A REVIEW OF FLIPPED LEARNING

WRITTEN BY

Noora Hamdan and Patrick McKnight, Ph.D. George Mason University

Katherine McKnight, Ph.D. Pearson's Center for Educator Effectiveness

Kari M. Arfstrom, Ph.D. Flipped Learning Network

PEER REVIEW SUPPORT FROM

the FLN's Research Committee

flipped learning network

PEARSON

GEORGE MASON UNIVERSITY

(c) Flipped Learning Network 2013

ACKNOWLEDGEMENTS

Thank you to the following educators who reviewed various versions of this literature review, white paper and executive summary. Their input was invaluable to the creation and editing of these documents.

Special thank you to the following for their editorial assistance and careful review:

Lori Brown, Ed.D., Pearson School Achievement Services (Asheville , NC)

Richard Lee Colvin (Washington, D.C.)

Barbara Hockstader, Pearson (New York, NY)

THE FLIPPED LEARNING NETWORK'S RESEARCH COMMITTEE

Jonathan Bergmann, Board Member, Flipped Learning Network (Arlington, VA). Lead Technology Facilitator, The Joseph Sears School (Kenilworth, IL)

Kristin Daniels, Board Member, Flipped Learning Network (Arlington, VA). Technology and Innovation Coach, Stillwater Area Public Schools (Stillwater, MN)

Anna Davis, Associate Professor of Mathematics and Department Head, Ohio Dominican University (Columbus, OH)

Thomas F. Driscoll III, Social Studies Teacher, Putnam High School (Putnam, CT)

Troy F. Faulkner, Mathematics Teacher, Byron High School (Byron, MN); Adjunct Professor, Augsburg College (Rochester, MN)

David J. Harrison, Instructional Designer, University of Nevada, Reno; Adjunct Assistant Professor of Educational Technology, Webster University (St. Louis, MO); Doctoral student, Old Dominion University (Norfolk, VA)

Chris Luker, Chemistry Teacher, Highland Local Schools (Medina, OH); Doctoral Student, Kent State University (Kent, OH)

Helaine W. Marshall, Associate Professor of Education and Director of Language Education Programs, Long Island University-Hudson (Purchase, NY)

Lindsay C. Masland, Assistant Professor of Psychology, Appalachian State University (Boone, NC)

Jerry Overmyer, Mathematics and Science Outreach Coordinator, Mathematics Instructor, MAST Institute, University of Northern Colorado (Greeley, CO)

Aaron Sams, Board Member, Flipped Learning Network (Arlington, VA); Director of Digital Learning, Reformed Presbyterian Theological Seminary (Pittsburgh, PA)

AUTHORS

Noora Hamdan, Master's Student, George Mason University

Patrick E. McKnight, Associate Professor of Psychology, George Mason University

Katherine McKnight, Principal Director of Research, Center for Educator Effectiveness, Pearson

Kari M. Arfstrom, Executive Director, Flipped Learning Network

INTRODUCTION

A teacher stands at the front of the classroom, delivering a lecture on the Civil War and writing on a white board. Students are hunched over desks arranged in rows, quietly taking notes. At the end of the hour, they copy down the night's homework assignment, which consists of reading pages from a thick textbook and answering the questions at the end of the chapter. This dramatic, defining period in our nation's history, which left questions unanswered that are as relevant today as they were then, has been reduced to a dry, if familiar, exercise. The teacher is acutely aware that many students do not understand the day's lesson but does not have the time to meet with them individually during the 50-minute class period. The next day the teacher will collect and briefly review the homework assignment. If students have additional questions there won't be much time to linger. The class cannot fall behind schedule. There is a lot of material to cover before the test at the end of the unit.

Educators have been working to break this lecture-centered instructional model by shifting the focus from the curriculum pacing guide to student learning needs as the driver of instruction. They are, increasingly, turning to an alternative model of instruction called Flipped Learning in which digital technologies are used to shift direct instruction outside of the group learning space to the individual learning space, usually via videos. Offloading direct instruction in this way allows teachers to reconsider how to maximize individual face-to-face time with students. Time becomes available for students to collaborate with peers on projects, engage more deeply with content, practice skills, and receive feedback on their progress. Teachers can devote more time to coaching their students, helping them develop procedural fluency if needed, and inspiring and assisting them with challenging projects that give them greater control over their own learning.

Regarded as the pioneers of Flipped Learning, in 2007, two rural Colorado chemistry teachers, who were concerned that students frequently missed end-of-day classes to travel to other schools for competitions, games or other events, began to use live video recordings and screencasting software to record lectures, demonstrations, and slide presentations with annotations. Those materials were posted on the then-nascent YouTube for students to download and access whenever and wherever it was convenient. But the mode of delivery turned out to be less important than what it made possible. In a book on their work called Flip Your Classroom: Reach Every Student in Every Class Every Day (2012), the two teachers, Jonathan Bergmann and Aaron Sams, reported that, after they flipped their classroom, students began interacting more in class. Moreover, because time could be used more flexibly, students who were behind received more individual attention while advanced students continued to progress.

In early 2012, Sams and Bergmann started the not-for-profit Flipped Learning Network™ (FLN) to provide educators with the knowledge, skills, and resources to successfully implement the Flipped Learning model. The goals of the organization are to provide professional learning opportunities on Flipped Learning; to conduct, collaborate and disseminate relevant research on Flipped Learning; and to act as the clearinghouse for distributing best/promising practices for current and future "flipped" educators. Preceding the FLN was an online Community of Practice called the Flipped Learning Ning, which is a free website for educators who have flipped or wish to flip their classes. It is hosted by the Math and Science Teaching Institute at the University of Northern Colorado and maintained by Jerry Overmyer. One gauge to measure the interest in Flipped Learning is indicated by the number of participants in the Ning; in January 2012, there were 2,500 members; by March 2013, more than 12,000 educators had signed up. [1]

1 More information about the Flipped Learning Network™ can be found at www.flippedlearning.org. To join the Ning, a free online community of practice, go to www.flippedclassroom.org.

As technologies and broadband become more widely available and as the focus on integrating technology into learning increases, interest in Flipped Learning will likely continue to grow. In recognition of this interest, the Flipped Learning Network, with the support of Pearson Education and researchers at George Mason University, undertook a comprehensive review of relevant research. In this review, we define and describe the Flipped Learning model, briefly note its historical foundations and address common misconceptions. We discuss learning theories that underlie the model and describe current, although limited empirical research findings. We also describe concerns that have been raised.

