Humanizing the Classroom by Flipping the Homework versus Lecture Equation

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Abstract: Technology is often accused of separating people, and in classrooms it can distance students even further from teachers if used improperly. However, innovative educators are using technology to revolutionize teaching by inverting or flipping the homework versus lecture equation. In an inverted or flipped classroom, students review pre-recorded lecture content online before class, freeing class time for active learning. Salman Khan, an entrepreneur and vocal proponent of flipping the lecture versus homework equation believed that flipping the homework with lecture literates and humanizes the classroom. Current research and practices about the inverted teaching, requirements for its successful implementation, and its possible payoffs are discussed in this paper.

Introduction

Bloom's taxonomy has been considered as a cornerstone of learning and it was revised as recently as 2000 (Bloom, 1956; Pohl, 2000). Bloom's taxonomy divides educational learning objectives into three domains: cognitive, affective and psychomotor (Krathwohl, Bloom, & Masia,1973; Pohl, 2000; Simpson,1972). According to Bloom (1984), an average student who receives one-on-one attention is enabled by constant feedback and corrective process, and can jump into the 98th percentile of the student population in academic achievement. Although his study caught educators' attention, it hasn't changed the standard teaching practices, mostly because one-on-one instruction is too expensive (Thompson, 2011).

New approaches in using technologies, however, have started to present great potentials for incorporating sound pedagogies into classroom teaching without incurring additional cost. The purpose of this paper is to describe a study where activities traditionally take place *inside* the classroom took place *outside* the classroom – an approach called "flipped homework versus classroom equation" by some (e.g., Kahn, 2011), and "inverted teaching/classroom" by others (e.g., Lage, Platt, & Treglia, 2000).

Flipping the Homework and Classroom Equation

In March 2011, at Ted Talk, Salman Khan, a hedge fund manager with multiple degrees in math and science from MIT spoke about flipping the homework/lecture equation and about what pushed him to create Khan Academy (www.khanacademy.org/), a very successful and free source of over 2,600 online tutorials covering everything from basic arithmetic to linear algebra, finance and chemistry. Khan asserts that teachers in a traditional classroom spend five percent of their time actually working with students, while spending the other 95 percent lecturing, creating lectures or grading. Using Khan's free online math tutorials, teachers flipped this equation to "humanize the classroom" (Khan, 2011).

Khan began to create math videos using Microsoft Paint to tutor his cousins. His cousins told him that "they preferred [him] better on Youtube than in person…they preferred the automated version of their cousin to their cousin... [because] they can pause and repeat their cousin, without wasting [his] time" (Khan, 2011). From his cousins' comments, Khan had a major realization that students value reviewing material they've already been exposed to as well as new materials at their own pace and in privacy, because this allows them to spend the time they need to learn without embarrassment, or to move ahead more quickly if they need to. He realized that "the very first time you're trying to get your brain around a new concept, the very last thing you need is another human being asking, do you understand this" (Khan, 2011). In 2010, the Los Altos, California, public school district asked Khan to work with several math classes. Kami Thordasrson, a fifth-grade math teacher, volunteered to use Khan Academy lectures in her lessons. Students generally watched lectures at home freeing class time to work on math problems. Thordasrson observed that this strategy helped her to give "specific, pinpointed help when needed" (Thompson, 2011, p. 1). At midyear, thirteen percent of Thordasrson's students were classified as average or lower in testing, but after implementing the Khan academy project, that percentage dropped to three percent (Thompson, 2011). Currently, over one million students around the world are using Khan's tutorials. Bill Gates, whose foundation invested $1.5 million in Khan's site, believes that Khan's approach has proved that education can be customized so that individual students get the help they need (Thompson, C. 2011).

