"KIDS-TEACHING KIDS": STUDENT-CREATED TABLET-BASED MATHTRAIN.TV TUTORIALS FOR A GLOBAL AUDIENCE

Technology in Practice Strand

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1. ABSTRACT

This paper details the benefits of empowering students to create video tutorials. For the past six years, middle school students at Lincoln Middle School in Santa Monica, California have adopted a "kids teaching kids" model. The students use a Tablet PC to create short mathematics tutorial lessons ("screencasts") based on classroom material. Their voice and writings are recorded simultaneously using screen recording software and produced as a video file. The student-created tutorials are shared with their peers during class instruction, on the class iTunes podcast, YouTube channel, as well as YouTube EDU, our student created mobile apps and archived on their own Mathtrain.TV video Web site. A global audience emerged as students, parents/guardians, teachers and the general public across the country and world began accessing this on-line library of freely available lessons. Students enthusiastically spend hours after school, on their own time, collaborating with other students, as they contribute to the library of student-created tutorials. They are self-motivated and never receive a grade or extra credit for these screencasts. Over 155 countries have accessed Mathtrain.TV. Students of all levels are having fun while taking an active role in their own learning and recognizing its global impact.

2. PROBLEM STATEMENT AND CONTEXT

2.1 The Classroom Tablet PC

For over six years, my middle school students have been creating video tutorials on our Tablet PC and sharing them as part of our "kids teaching kids" Mathtrain Project. This paper focuses on the powerful effects of a classroom Tablet PC, emphasizing student creation of content and the beneficial impact that student-created video tutorials have on education.

In 2006, I bought my first Tablet PC and began using it with a projector for classroom instruction as an upgrade to the clunky overhead projector. It was a convertible Tablet PC, which allowed the laptop screen to twist around and rest flat on top of the keyboard. An active digitizer stylus was used to interact with the computer. Students were instantly captivated by its ability to enable one to write directly onto the screen. This generated a marked increase in classroom participation. Students enthusiastically raised and waved their hands, hoping to be called upon so they could come up and use the Tablet PC. In several of my classes, it became necessary to keep a tally of students whom had and had not already come to the front of the class to answer questions. Several students who were previously distracted or inattentive became engaged in the lessons.

In an effort to capitalize on the exceptionally high-level of student interest with the Tablet PC, I decided to trust my students and let them actually try out and use the Tablet PC. They were visibly excited since students are sometimes not allowed to use the teacher's computer or

technology. The decision to allow and encourage students to use the Tablet PC was a major turning point as it allowed our student-created tutorials and "kids teaching kids" model to evolve.

Student interest in the Tablet PC continued to flow beyond the class period and throughout the school. Students of all levels, backgrounds, grade levels and other classes stopped by before school, in between classes, during lunch and after school for a chance to use the Tablet PC. Each day, groups of middle school students huddled around the Tablet PC waiting for their turn while observing their peers drawing, creating fonts, solving a mathematics problem or exploring the physics simulation program. They found common ground as they collaborated and learned from each other. This "kids teaching kids" collaboration made me recognize what a great, useful resource the students can be to each other. I realized they were natural collaborators and their power to teach and share their knowledge should not be underestimated.

Students visiting my classroom after school would stay for hours using the Tablet PC. Although they were often content with just doodling or drawing, they also enjoyed working on mathematics problems on the Tablet PC. The allure of the Tablet PC itself increased student engagement. But it proved to be even more valuable. The Tablet PC transformed our teaching and learning after I discovered screen recording software, Camtasia Studio. This software enabled the Tablet PC to create handwritten video tutorials, revolutionizing how content information could be accessed and shared.

2.2 The Power of Tablet PC Screencasts

One late afternoon, one of my students needed help on a homework problem. Using our class Web site messaging system on Mathtrain.com, the student asked for assistance. Ordinarily, I would use Microsoft Word or e-mail to explain mathematics problems when on remote locations. But that is not always an ideal way to tutor or assist a student. Those mediums can be difficult to follow for several reasons. For example, fractions do not always stack properly, equations are difficult to line up, mathematical notations can get messy and at the time it was not easy to insert sketches or drawings. Fortunately, I had just discovered the screen recording software, Camtasia Studio, which enabled the creation of dynamic videos using natural handwriting and voice. Instead of typing the instructions, I tried a new strategy, creating a video tutorial explaining the homework problem. It only took a few minutes to create a diagram and explain the mathematics problem on my Tablet PC as Camtasia Studio simultaneously recorded my computer screen and voice. The resulting video file was then e-mailed back to the student.

Within the hour the student replied that she now understood the problem and then requested, "Can I have another one?" It was the first time she had received a personalized video tutorial explanation of a mathematics problem, or for any subject. The next day in class, other students heard about the video and suggested they could have benefited from it as well. So, the tutorial was posted onto our class site. Other students began requesting homework videos. The demand and interest soon lead me to begin actively creating daily tutorial videos to assist students with each night's homework and to upload them onto our class Web site, Mathtrain.com.

