

IMPLEMENTING TECHNOLOGY IN THE MATHEMATIC CLASSROOM AND IT'S INFLUENCE ON PEDAGOGY

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Objectives or purposes

Teachers, students, and administrators often face uncertainties and unforeseen difficulties when school districts move to one-to-one student use of information and communication technology (ICT) – tablets and iPads. Teachers are intimidated by the expanding list of applications and how to implement, what pedagogies to use, and how to approach the necessary changes in classroom management. Students, on the other hand, have a new found freedom with technology and an opportunity to wander to unrelated sites. How do teachers keep them focused and on track? The bigger issue for administration is how to maintain reasonable expectations for ICT integration and pedagogical change, and what approach should be used for appropriate professional development. A proposed method for technology integration and corresponding pedagogical change is proposed in this paper as a guide to interpret the changing needs of teacher, students, and administrator. The researcher's intent is to study the use of this framework with a school district in Central Texas that will be implementing one-to-one iPad initiative beginning the academic 2013-2014 school year.

The questions addressed are:

1. What trends are noticed in teachers' pedagogy when implementing one to one technology in high school mathematics classes using the SAMR model and Niess, Lee, and Sadri's (2007) developmental stages?
2. What trends are noticed in student behavior and engagement when implementing 1-1 technology in high school mathematics classes using the SAMR model and Niess, Lee, and Sadri's (2007) developmental stages?
3. How are grades affected by implementing 1-1 technology in high school mathematics class using the SAMR model and Niess, Lee, and Sadri's (2007) developmental stages?

Perspective(s) or theoretical framework

The SAMR model (Puentedura, 2006), see Table 1, is a popular framework that discusses innovative usage of technologies for transforming learning. The SAMR

model has been used as a means of having teachers address pedagogical changes when introducing learning technologies to students (Hogan, 2010). The purpose of this paper is to use the SAMR model and the Niess, Lee, and Sadri (2007) developmental stages in TPACK obtainment that serve as a model for transitioning to higher levels of thinking (Krathwohl, 2002). The combination of the two takes the SAMR method, often related to language arts class, and makes it more specific to the needs of mathematics students through the use of Niess, Lee, and Sadri's (2007) developmental stages.

Puentedura's SAMR model includes the following four steps:

1. Substitution, technology acts as a direct tool substitute with no functional change;
2. Augmentation, technology acts as a direct tool substitute with functional improvement;
3. Modification, technology allows for significant task redesign; and,
4. Redefinition, technology allows for the creation of new tasks previously inconceivable.

SAMR model (see Table 1) when mapped with Niess, Sadri, and Lee (2007) stages of development makes it possible to use the model to investigate the impact of the prescribed use of new technologies on the behaviors of learners, the product of teacher actions. Where SAMR is a broad approach, focused primarily on the technology and the tasks technology are able to perform, Neiss's approach is on the teacher role and alignment of technology with content to be taught. Neiss, Sadri, and Lee (2007) suggests five stages of development:

1. Recognizing (knowledge) where teachers are able to use the technology and recognize the alignment of the technology with subject matter content, yet do not integrate the technology in teaching and learning of the content.
2. Accepting (persuasion) where teachers form a favorable or unfavorable attitude toward teaching and learning specific content topics with an appropriate technology.
3. Adapting (decision) where teachers engage in activities that lead to a choice to adopt or reject teaching and learning specific content topics with an appropriate technology.
4. Exploring (implementation) where teachers actively integrate teaching and learning of specific content topics with an appropriate technology.
5. Advancing (confirmation) where teachers redesign the curricula and evaluate the results of the decision to integrate teaching and learning specific content topics with an appropriate technology.

TRANSFORMATION			
SAMR	Definition	Example	Neiss's TPACK Transition Stages
Redefinition	ICT Technology allows for the creation of new tasks, previously inconceivable.	Students explore Wolfram interactive application for Pythagorean Triplets and reports on findings using Voicethread.	Advancing
Modification	CT Technology allows for significant task redesign.	Students change y-intercept and slope on web page using interactive applet. Students are asked to draw conclusions.	Exploring
Augmentation	ICT technology offers an effective tool to perform common tasks	Students take a quiz using Google Form instead of using pencil and paper.	Adapting
Substitution	ICT Technology acts as a direct tool substitute, with no functional change.	Students print out worksheet, finish it, pass it in	Accepting Recognition
ENHANCEMENT			

Table 1.
SAMR/Neiss Model

Before referring to our findings it is important to note that the use of iPads was delayed because the district did not have sufficient band-width for the entire high school. While making the needed changes to the system, teachers were without Internet for over two weeks. This is year one of a five-year study and implementation difficulties were

anticipated, but the extent of the infrastructure problem was not anticipated.

The first research question is embedded in student responses at this beginning level of the investigation. In addressing trends noticed in student behavior and engagement, students were asked to respond to the following prompts. The questions were asked during the third quarter of instruction when the students had only one semester of use with the iPads.

How have you used your iPad for educational purposes?

Student 1: You can look up theses[sic] that you need for projects and words and things about buildings you can maturely [sic] things and download [sic] apps to keep track [sic] of your grades[sic].