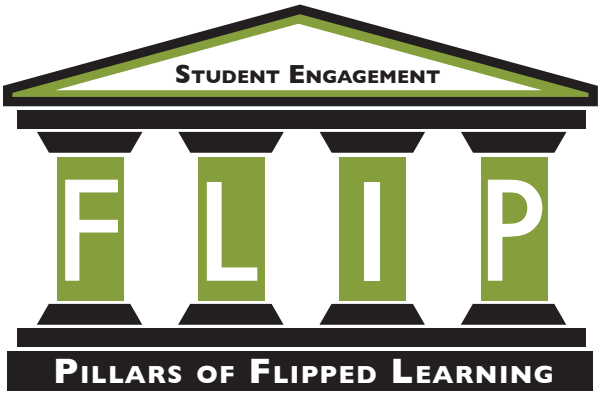
DEFINING FLIPPED LEARNING

In the Flipped Learning model, teachers shift direct learning out of the large group learning space and move it into the individual learning space, with the help of one of several technologies. Teachers record and narrate screencasts of work they do on their computer desktops, create videos of themselves teaching, or curate video lessons from internet sites such as TED-Ed and Khan Academy.[2] Many educators start flipping their classroom by using these readily available materials. The videos or screencasts are available for students to access whenever and wherever it is convenient—at home, during study hall, on the bus, even in the hospital—as many times as they like, enabling them to come to class better prepared (Musallam, 2011). Capitalizing on the students' preparation, teachers can devote more time to opportunities for integrating and applying their knowledge, via a variety of student-centered, active learning strategies such as conducting research or working on projects with classmates. Teachers also can use class time to check on each student's understanding and, if necessary, help them develop procedural fluency. Teachers can provide individualized support as students work through the activities designed to help them master the material, meeting them at their readiness level.

Flipped Learning has been compared to online, blended, and distance learning because of the screencast or video components, but, there are clear differences. Online education, for example, occurs only remotely, and the teacher and student are never face-to-face (Oblinger & Oblinger, 2005). Virtual class meetings, assignments, and lectures happen online through a course management website usually, but not always, asynchronously. Sometimes the lectures and other activities are augmented by group chats or other means of facilitating collaboration and peer instruction. Blended classes also have an online element, but that usually occurs during class time along with direct student-teacher contact (Allen, Seaman, & Garrett, 2007). Students' experiences in face-to-face sessions vary, however, and are not necessarily different than what occurs in a traditional classroom.

That is also the case in some flipped classrooms. The use of videos or other digital technologies to deliver content outside of class does not guarantee that anything different will occur during class time. However, due to the emphasis on students becoming the agents of their own learning rather than the object of instruction, the Flipped Learning model can enable educators to make the shift from teacher-driven instruction to student-centered learning.

2 TED-Ed (ed.ted.com) has an entire library of educational videos, made specifically accessible to professional educators who have flipped their classrooms. Likewise, Khan Academy has over 4,000 videos (khanacademy.org), many focusing on math and science, from which to select. Salman Khan, the website's founder, has said that while the Academy "has been associated with the idea of the 'flipped classroom'…the concept was actually conceived by others before Khan Academy existed" (Khan, 2012).



FOUR PILLARS OF FLIPPED LEARNING

Just as no two traditional classrooms are identical, such is the case with flipped classrooms. Because Flipped Learning focuses on meeting individual student learning needs as opposed to a set methodology with a clear set of rules, a cadre of experienced educators from the Flipped Learning Network, along with Pearson's School Achievement Services (2013), identified the key features, or pillars, of flipped classrooms that allow Flipped Learning to occur. The four Pillars of F-L-I-P™ are Flexible Environment, Learning Culture, Intentional Content, and Professional Educator.

FLIPPED LEARNING REQUIRES FLEXIBLE ENVIRONMENTS

Flipped classrooms allow for a variety of learning modes; educators often physically rearrange their learning space to accommodate the lesson or unit, which might involve group work, independent study, research, performance, and evaluation. They create Flexible Environments in which students choose when and where they learn. Flipped educators accept that the in-class time will be somewhat chaotic and noisy, as compared with the quiet typical of a well-behaved class during a lecture. Furthermore, educators who flip their classes are flexible in their expectations of student timelines for learning and how students are assessed. Educators build appropriate assessments systems that objectively measure understanding in a way that is meaningful for students and the teacher.

FLIPPED LEARNING REQUIRES A SHIFT IN LEARNING CULTURE

In the traditional teacher-centered model, the teacher is the main source of information, the teacher is the "sage on the stage" (King, 1993), i.e. the sole content expert who provides information to students, generally via direct instruction lecture. In the Flipped Learning model, there is a deliberate shift from a teacher-centered classroom to a student-centered approach, where in-class time is meant for exploring topics in greater depth and creating richer learning opportunities. Students move from being the product of teaching to the center of learning, where they are actively involved in knowledge formation through opportunities to participate in and evaluate their learning in a manner that is personally meaningful. Students can theoretically pace their learning by reviewing content outside the group learning space, and teachers can maximize the use of face-to-face classroom interactions to check for and ensure student understanding and synthesis of the material. Flipped educators help students explore topics in greater depth using student-centered pedagogies aimed at their readiness level or zone of proximal development, where they are challenged but not so much so that they are demoralized (Vygotsky, 1978).

FLIPPED LEARNING REQUIRES INTENTIONAL CONTENT

Flipped educators evaluate what content they need to teach directly, since lectures are an effective tool for teaching particular skills and concepts, and what materials students should be allowed to explore first on their own outside of the group learning space. They continually think about how they can use the Flipped Learning model to help students gain conceptual understanding, as well as procedural fluency. Educators use Intentional Content to maximize classroom time in order to adopt various methods of instruction such as active learning strategies, peer instruction, problem-based learning, or mastery or Socratic methods, depending on grade level and subject matter. If they continue to teach using a teacher-centered approach, nothing will be gained.[3]

FLIPPED LEARNING REQUIRES PROFESSIONAL EDUCATORS

Some critics of Flipped Learning have suggested that the instructional videos employed in the model will eventually replace educators. That is misguided. In the Flipped Learning model, skilled, Professional Educators are more important than ever, and often more demanding, than in a traditional one. They must determine when and how to shift direct instruction from the group to the individual learning space, and how to maximize the face-to-face time between teachers and students. Gojak (2012) noted that the right question for educators to ask themselves is not whether to adopt the Flipped Learning model, but instead, how they can utilize the affordances of the model to help students gain conceptual understanding, as well as procedural fluency when needed. During class time, educators continually observe their students, provide them with feedback relevant in the moment, and continuously assess their work. Professional Educators are reflective in their practice, connect with each other to improve their trade, accept constructive criticism, and tolerate controlled classroom chaos. While Professional Educators remain very important, they take on less visibly prominent roles in the flipped classroom.

