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AUTHOR Wetzel, Keith; Zambo, Ron; Buss, Ray; Padgett, Helen
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ABSTRACT

This qualitative study reports on Arizona Classrooms of Tomorrow Today (AZCOTT), a component of a Preparing Tomorrow's Teachers To Use Technology project. In conjunction with five partner school districts, Arizona State University West developed five technology-rich K-8 classrooms to serve as models for preservice students and university instructors. This study report describes changes occurring as the AZCOTT teachers learn to teach in technology-rich classrooms. Findings are presented related to: teacher change, including teaching methods, curriculum, leadership, teacher collaboration; and student change, including student engagement, student noise, student disposition toward learning, student collaboration, and students as helpers and coaches. Factors supporting change are discussed. Finally, the researchers discuss the progress made toward using these classrooms as models for preservice students. (MES)

A Picture of Change in Technology-rich K-8 Classrooms

By: Keith Wetzel, Ron Zambo,
Ray Buss, and Helen Padgett

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Keith Wetzel
Arizona State University West
keith.wetzel@asu.edu

Ron Zambo
Arizona State University West
ron.zambo@asu.edu
Ray Buss

Arizona State University West
ray.buss@asu.edu
Helen Padgett

Manager PT3 Project
Arizona State University West
helen.padgett@asu.edu

Abstract

This qualitative study reports on Arizona Classrooms of Tomorrow Today (AZCOTT), a component of a Preparing Tomorrow's Teachers to Use Technology project. In conjunction with five partner school districts, Arizona State University West developed five technology-rich K–8 classrooms to serve as models for preservice students and university instructors. This study report describes changes occurring as the AZCOTT teachers learn to teach in technology-rich classrooms. Changes are described in teacher practices and student attitudes. Factors supporting change are discussed. Finally, the researchers discuss the progress made toward using these classrooms as models for preservice students.

Only a small percentage of K–12 teachers use technology on a regular basis with children in their classrooms (Becker, 2000). At the same time many Preparing Tomorrow's Teachers to Use Technology (PT3) projects are attempting to identify technology friendly classrooms for preservice student internships. Ideally, teacher education programs would like to place preservice students in practica situations with exemplary teachers who provide the environment for K–12 students to use technology as part of their everyday lessons. However, such placements are not commonly available. According to the director of field placement at Arizona State University West, we lack school sites for field placements where our preservice students can observe exemplary technology integration practices in K–12 classrooms (Carlile, 1998). Each semester 800 students are in field placements in the ASU West program and the placement office simply lacks the technology-rich classrooms needed to accommodate the students. The AZCOTT program was designed to help create exemplary placements for our students. This research project focuses on the teachers and children in the AZCOTT classrooms, and the changes that occurred as the AZCOTT teachers learn to teach in technology-rich classrooms.

Characteristics of Exemplary K–12 Technology-Using Teachers

Becker (1994) analyzed national survey data to identify exemplary computer-using teachers. Out of a sample of 516 third through twelfth -grade teachers, 45 were identified as exemplary. Factors that contributed to exemplary computer use among those teachers were: opportunities for

collaboration, attempts to make computer activities consequential, access to staff development activities, and fewer students per computer in their classrooms. In addition, he concluded that exemplary computer using teachers were more likely to emphasize small-group work. Although the factors that Becker (1994) identified were in the context of classrooms, schools and districts, the same factors can be considered in the context of individual teachers in separate schools working in collaboration with a university, as is the nature of the AZCOTT teachers who are the subject of this paper.

Implementing Change in K–8 Classrooms

Buying technology for K–12 classrooms is expensive, but a relatively straightforward procedure. Much more difficult is changing the way teachers teach so that they use technology effectively, and even more difficult is changing teacher pedagogical beliefs that drive their choice of instructional strategy (Fullan, 1991). Moreover, the implementation of technology is problematic because it is not one innovation, but a combination of many related innovations, for example, hardware and multiple computer applications (Hall & Hord 2001).

