipped portions.

Table I, shows the Quantitative results of this study as compared to 2012-2013. There were improvements in both courses.

TABLE I: AVERAGE PASSING GRADE AND IMPROVEMENT

Course Code	This Study	2012-2013	Improvement
NET 125	85.1	82.5	2.6%
GEN 330	90.5	87	3.5%

A preliminary investigation on DFW grades ratio was conducted. Average Non-DFW grades and DFW Rates were used as metrics. The focus of these assessments is to compare the outcomes. The average non-DFW grades, the average above D will be used as a comparative assessment element for the purposes of this study. The F grades and Withdrawals are clearly failures as Learning Outcomes. Since the D grades are below the 2.0 threshold required for degree completion, it can also be counted as such. On the non-DFW grade, the results show that the grades improved in the pilot courses as compared to all courses that were offered over 2012 and 2013, see Fig. 2.

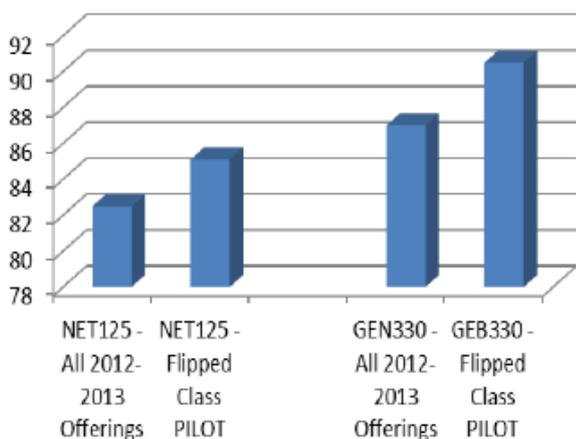


Fig. 2. Non-DFW grade ratio.

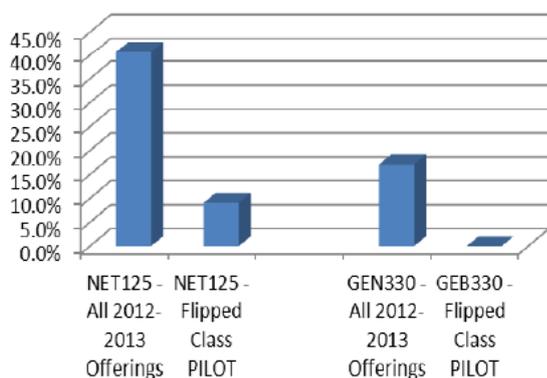


Fig. 3. DFW grade ratio.

The rates of the students with D's or F's, or Withdrawal will constitute another vital metric in the assessment of the effectiveness of the Flipped instruction or flipped classroom as a tool to improve learning outcomes. On the DFW grade, the results show that there was significant reduction on the DFW ratio. Fig. 3 below shows that DFW grades were eliminated in the pilot of GEN300, and radically reduced in NET125. Similar results occurred in comparing prior courses taught by the same Instructors who taught the pilot courses.

Qualitative assessments are based on a survey of student perceptions, and instructor perceptions of the course and the

flipped class delivery method. This paper addresses student perceptions only.

Qualitative Assessment: Student Perceptions Survey 5 Questions were asked on this survey, to gauge student's thoughts on how the flipped delivery method affected their learning. Response options for each question were as follows: Strongly Agree, Agree, Neither Agree nor Disagree, Disagree, and Strongly Disagree. Responses were summarized into 3 groups (by putting "Agree" and "Strongly Agree" together and putting "Disagree" and "Strongly Disagree" together). Table II, shows the Qualitative results of this study.

TABLE II: STUDENTS' PERCEPTIONS SURVEY RESULTS

Questions	Neutral	Disagree	Agree
1. I like this approach to learning	6%	0%	94%
2. This approach helped me learn the material better	6%	22%	72%
3. This approach required more work	17%	28%	55%
4. I would want more of the material in the course taught this way	28%	17%	55%
5. I would want other courses to use this approach to learning	22%	39%	39%

In question No. 1, the majority of the students chose "Agree" or "Strongly Agree" for this question. In question No. 2, a significant majority agreed that the flipped instruction approach aid them to learn the material better. In question No. 3, over half of the students felt that flipped instruction and learning did require more work. In question 4, also over half of the students want more of the course material to be taught using flipped lesson. In question 5, there is a 50-50 split between "Agree" and Disagree". It is interesting since most of the students said that they like the approach and that they also learned more. We believe that this might be due to multiple factors such as: the class time, which is 8:00 am, students not starting their homework before class and they do not want to appear unknowledgeable on a certain topic.