RESEARCH AND INSTRUCTIONAL FOUNDATIONS OF FLIPPED LEARNING

Quantitative and rigorous qualitative research on Flipped Learning is limited; however, there is an established body of research that supports the key elements of the model, which are built on various instructional foundations to shift from a teacher-centered to a student-centered approach to instruction. As mentioned throughout this review, a key feature of the Flipped Learning model is the opportunity to maximize student learning opportunities in the classroom by deliberately shifting direct instruction to outside of the group learning space. The emphasis on maximizing one-on-one interactions turns the focus to student-centered instruction that more actively involves students in the learning process. These approaches are commonly said to involve "active learning," defined as "the process of having students engage in some activity that

3 The teacher-centered approach as described by Huba and Freed (2000) emphasizes a passive student role in learning as teachers transmit knowledge, outside of the context in which it will be used. The teacher is the primary information giver and evaluator, and assessment is used to monitor learning, with an emphasis on the right answers.

forces them to reflect upon ideas and how they are using those ideas" (Michael, 2006). Other relevant research on various instructional foundations include peer instruction, priming, and pre-training. There is a growing body of research on using the Flipped Learning model with diverse student populations as well.

ACTIVE LEARNING

A substantial body of research on student-centered, active learning strategies supports the effectiveness of these approaches in increasing student learning and achievement (e.g., Prince, 2004; Michael, 2006). Active learning is associated with improved student academic performance (Hake, 1998; Knight & Wood, 2005; Michael, 2006; Freeman, 2007; Chaplin, 2009), and increased student engagement, critical thinking, and better attitudes toward learning (O'Dowd & Aguilar-Roca, 2009). When problem-based active learning occurs in science courses, for example, students report learning more, and their attitudes toward class improve (Akinoglu and Tandogan 2006). Moreover, misconceptions are significantly reduced.

Student-centered models are usually defined in opposition to "teacher-centered" models (Michael, 2006). Teacher-centered models focus on the acquisition of knowledge outside of the context in which it will be used, and instructional delivery includes lecture, homework, and exams, used for assigning grades (Huba & Freed, 2000). Little time is allotted for teachers to work directly with students to guide them as they attempt to meaningfully apply the information. This approach has been described as a "one-size-fits-all" model of instruction, in which effective teaching is characterized as presenting information well, and those who can learn, will learn (Huba & Freed, 2000). In contrast, teachers using a student-centered approach engage students in actively constructing knowledge and they work together to evaluate students' learning (Huba & Freed, 2000). According to Michael (2006), students build mental models of what is learned, deliberately test the validity of those models, and fix faulty models. He cites multiple studies supporting that students learning in this way are more likely to achieve meaningful learning.

PEER INSTRUCTION

Eric Mazur at Harvard University is a leading researcher on "peer instruction" (1996), which emphasizes the kind of in-class interactional elements made more practical in a flipped classroom. In 2011, he demonstrated the strategies he uses with his students during a keynote address at the Building Learning Communities conference in Boston. He discussed how assistive technology allowed students to respond and give feedback during peer instruction sessions, maximizing the time available with the instructor and making it possible to increase the focus on higher order thinking skills. In the traditional setting, students used such time for note taking and repeating information.

Characteristics of Mazur's model include teachers engaging students by helping them examine their logic to reveal their misconceptions. Mazur explained, "Once you engage the students' minds, there's an eagerness to learn, to master" (Berrett, 2012). Bloom observed earlier (1984) that the continuous feedback and correction students receive during one-on-one interactions significantly improves learning and achievement. Focusing on Bloom's findings, teachers have been trying to integrate one-to-one interactions with their students in the classroom long before Mazur. The Flipped Learning model can facilitate this type of one-on-one attention by relegating the lecture portion of the traditional classroom to the outside, and allowing for more one-on-one interactions as teachers guide students in the integration and application of the content in class.

PRIMING

Another relevant area of research related to the potential impact of the Flipped Model is focused on the effects of preparing learners with direct instruction outside of the classroom, prior to receiving in-class instruction. Research on learning suggests some potential mechanisms by which this flipped approach might be effective. A large body of research on the effects of priming on memory indicates that when learners are exposed to particular stimuli, for example a set of facts, their memory or recall of that stimulus is improved due to their previous experience with the stimuli (Bodie et al., 2006). By providing students with direct instruction outside of the classroom, they are in essence "primed" for the active learning tasks carried out in the flipped classroom.

PRE-TRAINING

Research on the effects of pre-training on learning is a similarly relevant area for the Flipped Learning model. One of the tenets of pre-training is to reduce the cognitive load on learners, to enable them to process information more efficiently. According to Cognitive Load Theory, there is a limit to the amount of information that can be used, processed and stored by the working memory, and overloading that limit undermines the learning process (Chaudry, 2010). Ramsey Musallam, a San Francisco chemistry teacher and adjunct professor of education at Touro University, researched the effects of pre-training (receiving some instruction before in-class instruction) on the intrinsic cognitive load of students in an advanced high school chemistry class. Intrinsic cognitive load is a facet of Cognitive Load Theory that describes the effect of the learning environment on learning complex subjects. Musallam (2010) found a significant relationship between mental effort and pre-training for students, indicating that students needed to use fewer cognitive resources to learn new material when they received pre-training. This and other studies (Ayers, 2006; Mayer, 2009) suggest that pre-training may be an effective method of managing the intrinsic cognitive load and, thereby, provides one potential mechanism of the effect of the Flipped model on learning.

DIVERSE LEARNERS

While there has been little formal data collected that disaggregates the results of Flipped Learning for diverse subgroups of learners, the model suggests that different subgroups might benefit from the student-centered support from both the teacher and fellow classmates.