In this study the authors will describe AZCOTT, a component of ASU West's Preparing Tomorrow's Teachers to Use Technology Project (PT3), and the changes occurring as experienced elementary teachers learn to teach in technology-rich classrooms and as the PT3 project leaders attempt to use the AZCOTT teachers and their classrooms as models for preservice students.

Program Description

Technology-rich K–8 classrooms that serve as models for preservice students and district teachers. Five college of education instructors participated in at least two days of the AZCOTT training along with the K–8 teachers. These instructors as well as the student placement coordinators encouraged preservice students to observe in or select these classrooms for practicum experiences.

AZCOTT teachers were selected through an application process. Teachers applying to participate addressed key questions about potential K–8 student use of technology in the classroom. In January 2000, children began participating in five AZCOTT classrooms. In addition to the technology already in their classrooms, these teachers each received 4-5 multimedia computers with Internet access, software, a projection system, and technical support from their school district; as well as more than 100 hours of training from the PT3 project.

The training consisted of an initial two-day workshop followed by four half days of training throughout the semester and three days in June. The curriculum addressed new technologies and creating and implementing curricular units called Units of Practice (UOP) (Sandholtz, Ringstaff, & Dwyer 1997) that integrated technology into elementary content areas. Participant's UOPs and the rubric can be viewed at http://azli.asu.edu. Time was also provided to share ideas and reflect on practice. Between sessions, participants communicated using an online conference. The second semester of training began in September 2000 and consisted of every other month half-day meetings and participation in a graduate course on using the Internet in the classroom. Preservice students were invited to participate in these classrooms after the AZCOTT teachers completed the first semester and summer of training.

Methodology

Using qualitative techniques, the authors describe changes resulting from the teachers' participation in the AZCOTT program.

Subjects

Five teachers, one from each university school district partner, were selected to participate in the first cohort of the AZCOTT program. These teachers were initially selected because it was thought that they would provide exemplary models of technology integration for preservice teachers and district teachers. A brief description of each classroom follows.

Mr. B taught 27-second grade English as a Second Language learners in an urban inner city school where all of the students are receiving free or reduced lunches. He was a technology mentor for his school helping other teachers with technology before and after school.

Ms. Lo taught 120 sixth graders science and language arts in an urban school with 35% of students receiving free or reduced lunch. She was a technology mentor for her school.

Ms. T taught 110 seventh graders mathematics and pre-algebra. Fourteen percent of these students were receiving free or reduced lunch.

Ms. Li taught 31 fourth graders in an urban elementary school with 50 percent receiving free or reduced lunch. She is a technology mentor for her school.

Ms. V Taught 100 seventh- and eighth-grade, gifted students in urban schools with few students receiving free or reduced lunch.

Data Collection

The data for the study came from multiple sources. First, during the AZCOTT workshops participants shared their questions, concerns, curricular ideas, and implementation attempts. These teacher reflections and discussions were audio or videotaped and transcribed. In addition participants participated in a FirstClass online conference that provided support as they implemented technology use in their classrooms. Between each workshop session participants used this online conference to react to selected chapters in *Teaching with Technology* (Sandholtz, Ringstaff, & Dwyer 1997) often comparing their situations to those described in the chapter. These messages were aggregated using a summarize feature of FirstClass, printed and analyzed. Although the transcriptions and the online dialogs were the major sources of data, other sources supported the themes identified, for example, the written report of an external evaluator, video vignettes taken in each classroom of the AZCOTT teacher and students, and the impressions of the PT3 project manager who visited each classroom and took notes on her visits.

Data Analysis

Using the constant comparative method (Strauss 1987), data analysis began when data were first collected and continued throughout the study. The first and second authors independently read the transcripts and online conference printouts and identified patterns and categories. Subsequently they met to discuss patterns they observed in the data and questions that arose after the readings. After that discussion, the authors re-read all the transcripts and re-categorized the data. Each highlighted the portions of the transcripts addressing each category. They met a second time to compare the answers to the questions and the categories that arose as they read. They compared key categories and re-read the transcripts to see if the selected categories worked to describe the experiences of the AZCOTT teachers. The categories were: changes in teaching methods, curriculum changes, teacher leadership, teacher collaboration, student engagement, student noise, student disposition toward learning, student collaboration, and students as helpers and coaches. These categories were organized around two major themes: teacher change and student change.