IV. DISCUSSION AND CONCLUSION

This study illustrates that using the Flipped classroom concept for thirty percent of the course content is a great help for the students. Some students do not grasp the concept in the beginning. The Flipped instruction concept facilitates interaction among students, and between students and their Instructors. Flipped instruction leads to better learning results. This concept helps students to effectively learn to acquire skill, knowledge, and also to show a good attitude towards learning. Both Quantitative and Qualitative results from the Partial Flipped Classed Pilot have been very encouraging. From a qualitative perspective, 94% of students responded that they liked this approach to learning and 72% indicated that this approach "Helped [them] learned the material better". The results of the study suggest need for further research. Currently, more study to investigate the impact of flipped learning to DFW rates is being done. More research are needed, first, perform the same study with more courses and students and Instructors involvement. Second, look at Flipped instruction effectiveness with students of special needs. Flipped instruction approach can be used in introductory and

remedial teaching. The Instructor should start small and keep it simple. Finally, developing a flipped instruction is a collegial process.

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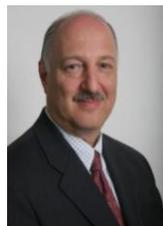
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Chris Nwosisi obtained his doctorate degree in computing from Pace University, master of science in management of technology from Polytechnic University and BA in computer science from Hunter College of the City University of New York. He has co-authored several papers in scientific journals and international conferences. Currently, he works for the College of Westchester in White Plains, New York as an associate chair and professor. He had received numerous presidential commendations, faculty recognition awards and the Shining Star award in Teaching from the College of Westchester. In 2010, he received the Upsilon Pi Epsilon Honors award for the Computing and Information Disciplines from Pace University. In 2007, he received the IEEE senior membership award. In 1993 and 1994 respectively, he was the recipient of the Recognition and Appreciation Awards from the Association for System Management. Dr. Nwosisi has over 25 years of professional experience and over 17 years of teaching experience. His current research interests include Machine Learning, Data mining, Teaching Methodology, and Pattern recognition.

Alexa Ferreira earned a bachelor of arts in literature from Purchase College, SUNY and a master of arts in liberal studies from Manhattanville College. She worked as a college administrator in academic affairs and in career development before joining the College of Westchester in 2008, where she is an assistant professor of general education and teaches courses in business writing, public speaking and career development. Ms. Ferreira has been consistently recognized for teaching excellence.



Warren Rosenberg currently serves as a provost and the vice president of academic affairs at the College of Westchester where he also holds the Faculty Title of Professor of Allied Health. Dr. Rosenberg has served in higher education administration for 20 years having served as the provost, the dean, and the department chair and has been teaching at the college level for over 30 years. His administrative activities include conducting and chairing program review teams for the New York State Department of Education, serving as a member of the N.Y. State Regents' Advisory Council on Program Accreditation, serving on and Chairing accreditation teams for the Commission on Higher Education of the Middle States Commission on Schools and Colleges, and serving on the Board of The Metropolitan Association of College and University Biologists and of Rice High School in New York City. Dr. Rosenberg holds a M.S. and Ph.D. in Biology from New York University and is the author of numerous research papers and coauthor of two textbooks.



K. Walsh is the CIO at the College of Westchester in White Plains, NY, where he also teaches as an adjunct instructor. Walsh earned his MBA from Long Island University and Bachelors of Science in Mathematics from Mercy College. In 2009, Walsh founded the popular website EmergingEdTech.com, where he writes regularly about engaging students and enhancing learning out comes through the use of emerging Internet and instructional technologies. In 2013, Walsh was ranked by the Huffington Post at #3 in a listing of the "Top 100 Social CIOs in Higher Education", and in 2014, he was included in the Top 5 in similar ranking of CIOs in all industries. Walsh regularly speaks and conducts workshops about a variety of education technology topics at schools and conferences across the U.S. His newest eBook, the *Flipped Classroom Workshop-in-a-Book* guides teachers through the development of their own flipped instruction implementation plan.