Regarding language learners, for example, Marshall and DeCapua (2013) note that in traditional classrooms, English language learners "put most of their effort into the lower levels" of Bloom's Taxonomy--understanding and remembering--as they attempt to follow the teacher's instructional delivery. In the flipped classroom, the teacher moves lower levels of the taxonomy to outside of the group learning space, where students can then work on mastering concepts on their own time and pace. When using video, for example, students can pause, rewind, and review the lesson at any time. In class, the teacher and students can then focus on the upper levels of the taxonomy (applying, analyzing, and creating). This has potential to allow struggling learners more opportunities to understand and improve their recall before they come to class, as previously described in the research on cognitive load. Marshall and DeCapua also note that the Flipped Learning model increases opportunities for in-class interaction with native speakers, which can

> "I've just finished reviewing lecture …for the second time. I personally like this flip classroom so far. I can spend my time study as much as I want and flip classroom makes my study livelier. Reading textbook alone can be bored some time. As…English learner…, I have some difficulties catching something in class. Flip classroom helps me a lot. However, I still like to go to class and have real conversation with Dr. M and my classmates."
>
> *Nattasiri, English learner from Thailand*

help English language learners further develop their academic language proficiency and confidence in using the language. As more classes are flipped and more data are collected on learners with diverse needs and backgrounds, it will be important to evaluate the potential benefits of the Flipped Learning approach for these student populations.

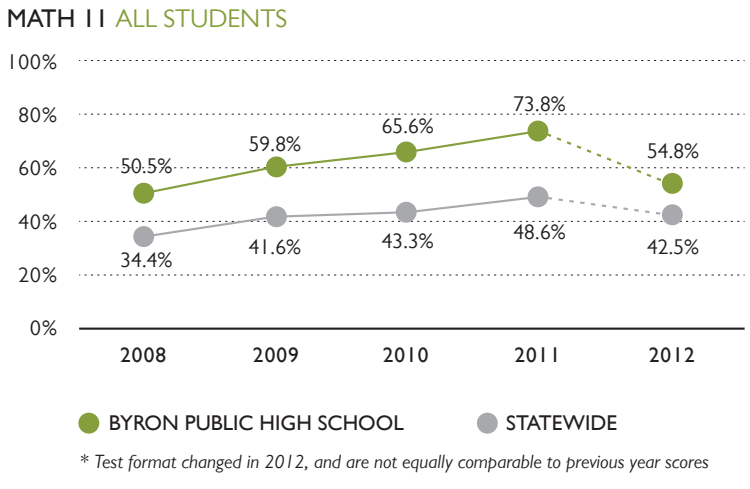
THREE K-12 CASE STUDIES

As noted previously, there is little rigorous empirical research on the effects of Flipped Learning on student achievement. However, the research that does exist consists of teacher reports on student achievement after adopting the model; descriptions of flipped classrooms; student, parent and teacher survey research; and numerous case studies documenting changes in student outcomes such as engagement, test scores, and disciplinary problems. Although limited, the research is promising, and warrants further inquiry.

The next section focuses on three case studies highlighting the Flipped Learning experience from three high schools that implemented the model for different reasons.

BYRON (MN) HIGH SCHOOL

The performance of Byron High School's students in math was perennially low. In 2006, fewer than one-third of students (29.9%) passed the state mathematics test (Minnesota Comprehensive Assessments) and ACT composite scores averaged 21.2. The scores prompted the school to analyze student performance data and take a critical look at its teaching. But the efforts to address the needs of students were limited by the fact that the school also was facing a financial crisis, which made replacing outdated textbooks impossible. Faced with this challenge, in 2009, Byron's math department came up with an ambitious idea: abandon all textbooks. Lead by math teacher Troy Faulkner, the school's math department wrote curriculum, identified open source materials, and adopted the flipped learning model (Fulton, 2012).



** Test format changed in 2012, and are not equally comparable to previous year scores*

After flipping their math classrooms, the teachers found that engagement increased and students began exceeding expectations. By 2011, nearly three-quarters (73.8%) of students passed the state math test, more than double the performance from just three years earlier, and the ACT composite scores improved to 24.5. Moreover, by 2012, 86.6% of Byron's seniors completed four or more credits of math. In recognition of these gains, Byron High School was designated a National Blue Ribbon School in 2010. The school also won the Intel Schools of Distinction award for High School Mathematics in 2011 (Fulton, 2012).

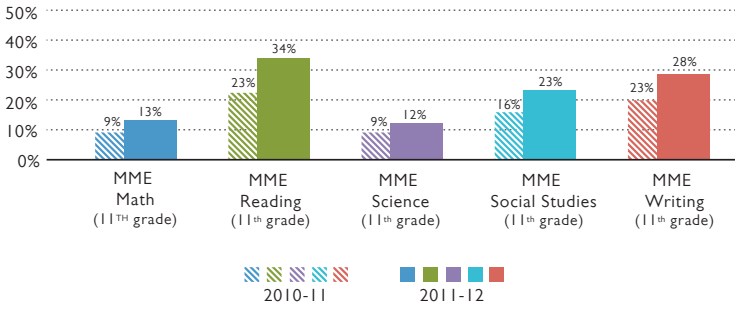
WOODLAND PARK (CO) HIGH SCHOOL

Woodland Park High School in Colorado faced a different problem—students were missing too many end-of-day classes because of extracurricular activities. Because Woodland Park is located in an isolated, rural community, many student athletes had to leave school early in order to compete at other schools. In working to find a solution, chemistry teachers Jonathan Bergmann and Aaron Sams (2012) realized that flipping their classrooms might be the way to ensure that those students who were missing class could still access the in-class lectures. They began discussing the potential of new software that would allow slide presentations, along with voice and annotations, to be recorded and converted into video files that could be easily distributed online.

In the spring of 2007, Sams and Bergmann started recording and posting their live class lessons using screencast software. After flipping where direct instruction and homework took place, students' interactions with one another in these classes increased. According to the educators, students who were behind began to receive the individual attention they needed to catch up to their peers, even as advanced students continued to be challenged.

CLINTONDALE (MI) HIGH SCHOOL

CLINTONDALE ACHIEVEMENT INCREASES ON MICHIGAN MERIT EXAM (MME)



The challenges of the teachers at Clintondale High School, located in a close-in suburb of Detroit, will be familiar to their peers around the world: their lecture-centered teaching was not connecting with their students, three-quarters of whom were minorities from low-income families. After hearing about Flipped Learning, the school in 2010, led by principal Greg Green, implemented the model in all freshman classes. By the end of the first semester, the school was seeing results. According to Green (2012), failure rates dropped by as much as 33 percentage points. The number of student discipline cases fell from 736 in 2009 to 249 in 2010 and to 187 in 2011, a drop of 74% in two years. Parent complaints also dropped, from 200 down to seven after the change in instructional models. Encouraged by these results, the principal converted the entire school to the Flipped Learning model in fall 2011.