Inverted Teaching

Lage, Platt, and Treglia (2000) described reasons for and results of their attempt at flipping the classroom environment. They advocated that instructors should engage students in using "a portfolio of teaching styles so as to appeal to a variety of student learning types" (p. 30). They further argued that although no teacher could incorporate lessons to fit all learning styles in a traditional classroom lecture environment, advances in online multimedia that students could utilize to learn, as well as user-friendly multimedia software for development had advanced enough to allow instructors to "provide a [multimedia] menu of options for student to use in learning…[allowing] students to choose the best method to reach [the instructor's desired learning] outcome" (p. 32). In the fall of 1996, Lage, Platt and Trelia chose to flip 5 out of 35 sections of a required introductory microeconomics class at Miami University. All the sections used the same materials, and two different instructors taught sections of about 40 students. On the first day of class, students were told they would be responsible for reviewing videos of the lectures, or watching power point slides of the lectures with accompanying audio to prepare for class. They were also instructed to complete worksheets related to the topic, and these worksheets were randomly taken up for grading. To ensure students had ample support, supplementary materials, including optional interactive online quizzes, were provided on a class Website. Instructors began each class by asking for questions regarding the online "lecture" materials. Often students did ask for clarification, which usually led to a 10-minute lecture reviewing problem areas. If students didn't ask questions the instructor informed the class that a lack of questions led him/her to assume they understood the material. Instead of using class time to lecture, the instructor led hands-on activities and experiments relating to the weekly topic (Lage, Platt, & Treglia, 2000, pp. 33-34).

At the end of the semester, students completed a survey. Most rated the class favorably compared to normal lecture classes and indicated that they enjoyed and learned a lot working in groups (Lage et al., p. 35). The two instructors noted that students appeared to be more motivated in an inverted class. "One possible explanation is that this type of classroom demanded that students take ownership of their learning" (Lage et al., p. 37). Faculty-student interaction helped instructors "monitor performance and comprehension." And the instructors enjoyed interaction with students, calling it a "stimulating" environment that required "active involvement with students" (Lage, Platt, & Treglia, 2000; pp. 37). Lage, Platt and Treglia (2000) concluded that the exercise was a success. They acknowledge the intensive work required to create and upload the video and PowerPoint lectures, supplemental materials and online quizzes, as well as the effort required to create and facilitate hands-on class activities. However, they note that many materials, quizzes and class activities can be found online or slightly altered from previously used lecture materials. The instructors didn't sacrifice any content, yet they increased the amount of time they spent actively interacting with students. In addition, since they did not have to prepare hour-long lectures, their pre-class prep time dropped dramatically (Lage, Platt, & Treglia, 2000; pp. 38-41). Four years later, in 2000, Miami University was using this method for all its microeconomics sections, and Lage and Platt called the course Website the "cornerstone" of the class. The Website is "divided into 4 distinct components – the classroom, the desk, the coffee shop, and the library – that map to different real-world student learning environments…the philosophical foundation

of our Website is that the Internet provides students with an excellent complement, not substitute, to their in-class efforts" (Lage, Platt, 2000, p.10).

In Fall 2000, professors at the University of Wisconsin-Madison used eTEACH, a streaming video and multi-media application, to upend the lecture and homework paradigm for large engineering classes, proving that Lage's and Platt's inverted classroom could work with larger classes. Students viewed eTEACH lectures on their own time, and professors utilized class time to facilitate small team problem-solving sessions. Two semesters of evaluation revealed students rated the flipped paradigm course higher in all aspects "including lecture usefulness, professor responsiveness, the course overall, and the instructor" (Foertsch, Moses, Strikwerda, Litzkow, 2002, p. 267). The authors of the resulting paper argue that although a professor can often convey foundational information best via lecture, classroom lectures "take up most of the available time that students and professors have to interact" (Foertsch et al., p. 267). Most students don't think of questions during lectures, but rather while they're working through homework. According to the Wisconsin-Madison study, many professors learn what students understand by "watching a student attempt to apply or misapply the principles being taught" (Foertsch et al., p. 267). If professors don't interact with students as they attempt to use knowledge from lectures, they only see evidence of learning on tests or assignments and even then teachers can often only guesstimate "how and why students arrived at the answers" (Foertsch et al., p. 268). As Salman Khan said in his 2011 Ted Talk: “By removing the one size fits all lecture from the classroom and letting students have a self paced lecture at home, and then when you go to the classroom, letting them do work, having the teacher walk around and having the peers actually interact with each other - these teachers have used technology to humanize the classroom.” (Kahn, 2011). A big bonus with online lectures for students is the ability to pause, re-wind and re-watch material at their own pace. Around 89 percent of the Wisconsin-Madison students went back over parts of lectures to learn the material and 67 percent re-watched lectures to study for exams (Foertsch et al., p. 268).