2.3 Student-Created Tutorials

The idea of developing student-based mathematics tutorials evolved and became a reality after our Winter Break in 2007. Students continued to be fascinated with the Tablet PC and continued to request new teacher screencast tutorials. That could have been the end of a positive story right there, where "teacher creates personalized video tutorials to help students with

mathematics concepts and homework". However, through trusting my students and allowing them to use the Tablet PC, a more important and unexpected, story was born.

In February 2007, a student came after school and asked if she could create a video tutorial. She wanted to produce a screencast that explained how to solve proportions. This student proceeded to create a short tutorial on the Tablet PC. The student-created video was shared in my mathematics classes the next day. The students reacted positively and suddenly other students began showing up after school to now create mathematics tutorial videos. The students never received a grade or extra credit for these screencasts. They were self-motivated to produce them.

As the number of student-created tutorials grew, it became necessary to have one location that stored them all. In addition to posting the tutorials onto our class Web site, Mathtrain.com, we had also been uploading the videos onto YouTube and a few other sources. But YouTube was blocked at our school and posting blog links onto our class site was becoming inefficient and difficult to navigate. To alleviate these issues, we launched our own YouTube-clone video site, Mathtrain.TV, to house our growing number of student-created content.

3. METHOD EMPLOYED

3.1 Overview

The student videos we produced are also known as "screencasts". We use a Tablet PC with an active digitizer to write onto and screen recording software Camtasia Studio. Our videos were not created using an external video camera pointed at our hands nor are they the type of video one might create at a wedding or birthday party. Instead, as one wrote and explained the mathematical problem, Camtasia Studio simultaneously recorded both what was written onto the Tablet PC screen and the accompanying audio. This enabled the students to write and speak naturally. In an effort to protect the identity of the students, their faces and real names were not used in the tutorials. Students would choose an alias prior to recording. Camtasia Studios' recording and editing features were easy for students to use and made it simple to create a video file that could be easily shared on a Web site or e-mailed. Many of the videos were produced as ".swf" and ".flv" flash formatted files. Today, in an effort to be playable on the most devices possible, we mainly produce ".mp4" and "H.264" video files.

3.2 Steps for Creating a Student Tutorial

When a student wanted to record a screencast, they would come after school to my classroom with an idea of which mathematical concept or lesson they wanted to produce. On the Tablet PC, we used a drawing program such as the free Windows Journal or OneNote program as the canvas area to write onto with the active digitizer stylus. We used an active digitizer stylus because it mimicked true handwriting the best, as it was sensitive to pen pressure. Each of these drawing programs allowed the background color to be changed as well as multiple pen and highlighter colors and thicknesses. This facilitated student creativity, personalization and the overall comprehension of the video. After observing the teacher or a peer create a tutorial screencast, the students would be empowered to run the entire process themselves. The student would usually begin by writing a title and then opening the screen recording software, Camtasia Studio. They would then select the area that would be recorded and check the microphone level. If more than one student was collaborating, they would check the microphone level for each student. Once they were ready to go, the student would push the big red "record" button, watch it count down and begin their tutorial.

When finished, the student would stop the recording and preview what was just recorded. If there were major errors or issues, they would delete the file and start over, re-recording everything. If there were minor errors or no issues at all, the student would save the clip and display the recording in an editing window. In the editing window, students could add pop up messages, arrows and other effects using a feature called "call outs". Any undesired audio could be easily removed, making the screencast easier to follow, shorter in length and a smaller file size. Background, intro/outro music could also be added to the clip. Usually, opening and ending titles would be added as bumpers. The opening title would include the topic about to be taught and the ending title would usually thank the viewers for watching.

Once satisfied, the student selected "Produce" and the clip would be rendered into a freestanding video file. This video file was then shared with their peers during class instruction, and with a global audience on our class Mathtrain iTunes podcast, YouTube channel, including YouTube EDU as well as archived on our own Mathtrain.TV video Web site.

3.3 Microphone

Although most Tablet PCs have a microphone installed, we found it advantageous to use an external microphone. It made the audio sound clearer. The factory-installed microphone will pick up every click and scribble sound you write onto the Tablet PC screen. In our first few years, we used a cheap Radio Shack microphone leftover from my cassette player days. It turned out the students enjoyed holding the microphone, because they felt like they were on American Idol. Eventually, we replaced that microphone with an inexpensive desktop microphone. This freed up the student's hands and allowed them to collaborate more easily.

One mistake I made was purchasing an expensive microphone. The issue was not because of the students handling it. The problem with an expensive microphone is that they are built to be spoken into directly and cut out ambient noise from the sides. The problem is that students do not sit with the microphone directly in front of them at a constant and consistent distance. They are often animated as they are when called to the front of the class to solve a problem. A cheaper microphone is more forgiving and is often designed to pick up audio in a less directional and more cardioid area. We want to capture an authentic representation of the students explaining their concepts, not a robotic narration, so we opted to use an inexpensive desktop USB microphone that offered more student mobility during the recording process.