FLIPPED LEARNING AND HIGHER EDUCATION

Flipped Learning is also being used in higher education, and results have been documented in student academic performance and student and instructor morale. Kelly Walsh, Chief Information Officer at the College of Westchester in White Plains, NY, became 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. He reported on several higher education institutions that have successfully implement Flipped Learning models. The short cases that follow were included in Walsh's implementation report (2010).

Upon applying an "inverted" model of learning (similar to the Flipped Learning model, where lecture material is delivered outside of class and students do guided work in class) in an electrical engineering class, Papadopoulos and Roman (2010) saw that students progressed through material faster, that students understood topics in greater depth, and additional content could be covered without sacrificing the quality of the course as a whole. Additionally, they found that 75% of students frequently or always helped other students in the class. In terms of student performance, test scores exceeded those in the traditional learning environment. On a pre-test, students in an inverted class answered about the same proportion of questions correctly, compared to their counterparts in a traditional classroom (18.3% and 17.1%, respectively; the differences were not statistically significant). At posttest, the difference in scores for the two groups was statistically significant, with students in the inverted class answering 31.2% of questions correctly, and those in a traditional class answering 24.1% of questions correctly.

Faculty at California State University, Los Angeles in 2008 flipped the freshman and sophomore Introduction to Digital Engineering course in order to increase opportunities for collaborative project-based learning. The shift was intended to address what was perceived to be the limited professor-student interaction and the prevalence of passive learning in engineering classrooms. In a post-course analysis, flipping the classroom seemed to be effective in helping students understand course material and develop design skills (Warter-Perez & Dong, 2012). Their findings were reinforced by satisfaction surveys and focus groups in which over 70% of students said the class learning environment was more interactive. In the same study, all students strongly agreed that the new learning environment allowed them to gain better hands-on design skills and agreed that the flipped class helped them to learn the content better. Overall, the results suggest that flipping the classroom in this instance had a positive effect on student learning and helped extend learning objectives.

However, not all research on Flipped Learning in higher education has reported positive effects. It may not be the best structure, for example, for an introductory course. In one study, students in a flipped college introductory statistics course reported being less than satisfied with the way they were prepared for the tasks they were given (Strayer, 2012). The reason may be that students in introductory courses have not yet developed a deep interest in the content, and thus may be frustrated when they encounter tasks that are not clearly defined. However, even in the introductory course, students indicated that they were more open to cooperative learning and innovative teaching methods (Strayer, 2012).

In another instance, the students who experienced web-supported learning versus lecture-based learning in a research methods and statistics course were less satisfied with the web-based instruction; however, they were more satisfied with the peer collaboration stimulated by this learning environment (Frederickson, Reed, & Clifford, 2005; Crouch & Mazur, 2001). There were no significant differences in students' knowledge and anxiety levels between the two versions of the course (Frederickson et al., 2005). In looking at the effect of the flipped classroom model on a computer applications course, Johnson and Renner (2012) found no significant differences between mean test scores of those who experienced the flipped classroom components and those students who did not. They also found no benefit to using the flipped method of classroom instruction in a secondary computer applications class. These results might be explained by the fact that the instructor of this course was asked to implement the Flipped Learning instruction method absent any perceived need.

PERCEPTIONS FROM TEACHERS, ADMINISTRATORS AND PARENTS

A modest amount of research exists from individual educators who practice the Flipped Learning model and their views on behalf of their pupils. Until recently, Flipped Learning has been mainly a grassroots movement, but now principals and superintendents are inquiring more about this model, as well as parents of students in flipped classes. A number of surveys have been conducted with these three groups and are highlighted below.

TEACHERS

An online survey of 450 teachers conducted in 2012 by the Flipped Learning Network in conjunction with ClassroomWindow found that teachers associate Flipped Learning with improved student performance and attitudes, and increased job satisfaction. Of the teachers surveyed, 66% reported their students' standardized test scores increased after flipping their classrooms. In the same survey, 80% of teachers perceived an improvement in their students' attitudes towards learning. Nearly nine in ten of the teachers surveyed reported that their job satisfaction also improved, with 46% reporting significant improvement.

While the Flipped Learning model was not the intended topic of this research, it does warrant inclusion because of the related findings on use of video by teachers. In a nationally representative survey of 1,401 pre-K-12 classroom teachers, PBS and Grunwald Associates (2010) found that 68% of teachers believed that using videos helped to stimulate discussion, 66% associated videos with increased student motivation, and 62% said they helped make them more effective. Over half (55%) said they were more creative when they used videos. A majority of teachers (61%) also said students prefer videos over other types of instructional resources and just under half (47%) said videos stimulated student creativity.

The Flipped Learning and Democratic Education survey conducted by Tom Driscoll at Teachers College, Columbia University in 2012 was completed by 26 educators and 203 students from across the United States. Overall, close to 80% of students in flipped classrooms agreed that they have more constant and positive interactions with teachers and peers during class time; they said they have more access to course materials and instruction; are more able to work at their own pace; they can exercise more choice in how they demonstrate their learning; and they viewed learning as a more active process. Close to 70% reported that they are more likely to have a choice in what learning tasks they engage in; they are more likely to engage in collaborative decision making with other students; they are more likely to engage in critical thinking and problem solving; and that the teacher was more likely to take into account their interests, strengths, and weaknesses. According to Driscoll (2012), these results suggest how Flipped Learning can democratize the learning environment.

FLIPPED LEARNING AND DEMOCRATIC EDUCATION SURVEY

80% of students agree that they...

- Have more constant and positive interactions
- Have greater opportunities to work at own pace
- Have greater access to course material and instruction
- Have more choice in how they demonstrate their learning
- View learning as a more active process

70% of students agree that they...

- Are more likely to engage in collaborative decision making
- Are more likely to engage in critical thinking and problem solving
- Teacher is more likely to take into account their interests, strengths, and weaknesses
- Are more likely to have a choice in what learning tasks they engage in

Of the educators surveyed, 100% agreed that after flipping their classrooms, learning became more active. Over 90% said that positive interactions with their students increased; students had greater access to course material and instruction, students could work at their own pace; students were more likely to engage in critical thinking; and instruction became more differentiated and personalized. Close to 80% reported that positive interactions between students increased; that students became more likely to engage in collaborative decision-making; and that students were more likely to have choices in how they demonstrated what they'd learned. Over 50% agreed that students were more likely to have a choice of which learning tasks to engage in.In fall 2012, over 466,000 K-12 students, parents, teachers, and administrators participated in the annual Speak Up online surveys facilitated by the national education nonprofit organization, Project Tomorrow©. Specific questions about Flipped Learning were asked for the first time in that survey. The survey defined Flipped Learning as a model in which students watched instructional videos as homework and class time was used for "discussions, projects, experiments and to provide personalized coaching to individual students." Of the more than 56,000 teachers and librarians who responded, 6% indicated they were using videos they found online and 3% said they had already created videos as part of flipping their classroom.