Results

The data from selected aspects of the themes (teacher change and student change) will be reported in this section.

Teacher Change

The researchers found the following types of teacher change: change in teaching methods, change in thinking about curriculum (UOP), change in teachers' roles as leaders, change in the level of teacher collaboration, and change in the way the teachers communicate with parents. Using the actual words of teachers, teaching methods are addressed first.

Changes in Teaching Methods. As teachers became involved in the training, workshop reading and sharing with peers, they attempted to integrate technology in their classrooms. This led them to question their approaches to teaching. For example:

- What AZCOTT is forcing me to do is to look beyond what is comfortable and ask where and if my current practices fit and if they don't what can I do to alter them so that they do fit. I try to accept that I may not have all the answers and hope that I am flexible enough to accept any needed changes. Ms. T Gr. 7 math

- I was really insistent that people stay at their own station. Through some of the reading and things that we have done in this course, I now see more of the value of kids working together at stations and sharing together. I have seen a lot more peer teaching, so I am a little bit more open to that now. Ms. Li, Gr. 4

Changes in teaching methods included movement from a teacher-oriented approach to other approaches that involved student collaboration. This has induced a shift of focus in the classroom from the teacher as the provider of knowledge to the students as seekers of knowledge. Examples of this change are evident in the comments that follow.

- Instead of doing a lecture where I used to stand there and just give them scads of notes and they would all walk out grumbling, I give them the study guide research sheets and in groups they work to find the answers using the [computer] program. Ms. Lo Gr. 6
- "[While working on a house design project] a group of students.... insisted they needed a bowling alley in their house. What they found out was that they couldn't get it to fit. I did not [have to] tell them. It was a learning process. Exceptional, in terms of their own learning process. Ms. T, Gr. 7 Math

The teachers realize that this change in the classroom focus allowed the students more control in what will be studied.

- [The students] were able to come up with such neat stuff for me to teach this year and that was really hard for me to accept- my kids were helping me figure out what to teach. I turned some to the control over to them so they were coming up with different ways of doing it. Ms. Lo, Gr. 6
- I have started reading material about individual work stations and having students go through stations that will allow them to choose more of what their work will look like .... I didn't know how I could go from direct instruction to primarily student led instruction. Now I see it. Ms. T, Gr. 7 Math

Sometimes the change is simply doing a traditional assignment in a new way with technology, for example.

1. We did a character analysis on the characters in the story called the "Fisherman and the Wife." For each group I created a Hyperstudio template and then each group was just to type in the information about the character that they were studying. This was an alternative form of a book report. Mr. B, Gr. 2

The teachers express their interest in new ideas for using technology in their classrooms. They also build on the ideas of their peers.

- When I hear an idea I'm trying them out just as quickly as I can work with them. Mr. B, Gr. 2
- The creative problem solving part, I want to address that with a different view of the kinds of products and projects that I want to be the outcomes of student work. That is going to require me to take a look at alternative ways of assessment. Ms. Li, Gr. 4

Curriculum Change. The data revealed changes in both planning curriculum and in procedures and materials. This PT3 project incorporated the use of the Unit of Practice (UOP). The UOP has helped teachers to understand that technology for the sake of technology is not appropriate. It is the use of technology to support curriculum that is. For some of the teachers, this was a new way to look at technology.