In the Spring of 2008, Pennsylvania State University engineering faculty members flipped a large undergraduate architectural engineering course entitled “Introduction to the Building Industry.” The instructor had begun using iTunesU to post videotaped lectures for review in 2007. Those lectures were edited for the spring inverted teaching experiment. To help ensure students watched the lectures and read the textbook and any supplementary materials, online quizzes were posted each week (Zappe, Leicht, Messner, Litzinger, Lee. 2009. pp. 5). Some 92 percent of students reported watching the video one time, and many reviewed trouble areas more than once (Zappe et al., p. 6). Some 74 percent of students thought flipped classes helped them understand concepts and 24.7 percent thought flipped classes were somewhat helpful. Overall, 75.3 percent of students agreed or strongly agreed that spending class time solving problems rather than listening to a lecture helped them learn (Zappe et al., p. 8). The authors of the study (2009) suggested the following steps for successful implementation of a "flipped" classroom: “1) Require students to complete an online quiz before students come to class as a “gate- check” to make sure that they are prepared. 2) Keep the videos relatively short (no longer than 20 to 30 minutes) in order to ensure that students watch them. 3) Briefly review the course content before in-class activities to answer any questions and to make sure that the majority of the students have sufficient understanding of the material. 4) Consider adding multi-media to the online lectures in order to keep students interested and engaged in the material.” (p. 11)

In 2010, a Potomac, Maryland high school math teacher flipped her classroom. Stacey Roshan, an AP Calculus teacher at Bullis High School, switched to what her students call the "backwards classroom" after a few years of watching students leave class "with that look on their face that you just don't want to see as a teacher" (Schaffhauser, 2011. p. 1). She had been cramming as much content into class periods as possible, leaving very little room to answer student questions, but she couldn't cover less material. At a summer conference, she discovered Camtasia Studio, a video capture program that records the user's computer screen and voice, and allows editing. She recreated problems using PowerPoint and then used Camtasia to talk students through the solution. Students began watching recorded lectures at home and spending class time working through "homework." Roshan admits the process takes a lot of time - about an hour and 15 minutes to record and edit a 30-minute lecture. But now instead of lecturing in class, Roshan spends time "just walking around seeing what [students] need help with…they're able to work at their own pace" (Schaffhauser, 2011. p. 2). A 17-year-old junior says the technique has "made math class less full of anxiety" (Schaffhauser, 2011. pg. 3). Teachers at other schools have started using Roshan's recorded lectures, and as one teacher said, a huge benefit is that "the lecture can happen as many times as a student wants it to happen" (Schaffhauser, 2011. p. 4). Roshan advises teachers who may want to flip their classroom to make sure you choose a class with motivated students.

The Study

During summer 2011, several faculty and staff members of a journalism school at a Southern university in the U.S. gathered to rearrange a classroom. When the classroom was built in 2001, faculty, staff, the school's recruiters and tour guides praised it as an example of technological innovation that would raise the bar for learning. The room consisted of four rows of Apple iMac computers with seating for sixteen students. The teacher would stand at the front of the room. He or she had access to another iMac sitting at the front left side of the room next to a large whiteboard and a screen. Using a control box, the teacher could access and present material from the computer, the Internet, VHS, DVD, cable TV, or the server for the TV studio down the hall. A teacher could choose to go "old school" and raise the screen to write on the white board. Every computer was outfitted with extensive professional software, and a printer allowed students to print material for review.

However, teachers quickly developed a love/hate relationship with the room as they faced a row of computers behind which students could hide mentally and for the most part, physically. Students could choose to shop online, email, Facebook or zone out in ways that were hard to target. The rows of computer monitors partially blocking student faces emphasized the moat between teachers and students - but that barrier had existed before the computers were installed. Standing at the front of a classroom trying to get a dozen or more students to comprehend material, all at the same pace, is maddening. Advanced students zone out from boredom while struggling students get lost and often give up. Since the technological revolution began in earnest in the early 1980s, teachers have looked to technology to change the paradigm. Schools have invested millions on classrooms, but the effort hasn't worked.

Therefore, the teachers convened with staff to rearrange the classroom in July 2011. All the computers and computer hook-ups were moved to the outer walls of the room to create space for a makeshift conference table in the center of the room. When school started in August, this arrangement premiered to rave reviews from students and teachers alike. Nobody complained about the makeshift table, they loved it. Teachers said interaction shot up so much they had to rethink how much information they planned to "present" in order to create more time for in-depth discussion and question/answer sessions. Students felt connected. They laughed, responded to questions and engaged with the material more. And when it was appropriate, they rolled their chairs to a computer to work on a class project. Teachers found it easier to get to students who needed help and it was a lot easier to gather students around computers for peer review.