The survey also found that 18% of teachers and 27% of administrators said they were interested in trying Flipped Learning this year. Twenty percent of teachers said they wanted to learn more about how to create instructional videos for their students to watch and 15% wanted to learn how to implement a flipped classroom model. Nearly 60% of the students in grades 6-12 who participated in the Speak Up survey agreed with the statement that Flipped Learning "would be a good way for me to learn." Teachers who have implemented Flipped Learning also report feeling re-energized by their heightened interaction with students (Baker, 2012).

ADMINISTRATORS

Of the more than 6,000 administrators who responded to the same SpeakUp survey, 23% said that their teachers are using videos they found online and 19% reported that their teachers are creating their own videos for use in Flipped Learning. Teachers and site administrators agreed that the following hindrances, however, are keeping them from flipping their classrooms: concern that students might not have access to the internet at home; the teachers' needs for professional development to help them learn to make or find high quality videos; and how to best utilize the additional classroom time (Speak Up survey, 2012).

Administrators need to support and motivate professional educators as they transition to flipped classrooms. Flipped Learning Network board members Jon Bergmann and Brian Bennett identified several ways administrators can do this during a fall 2012 webinar titled "Flipped Learning: What it Means for District Administrators." Their recommendations align with what others have noted as strong leadership skills for managing change (e.g., Marzano et al., 2005). First, when observing flipped classrooms, administrators should pay attention to whether students are engaged and learning, although classrooms may seem louder and more chaotic than traditional classrooms. Also, administrators need to encourage teachers as they struggle to master the new model. They should communicate to their teachers that they recognize the challenges involved and listen to their concerns. Administrators also need to serve as a buffer for teachers who flip their classrooms. As with anything new, there are bound to be many questions and concerns from parents and even other teachers, and administrators should be prepared to address them.

The March 2013 issue of the School Administrator, published by the American Association of School Administrators (www.aasa.org), was dedicated to the topic of flipped learning. Many leaders weighed in:

"What I observed…in the classroom at Piedmont Elementary School exemplifies the potential for personalized learning through flipped instruction."

Matt Akin, School Superintendent, Piedmont City School District Piedmont, AL

"I am certain many of my colleagues across central Illinois thought I had indeed flipped out... We were proposing the entire high school staff. Our failure rate was simply too high to accept. Principal Don Willett and I set out to change the course of our education content delivery system — and ultimately the lives of our 350 students."

Patrick Twomey, Superintendent, Havana School District #12 Havana, IL

"This new model is challenging teachers to reflect on their practice and rethink how they reach their students. It is an approach that encourages students to set the pace for truly individualized instruction. It is a catalyst for teachers, administrators, and students to change the way things have always been done."

Joe Corcoran, Principal, Harriet Gifford Elementary School, Elgin, IL

It is also critical that administrators ensure that the technology department is providing adequate support to teachers. Bergmann and Bennett noted that flipping works best when the IT staff is on board and supports the changes. Encouraging teachers who have made the flip to work together and support one another is also critical (Schoolwires, 2012).

PARENTS

Whenever children's homework changes, as it will with Flipped Learning, parents need to be on board. Flipped Learning Network members Katie Lanier and Crystal Kirsh presented a webinar in March, 2013 titled "Engaging and Informing Parents in the Flipped Learning Process." Their premise is that change can be difficult and therefore the need for ongoing communication is critical to success. They suggest teachers keep parents informed through written communications or through a short illustrative video (or both) prior to implementing this model. They suggest that updates be provided mid-year and at year-end, along with a short survey to elicit parents' views of the experience. Educators, along with their administrators, should inform parents why this change is being made and set expectations for students and parents as to how this

model differs from the previous classroom structure. Explaining the shift directly to parents can help avoid difficult situations before they occur (Schoolwires, 2013).

With Flipped Learning, parents may welcome the opportunity to watch videos with their children to gain a better understanding of what they are learning and may become more involved and engaged as a result. Parents will gain greater understanding of what their children are learning and how the teacher teaches. Parents of 5th grade math students who participated in a pilot project in Stillwater, Minnesota reported that their children's attitudes towards math were either the same or improved, their children were doing better in math, and that they wanted the flipped approach to be continued.

Karen Cator, former director of the Office of Educational Technology for the U.S. Department of Education, also says that Flipped Learning may increase parents' participation in their students' learning. Cator acknowledges that while the trend toward Flipped Learning is growing, more research is required in order to determine its effectiveness (Baker, 2012).

Students weigh in about Flipped Learning

Kaitie, a high school senior said, "For the first time ever I had the ability to "pause the teacher" while watching the lectures online. Working on my own timetable allowed me to explore learning styles and techniques, and to hone in on the way that I learn best. Another reason I enjoy the flipped class so much is the stress-free environment it creates. I cannot remember a time when I was stressed out about my flipped chemistry classes. I most definitely have been stressed about other classes that are not taught in the flipped classroom model, and I looked forward to my flipped class. The bottom line is that I learned in the flipped classroom. And that learning that occurred helped me get through many classes in high school, simply by learning how to learn."

From Kylie, a high school senior: "The flipped teaching model allowed me to learn at my own pace and made a huge impact on my education. Almost overnight, my grades went from Bs and Bs to all As. I began to understand complex problems that I never before grasped. When I took the ACTs a second time after my junior year, I ended up scoring a 22 on the test! I was thrilled, and couldn't believe how much I improved. With my new grades and ACT score, I realized that there were a lot of options for me beyond high school, and I would no longer have a limited future. I truly believe that the flipped classroom has changed my life, and opened many doors. This year has been a really exciting one for me: I have enjoyed thinking of what my education will bring in the next few years."

CONCERNS ABOUT FLIPPED LEARNING

Some have argued that the student-centered instruction and engaged, active learning made possible in a flipped classroom represents what should already be occurring in classrooms (Stumpenhorst, 2012). They also contend that Flipped Learning is not a defined model but is, instead, the result of teachers using different tools to meet individual students' needs. This is a valid observation. The flipped classroom model does not eliminate the lecture or other means of direct instruction. Instead, it removes lectures from the group learning space to maximize the amount of time teachers have to spend with individual students and students have to spend working with one another. Flipping the classroom provides more time to address the needs of individual students and enables more active and engaged learning, without sacrificing the amount of material that can be covered. It is true that the Flipped Learning model is not the only way to facilitate good teaching. However, effective teaching may be better enabled and flourish more readily in flipped classrooms.