3.4 Unscripted

One of the most important aspects of our student-created videos is that they are unscripted. Conventional wisdom is that narrated videos should be planned and scripted. We certainly planned out each video in that the student knew ahead of time which concept was to be taught and knew what the expected answer or answers would be. But we never scripted the dialog. If one listens to a scripted video, it can sound lifeless and artificial as the narrator is concentrating on reading the right words in the correct order at the right time instead of focusing on delivering the overall multimedia message.

Our goal was to capture an authentic representation of the student's explanation. For example, when a student is called to the front of the class to answer a question on the chalkboard or whiteboard, that student does not usually craft a scripted discourse as he or she approaches the front. Instead, the student might bring their paper or notebook with them and use that as a guide as they explain their reasoning or answer. Another benefit of keeping our videos unscripted is

that we hear the student's own voice or, "kid language" as one student called it. Students have reported they often prefer a peer's explanation to another adult's or teacher's.

3.5 Captioning

We continue to caption our student content and are passionate about making our content viewable and useful to as many people as possible. All users can benefit from captions.

3.6 Mathtrain.TV

Although we share our student-created tutorials in multiple locations, our main location is our own video Web site, Mathtrain.TV. When we first began creating videos, YouTube was blocked at many schools, including ours. This led to the creation of our own site. Mathtrain.TV runs on free software, called PHPMotion, where videos are categorized by groups, genres and tags to make search easier and efficient. The site is free to use and ad-free. No login is required, unless a user wants to comment on a video or upload their own content. Mathtrain.TV also offers numerous sharing options, including embed codes and links to social networking sites.

3.7 Other Devices

Our main workhorse for creating student screencasts has been a convertible Tablet PC. We have also had success using SmartBoards, Wacom Tablets and iPads for creating student content. The iPad has offered some encouraging results due to its mobility and apps. Free iPad apps such as ScreenChomp and Educreations and ShowMe have been useful. The most promising app is Doceri. With its Doceri GoodPoint Stylus connected, which has a palm rejection feature, students are able to nearly replicate an actual Tablet PC experience (minus pen pressure).

4. RESULTS AND EVALUATION

Whether created on a Tablet PC or iPad, it is exciting to watch how students naturally develop their presentation skills. The students enjoy creating and do their best because they know their tutorials have purpose. As mentioned above, students never receive a grade or extra credit for creating a tutorial. Yet they are self-motivated to produce them. Students continue to come after school, on their own time, to contribute to our growing library of tutorials. At Mathtrain.TV, middle school students of all levels who desire to take an active role in their own learning, drive our unscripted student-created tutorials. They learn skills such as the importance of empathy as they compose their screencasts with helpful arrows, highlighting, "white space" and organization. Students are even eager to caption our videos on their own time as we continue to develop closed caption versions of our student videos for deaf and hard of hearing with assistance from the DCMP "Described and Captioned Media Program" [1]. Our students understand the value and need to make the videos as accessible as possible.

Several of my students (accompanied by their parents) have co-presented with me at education conferences across the country (e.g. Boston, Philadelphia, San Diego) and participated in interviews or Skype sessions with classes in New York City and podcasts such as the EdTechCrew in Australia. We have also been featured on EuroNews, which was broadcast to over 155 countries and translated into 11 languages. It is empowering to the students to know their video tutorials are being watched by real people-students, families, educators and even universities, who often e-mail us or post meaningful comments about their work.

Students will spend hours on one tutorial, where they may only spend minutes on a homework question, because they find creating screencasts to be fun. When the first iPhone was

released, one student was motivated to create an iPhone app for our student content. Shortly after, another student created an Android version of the app.

Today, our student-created videos are shared with a global audience. The instructional tutorials are also used as authentic assessment and flipping or double flipping classrooms (including our own). The student who creates a tutorial certainly benefits. Instead of just being consumers of content, they are also creators of content. As one student pointed out, the best way to learn something is to teach it. There are times when a student producing a video has to pause the recording because they realize they do not know why they are performing a mathematical step. The student might collect their thoughts, ask a peer in the room or go seek out the reasoning and try recording the next day. It is a wonderful self-learning tool.

Internationally-recognized education technology leader, Alan November, helped spread our student's Mathtrain.TV tutorials in his keynotes, TEDx Talk and presentations across the world. Mr. November inspires others to set up student Tutorial Designers in every classroom, based on our Mathtrain.TV model. He also featured Mathtrain.TV and interviewed several of our students in his recent book, "Who Owns the Learning?" [3]

The student-created math tutorials have been an inspiration to other students and educators across the globe. Our YouTube channel gets an average of 1000 views per day and 29,000 views per month. One student tutorial, "Egyptian Multiplication", has been viewed over 30,000 times on YouTube and over 7,000 times on our very own MathTrain.TV. Mathtrain.TV receives an average of 766 views each day. Each month, MathtrainTV gets about 23,000 visits and 750,000 hits. Over 155 countries and every continent have accessed our student tutorials. Students are contributing to not only the mathematics community, but to the education community at large.

5. FUTURE WORK

This project was achieved with limited personal resources. I look forward to future school and district support. We will continue our quest to create a student-created mathematics tutorial lesson for every topic we cover in class. In addition, it would be valuable to continue studying how the on-line collaboration influences mathematical understanding.

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