Sitting around that table begs for interaction, debate and critical discussions -- not lecture. But to engage in serious discussion students must have already had a handle on the material, and that requires flipping the lecture versus homework equation. Today's technologies offer numerous ways to deliver lectures hyperlinked to resources featuring multimedia. Students can listen to podcasts on iPods while working out, walking to campus, or studying at home. They can use laptops to watch videos a teacher uploads to Youtube or Vimeo for free, download PDF files, or use numerous other Web1.0 or Web 2.0 tools to learn at home or even while travelling for athletics or other student competitions. Flipping the homework versus lecture equation utilizes technology to remove passive, one-way lecturing, so teachers and students can interact.

This first author of this paper teaches an intense, boot-camp style video production class at the university. For the first eight years she taught, she often worked 50-hour weeks, because it was the only way she knew how to spend the one-on-one time necessary to help students master the required content. In 2010, she learned to write HTML and CSS and began to create a Website full of tutorials and lectures that she would normally present in class. Her goal was to shorten lectures to 15-minute question and answer sessions or explanations of material students didn't understand, and increase in class hands-on project work and her one-on-one interaction time with students. In the process, she realized that students did not need her help to watch a lecture or read material, but they needed her help when they were trying to learn a new skill, and got stumped by the software, or by a technical or aesthetic issue. The ability to post tutorials and lectures that she created, as well as supplementary videos and materials from various professional video Websites, Youtube, Vimeo, and other Universities, opened up an avenue to maintain or increase her interaction with students, while at the same time cutting back the hours she was used to working.

The site has been a work-in-progress. Some modules feature video examples, PDF files with text and graphics, and briefer text on the website. Some modules only feature text. To create a full module, including illustrated PDF lectures with accompanying video and supplementary online materials takes about 12 hours of work,

and she has not yet created materials to cover all the course content. Some additional materials are housed on a class Blackboard site. She began using it in class in Spring 2011, but was able to improve many of the modules over the summer and launched it as a way to "flip" the class in Fall 2011. As mentioned by all the instructors from the research papers, she now spends much more class time interacting with students answering questions. Students appreciate being able to watch videos or re-read materials multiple times. They indicate that when they have trouble comprehending a concept, they utilize the additional supplementary videos and Websites.

As of October 2011, students have turned in one video project. Advanced students have used the website to work ahead of the class calendar, learning skills in advance. One day in class, she asked several students if they'd shot and edited video in high school. All of them replied that they had not; they had used the Website to learn skills not yet presented in class. At the same time, students who openly admitted that learning to shoot and edit video scared them have bookmarked the site and refer to it often. When a student asks a question that she knows can be answered by reviewing material on the site, she has begun asking them if they have studied the material online. Sometimes, a student answers that he/she has watched/read the material, but that he/she didn't understand a particular aspect of the task. This helps her to comprehend exactly where students need more information. Sometimes, the student simply needs to be reminded to look before asking for help. She has heard students respond to another student with a question by asking, "Have you looked on the site?"

In addition to the Website, she has utilized Blackboard. She posted the class calendar, and syllabus, and uploaded all class assignment rubrics, deadlines and video examples before the first day of class. Now, instead of spending an entire class period going over an assignment rubric and showing examples, she opens class with a brief question and answer session and move on to showing examples. This technique has also opened up more class time for hands-on work. She does not use a textbook for this class anymore, but has posted Word documents and links to online resources for all lecture materials not currently on the Website. Blackboard makes it easy to see what students have reviewed material, when and how often they have reviewed it. Her next experiment with Blackboard is to create a class Wiki for test review. She plans to start it by typing a list of key words, and open it up to students to fill in the information.

Conclusion

Wesch promotes creating a true participatory learning environment, and he argues instructors must engage the student by creating something of deep significance to students, because participation takes a lot of energy (Wesch, 2007). As mentioned by all inverted teaching practitioners, flipping the classroom requires a lot of commitment and work up front from an instructor. It will also require students willing to take responsibility for their learning. They won't be able to blow off prepping for class, because they won't be able to settle back for a passive lecture experience in class. What Roshan's students call the "backwards classroom," Lage and Platt call "inverted teaching," and Salmon Khan calls "flipping the homework/lecture equation" is beginning to catch on. All educators grapple with trying to effectively teach students who learn at different paces and prefer different modalities. Teaching to the middle is frustrating. The inverted classroom model offers educators a tool that can help them engage students who need a different style, or more one-on-one interaction to excel.

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