Another concern is voiced by those who want to use the Socratic Method to engage students in the material as it is being delivered. These teachers believe that a flipped classroom sacrifices actual instruction in order to increase opportunities for student collaboration and activities generated and led by students. However, as Marshall (2013) points out in her model of Flipped Learning, one key role for teachers is to "lead from behind." In other words, the teacher engages in "observation, feedback, and assessment" during class and, in the process, guides the learners' thinking, in the best spirit of the Socratic Method. The difference, and

perhaps a major benefit, according to Marshall (2013) is that this instruction is spontaneous, cannot be planned out, and is relevant for the learners at that moment. Furthermore, the learners themselves can fill these same three roles as they observe and provide feedback to each other during class and as they assess their own learning.

Gary Stager, an educator, speaker, and journalist, is a critic of Flipped Learning. He expressed three concerns about the model during a radio debate with Aaron Sams on Southern California Public Radio (2013). First, he argued that the Flipped Learning model places too much emphasis on lectures and homework, neither of which is productive, and merely flips the position of the two. Next, Stager said that the need to flip the classroom is symptomatic of a bloated curriculum. Because schools are trying to cover too much content, some of it has to be taught outside of class. He also contended that, rather than opening up classroom time for student-centered instruction, the Flipped Learning model requires standardizing the learning experience and will further the privatization of education and the elimination of most teachers. He predicts that mediocre teachers will be hired to create videos of lectures that are not customized for the specific needs of a class.

As is true of all models, Flipped Learning can be done poorly. This literature review has stressed that flipping the classroom creates the potential for active, engaged, student-centered learning, peer interactions, and personalized instruction. But none of these result automatically from moving direct instruction outside of the group learning space. Stager is concerned that flipping the classroom is a way to replace teachers with videos. But, as has been amply illustrated, skilled, professional teachers are critical to success in a flipped classroom. Teachers have to know how to facilitate learning, and not just be able to proficiently communicate content.

Sams and Bergmann (2012) share Stager's concern about generic videos substituting for teachers delivering instruction adapted to the needs of the students in their own classroom. Ideally, teachers will make their own videos and, as the model spreads, it will be important for teachers to have opportunities to gain the skills required. However, it should also be acknowledged that videos produced by other teachers who have a different style may better serve the needs of some students. In addition, teachers are not necessarily experts in all facets of their field. They can supplement their own knowledge by selecting videos of other teachers who may be more knowledgeable in some areas.

Concerns also have been raised about students having unequal access to technology. While this is a legitimate concern, it is important to note that home use of computers and the internet is increasing rapidly. In a survey conducted in 2010 by Child Trends, 57% of children aged 3 through 17 had used the internet at home, nearly three times the percentage in 1997 (22%). Almost 85% of students had access to a computer at home (compared to 15% in 1984). It is true, however, that Hispanic and African American children, children whose families who have lower incomes, and children whose parents are less educated have less access to computers and the internet. More than 90% of White and Asian/Pacific Islander children have computers they can use at home, compared to about three-quarters of Hispanic and African-American children. About two-thirds of White and Asian/Pacific Islander children can access the internet at home, compared to just under half of Hispanic and African-American children (Child Trends, 2012).

It is likely that these disparities will lessen over time. Meanwhile, there are multiple ways to deliver instruction digitally. The simplest is to download the material to memory device that can be plugged into the home computer. Video lessons also can be made available via Smartphones, which are increasingly ubiquitous. Similarly, parents who have iPods or iPads can set up a free iTunes account and students can then subscribe to receive the material. Teachers can burn lessons onto DVDs that can be viewed on computers in the school or public library or at home.

It is important to note that Flipped Learning might not work for all educators and students or with all grades and subject matters. Not all educators will succeed with it and some students may prefer traditional classroom approaches. In their book, Bergmann and Sams (2012) noted that Flipped Learning might be appropriate for certain lessons or units in some lower elementary grades, but not entire classes. Research that focuses on who benefits, in what ways and in what contexts, from the Flipped Learning model, would help educators to understand when flipping the classroom would benefit learners and when it might not be warranted.

CONCLUSION

As illustrated throughout this paper, more qualitative and quantitative research needs to be done to identify how the potential of the model can be maximized. But the existing research clearly demonstrates that the Flipped Learning model can be one way to create a classroom environment that is learner-centered. The Flipped Learning model should by no means be thought of as a panacea for solving all educational issues, rather, it might be one way to enable learning. This is something that most teachers want to do but are constrained by the current organization of schools and other barriers.

Michael Gorman (2012) observed that any learner-centered educator would provide activities in the classroom that are action based, authentic, connected and collaborative, innovative, high level, engaging, experience based, project based, inquiry based, and self-actualizing. Gojak (2012) noted that the right question is not whether or not to flip your classroom, instead, professional educators ought to ask how they can use the affordances of this model to become more effective as teachers and increase students' conceptual understanding, as well as procedural fluency (where necessary). The Flipped Learning model provides that bridge to a learner-centered classroom environment, thereby enabling deeper learning (Bergmann & Sams, 2012) that educators are seeking.

REFERENCES

Akinoglu, O. & Tandogan, R. (2006). The effects of problem-based active learning in science education on student's academic achievement, attitude and concept learning. *Eurasia Journal of Mathematics, Science & Technology,* 3, 71-81.

Ayers, P. (2006). Using subjective measures to detect variations of intrinsic cognitive load within problems. *Learning and Instruction, 16(5)*, 389-400.

Baker, Celia. (2012, November 25). Flipped classrooms: Turning learning upside down: Trend of "flipping classrooms" helps teachers to personalize education. *Deseret News.* Retrieved from http://www.deseretnews.com/article/765616415/Flipped-classrooms-Turning-learning-upside-down.html?pg=all

Bergmann, J. & Sams, A. (2012). *Flip Your Classroom: Reach Every Student in Every Class Every Day.* International Society for Technology in Education.

Berrett, D. (2012, February 19). How 'flipping' the classroom can improve the traditional lecture. *The Chronicle of Higher Education.* Retrieved from http://chronicle.com/article/How-Flipping-the-Classroom/130857/

Bloom, B. S. (1984). The 2 sigma problem: The search for methods of group instruction as effective as one-to-one tutoring. *Educational Researcher, 13(6)*, 4-16.