Student 2: I have researched stuff for science class that I needed to do for a project. Also in Geography I take notes on it and I remember them because it's on an electronic and not on a piece of paper I might lose. Sometimes like during lunch I use it for games but that's only on my time. That's about all I do right now.

Student 3: I have used my iPad for many educational purposes such as looking up definitions in my biology class. Also I have downloaded many APPs to help me in my French class. I even have downloaded apps to help me with my learning Japanese and German outside the class.

Student 4: I used the iPad for education in class using Dictionary or other websites to find out information. I use google.com which provides most things for most of my classes.

Student 5: I have used this iPad for research in Biology and World Geography. I search up pictures to draw for group projects and important facts and names. I also use iPad to check time and date to write on my heading.

Student 6: I would use an iPad for education apps perhaps have a certain page for things that are necessary for school & class.

Notice that students are using the iPad to look up information, using it to substitute for a dictionary or their classroom text. We know the French teacher is using the technology to help students understand French words and grammar, but we are unsure if the iPads are used for more than a translation dictionary. The Biology and World Geography are encouraging their students to use the Internet to do research, to access information. There is no mention of the iPad being used in their mathematics class.

The following were some typical responses to the second question: How do you typically use the iPad?

Student 1: To learn [sic] to misuse [sic] and play games but at school even [sic]

the people that don't do there [sic] work well look somethins [sic] up.

Student 2: I have an iPad at home so I use this one at school only.

Student 3: I use it during school to help me with my French class and out of class to play games.

Student 6: I use it more to play games but when it comes to school business I have to get into google or whatever to successfully use it.

Student 7: In some classes I don't use them at all since they haven't really given us assignments that need the iPad.

Student 8: I take pictures sometimes other times I use enternet [sic] to find answers for work.

With this question problems began to emerge. Students were using their iPad to play games during school and teachers were not able to see how to integrate their content with the technology. The students and teachers did use their iPads to access the Internet to search for definitions or, in the case of the French class, they may have used it to hear the words and see the translation. Again, technology is used for substitution at best. We know little about whether teachers are accepting the technology or allowing it to be used to replace existing reference sources, but we do know as recorded by student 7, some teachers are not using iPads in the classroom.

The following were some typical responses to the third question: Do you think students should get iPads?

Student 4: Yes and no because the[sic] are helpful with work and no because students can download games.

Student 6: I think people who are doing good in school should get iPads for the minimum of \$20 dollars or discount & the other 20 they got it from discipline being on school & on task.

Student 7: I think that kids that don't take their education seriously shoundl't get them because obviously their just gonna [sic] play with them.

Student 9: Some students in particular NO! They'll misuse it and probably steal it. But some will take care of it correctly.

Student 10: No, because students don't use them for learning. They get distracted and start playing games.

Student 11: I think students should get the iPads because they get to learn how to

bond or learn with the technology.

Student 12: From my understanding we already have iPads so there's your answer.

Student 11's response is particularly insightful. Do students need to bond with technology? In today's techno centric world, the answer would be yes. Students need to learn to work with technology and so do teachers. It does not happen spontaneously once students are given the technology as we see in the dialogue captured here. They need to learn how to properly balance both learning with and without technology, and know when it would be more effectively to use technology. Students need to be taught the appropriate use of technology and to let the iPad rest on the desk if it is not being used in class. There is a time for hands off the iPad and hands on the iPad, and this should be part of the classroom policy. The student's response indicates they understand that technology must be handled responsibly. They know this does not mean playing unrelated games on their iPad during class. They are still unsure what it looks like in terms of using the iPad for learning.

Significance of the Work

If we go back to the combined SAMR and Neiss model it is clear students and teachers are still at the beginning of the process with a long road ahead. This is what could be expected at the beginning of a program to integrate technology into a high school. However, lessons have been learned that could lead to an easier adjustment. (1) Teacher training is necessary and should be specific to the discipline. Once the foundation has been laid, (2) continuing support needs to be provided for all teachers in the form of content related assistance. (3) School policies on when and when not to use iPad need to be in place and enforced. (4) Blocks on certain website must be made, but judiciously so as to keep teacher channels open. (5) Parent support must be solicited. At the school observed the students had to make a forty dollar deposit for the iPad; and, parent and student signed that they understood the given rules and responsibilities they were agreeing to maintain. (6) Teachers need to be aware that students may not have Internet access at home and adjust assignments accordingly depending on their population. (7) Where possible software such as Nearpod should be used. With Nearpod the instructor can make a presentation, then share their interactive lesson in real time. Students interact by responding in real time on any PC, Mac or mobile device; in turn, the teacher can monitor and measure the results on an individual and aggregate basis. This encourages on task behavior.

By using the steps suggested above, the course will still have a learning trajectory as suggested in the SAMR/Neiss Rubric and the transitions will proceed smoother. It is hoped that the gradual adoption of progressive stages will create major changes and movement toward a more student centered learning environment. The developmental stages reiterate the danger of placing a practicing teacher within a classroom where every student has technology and expect them to function at the transformative stage. Even as the sentence was written, the researcher realizes that with smart phones we have that environment in most high school classroom right now. Our challenge is to recognize the

power of technology and engage students in learning through technology.

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