Chaplin S. (2009). Assessment of the impact of case studies on student learning gains in an introductory biology course. *J. College Science Teaching*, *39*, 72–79.

Child Trends. (2012). Home Computer Access and Internet Use. Retrieved from Child Trend's website: http://www.childtrendsdatabank.org

ClassroomWindow and Flipped Learning Network. (2012). *Flipped Classrooms: Improved test scores and teacher satisfaction*. Retrieved from Classroom Window website: http://classroomwindow.com/flipped-classrooms-improved-test-scores-and-teacher-satisfaction/

Clintondale High School (2013). *About Clintondale High School.* Retrieved from Clintondale High School's website: http://flippedhighschool.com/

Driscoll, Tom. (2012). *Flipped Learning and democratic Education: The Complete Report.* Retreive from http://www.flipped-history.com/2012/12/flipped-learning-democratic-education.html

Frederickson, N., Reed, P., & Clifford, V. (2005). *Evaluating web-supported learning versus lecture-based teaching: Quantitative and qualitative perspectives.* Kluwer Academic Publishers, 50(4), 645-664.

Freeman S., O'Connor E., Parks J. W., Cunningham M., Hurley D., Haak D., Dirks C., Wenderoth M. P. (2007). Prescribed active learning increases performance in introductory biology. *CBE Life Science Education, 6,* 132–139.

Fulton, K. (2012, April). Inside the flipped classroom. *The Journal.* Retrieved from http://thejournal.com/articles/2012/04/11/the-flipped-classroom.aspx

Gojak, L. (2012, October). To Flip or Not to Flip: That is Not the Question! *National Council of Teachers of Mathematics.* Retrieved from http://www.nctm.org/about/content.aspx?id=34585

Gorman, M. (2012, July 18). *Flipping the classroom...a goldmine of research and resources keep you on your feet.* Retrieved from http://21centuryedtech.wordpress.com/

Green, G. (2012, July). *The Flipped Classroom and School Approach: Clintondale High School.* Presented at the annual Building Learning Communities Education Conference, Boston, MA. Retrieved from http://2012.blcconference.com/documents/flipped-classroom-school-approach.pdf

Hake, R. (1998). Interactive-engagement versus traditional methods: a six-thousand-student survey of mechanics test data for introductory physics courses. *American Journal of Physics, 16,* 64–74.

Johnson, L., & Renner, J. (2012). *Effect of the flipped classroom model on secondary computer applications course: student and teacher perceptions, questions and student achievement* (Doctoral Dissertation, University of Louisville).

King, A. (1993). From sage on the stage to guide on the side. *College Teaching, 41(1),* 30-35. http://www.edweek.org/ew/articles/2012/10/03/06khan_ep.h32.html

Knight J. K., & Wood W. B. (2005). Teaching more by lecturing less. *Cell Biology Education*, *4,* 298–310.

Lochead, J., & Mestre, J. (1988). From words to algebra: Mending misconceptions. In A. Coxford & A. Shulte (Eds.), *The Ideas of Algebra, K-12* (1988 Yearbook of the National Council of Teachers of Mathematics, pp. 127-135). Reston, VA: National Council of Teachers of Mathematics.

Marshall, H. W. (2013, March 21). *Three reasons to flip your classroom*. Retrieved from http://www.slideshare.net/lainemarsh/3-reasons-to-flip-tesol-2013-32113

Marshall, H. W. & DeCapua, A. (in press). *Making the transition: Culturally responsive teaching for struggling language learners.* University of Michigan Press: Ann Arbor, MI.

Mayer, R. E. (2009). *Learning and Instruction.* Pearson/ Merrill/ Prentice Hall: Upper Saddle River, NJ.

Mazur, E. (1996). *Peer Instruction: A User's Manual.* Addison Wesley: Boston, MA.

Michael, J. (2006). Where's the evidence that active learning works? *Advances Physiology Education*, *30,* 159–167.

Musallam, R. (2010). *The effects of screencasting as a multimedia pre-training tool to manage the intrinsic load of chemical equilibrium instruction for advanced high school chemistry students* (Doctoral Dissertation, University of San Francisco).

O'Dowd, D. K., & Aguilar-Roca, N. (2009). Garage demos: using physical models to illustrate dynamic aspects of microscopic biological processes. *CBE Life Science Education*, *8,* 118–122.

Papadapoulos, C. & Roman, A. S. (2010). Implementing an inverted classroom model in engineering statistics: Initial results. *American Society for Engineering Statistics.* Proceedings of the 40th ASEE/IEEE Frontiers in Education Conference ,Washington, DC, October 2010

Pearson & The Flipped Learning Network (2013). *Flipped Learning Professional Development*. Retrieved from http://www.pearsonschool.com/flippedlearning

Prince, M. (2004). Does Active Learning Work? A Review of the Research. *Journal of Engineering Education*, *93*, 223-231.

Project Tomorrow. (2013). *Speak Up Survey*. Retrieved from http://www.tomorrow.org/speakup/

Southern California Public Radio (Producer). (2013, February 20). *Can flipping the classroom fix the educational system?* [Audio Podcast]. Retrieved from http://www.scpr.org/programs/airtalk/2013/02/20/30599/can-flipping-the-classroom-fix-the-educational-sys/

Strayer, J. (2012). How learning in an inverted classroom influences cooperation, innovation and task Orientation. *Learning Environments, 15(2),* 171.

Stillwater Area Public Schools. (2012). *The Flipped Classroom*. Retrieved from http://www.stillwater.k12.mn.us/departments/technology/technology-around-district/flipped-classroom

Stumpenhorst, J. (December 3, 2012). *Not Flipping for Flipped*. Retrieved from http://stumpteacher.blogspot.com/2012/12/not-flipping-for-flipped.html

University of Minnesota Center for Teaching and Learning. (2008). *What is Active Learning?* Retrieved from http://www1.umn.edu/ohr/teachlearn/tutorials/active/what/index.html

Vygotsky, L. S. (1978) *Mind in society: The development of higher psychological processes*. Harvard University Press: Cambridge, MA.

Walsh, K. (2010). About Emerging Education and Instructional Technologies and Sharing the Learning Journey. Retrieved from http://www.emergingedtech.com\about

Warter-Perez and Dong, Jianyu. (April, 2012). *Flipping the classroom: How to embed inquiry and design projects into a digital engineering lecture*. Paper presented at ASEE PSW Section Conference, California Polytechnic State University, San Luis Obispo.

(c) Flipped Learning Network 2013