- When we started..., I kept waiting for the technology to appear. Then I realized ... that the focus was going to be... the curriculum, and that technology should always be a way to get to the curriculum. What is it that we want children to know and be able to do and how does technology help with that? Ms. V, Gr. 7 & 8 Gifted Program
- The technology was driving what I was teaching. The UOP has been able to help me to get the technology in where I needed it yet still keep the focus on my teaching. Ms. Lo, Gr. 6

Teacher leadership. AZCOTT teachers have seen the value of instructional technology and have taken leadership in finding and developing additional support for technology integration. They have demonstrated their leadership in PTA fund raisers, grant proposals, teaching of teachers, and in offers of positions of leadership.

- We have a PTA carnival to raise funds and we are doing a project called Fun Photos. The students will take photos of kids with the digital cameras, we will download them print them off on that nice photo paper and sell them. Ms. T, Gr. 7 math
- ....I have been asked to teach district classes now and I am teaching a district class called the Technology Toolbox and that's really been exciting for me professionally and it's just really – being on AZCOTT has been really built my confidence. Mr. B. Gr.2

The teachers seem truly excited about spreading the word about technology. In addition to their current involvement, they have also envisioned future avenues.

- I hope to be training our new teachers at our school about the technology we have at our school. In the future the computers and software need to become something that is open and available. Come get it. Mr. B, Gr. 2

Teacher Collaboration. The teachers realize that working as a member of a team has been a powerful experience. They value this collaborative opportunity, look for ways to increase collaboration within the group as well as outside of the group, and envision future ways of using it for the benefit of technology integration.

2. I guess the best part for me in being part of the AZCOTT project is being able to communicate, collaborate, and creative problem solve with all of you. What is interesting to me being a 7th and 8th grade teacher is the ideas I get from Mr. B who teaches 2nd grade and the ideas I can get from a 6th grade teacher and a 4th grade teacher. Ms. V, Gr. 7 & 8 Gifted Program

3. We are great resources for each other. I am tired of being the one in front of my staff all the time; it would be great if one of you guys would come over. We can be guest speakers for each other; there is no reason why we couldn't do that. Ms. Lo, Gr. 6

The AZCOTT teachers also thought about the benefits of involving other teachers.

- I've been going to other classrooms asking – How do you use technology? What do you use technology for? Could you give me some hints about how I could use it because I'm lost here? Ms. T, Gr. 7 Math
- Next year I see my classroom as being much more open to other classrooms on campus, doing a lot more team teaching, peer teaching with the other kids. I see a lot more planning collaboratively with other teachers. Ms. Lo, Gr. 6

Student Change

The researchers shared the teachers' discussions of their methods and curriculum. However, the teachers also discussed the student responses to this changing environment. The categories comprising student changes are student engagement, levels of classroom noise, disposition toward learning, collaboration, and willingness to help others. Listen to the voices of the teachers as they describe student engagement.

Student engagement. AZCOTT teachers describe students at work in their classrooms. For example:

4. Today I was watching students working in all corners of the room. While I was helping one (group of) students edit their animal report, I looked around and everyone was busy, helping each other with typing, getting ideas synthesized into paragraphs or finishing up poems and drawings for their reports. There was plenty of activity and noise, but everyone was on task. Ms. Li Gr. 4

5. I have students now getting involved that were not before. Ms. Li. Gr. 4

6. I see 110 seventh graders comfortable working with each other . . .. They became the experts. Collaboration was amazing between them....They are willing to take risks. They are on-task, engaged. Ms. T Gr. 7th math

7. We only have four days of school left. The kids are in a MathQuest .... Those kids are working ... they are so engaged. Ms. T Gr. 7th math

Student noise. Although, student conversations were integral to student active participation in projects, teachers revealed a general unease over the amount of noise in their classrooms. For example:

- It's a tremendous amount of conversation. The noise level is always up. I don't have a problem with that. It bothers some of my colleagues, so I have to deal with that, and I do. Ms. T Gr. 7 math
- I wasn't prepared for the noise level. I was not ready for the constructive arguing that was happening. It really made me go back and think about what I will do next time management wise. It is very difficult to manage the kids when they aren't used to doing it. Mr. B, Gr. 2

Student disposition toward learning. AZCOTT teachers discussed student desire to learn and willingness to contribute to the learning process. For example:

- The technology is a surprisingly natural tool, it didn't just come and appear to be one of those abnormal things that you're not going to use inside the classroom. The students actually were the ones to touch it first. They were the ones who wanted to discover things. Ms. T, Gr. 7 Math
- Students come up with ideas on how to use the laptops and software (Inspiration). They always go beyond what I asked them to do. Ms. Lo. Gr. 6
- Already the kids have said, "Well, you know, can we stay after school sometimes and do the extra work? Ms. Lo Gr. 6

Student collaboration. All of the teachers reported that their students worked together and helped each other. In the first example, Ms. Lo explains the social changes in her students over the course of the year.

8. I work with 6th graders and we all know that at that age being collaborative is not always a possibility, and liking everybody in the room is not always an option. So having five laptop computers ... with thirty students—that was going to require that they work with people. What happened initially, I got big responses " I don't want to work with him" or "I don't like her". As we progressed they started making choices of who they wanted to work with based on skills rather then who it was they liked ... I heard this group saying, let's ask him to come over here because he really knows how to use that program. They were recruiting people that they knew had the skills. That was something I totally did not expect to have come out of this. Ms. Lo, Gr. 6)

Other teachers shared similar findings.

- They often times come with a lot of technology knowledge. So it was really nice for me because when I need someone to walk someone through a PowerPoint presentation they could and they were better at it than I was. The kids were so comfortable with each other doing that so it didn't set up a "I am going to teach you" kind of situation, it was a real exchange of two peers. Ms. T, Gr. 7 Math
- The collaboration was amazing, the kids were willing to help each other. We did videotaping and you could just see kids get up when someone asked them a question and go right over and help someone in a non-threatening manner. It was just exceptional! Ms. T, Gr. 7 Math

In these examples students were spontaneously helping each other, but also students who were placed in groups or who self-grouped in ways that worked harmoniously.

Students as helpers and coaches. In the next instance, Ms. V explains that students can help teachers by creating multimedia projects and by trouble shooting technology problems with teachers.

9. Exposing students to technology and its effective use as a communication tool has allowed them then to go back and do projects for the teachers. And they ask teachers, "Can I use PowerPoint to do this, can I do a graph on the computer, can I use the Internet for this particular purpose?" They have become models of effective use of technology in their classroom. Ms. V, Gr. 7 & 8 Gifted Program

And in this case, the experiences led to enhanced student self-esteem.

10. We've been trying to get teachers comfortable with technology and giving them the staff development to do it in order to do it, so this is just coming from the ground up having the students sort of lead the way as well. We now have two students, a seventh grade girl and an eighth grader boy. Teachers call them out of class and say my printer

won't work, can you help me do that? It has had a huge impact on my students as far as self-esteem as well. Ms. V, Gr. 7 & 8 Gifted Program

In addition, the students have become coaches.

- ... last year my students helped build the school Web site ... this year I don't have time to maintain that. Two of my students called me during the summer and asked me for a letter of recommendation to take a college course on programming. I approached them at the beginning of the year and I said, "Do you want to be the Web masters? In addition to maintaining the Web site, they coach some teachers as the teachers build their own Web pages. Ms. V Gr. 7-8 gifted

Discussion and Implications

In this study we found change occurring in areas that are similar to those discussed by Fullan (1991): new or revised materials, new teaching approaches, and the alteration of pedagogical beliefs. Aspects of each of these areas are discussed below.

The regularly scheduled AZCOTT meetings provided opportunities for teachers to learn new technologies, design lessons, share ideas, and reflect on their teaching approaches. This support allowed them to integrate technology more often in their classrooms. As a result the participants often noted changes in their approaches to teaching that were less lecture oriented, more project oriented, more collaborative allowing students to work in small groups, and more collegial in that students became experts and worked with other students and teachers. This is consistent with Becker (1994) who found that opportunities for collaboration supported exemplary computer use; and that exemplary computer users tended to allow for more small group work.

The choice of the Unit of Practice (UOP) format had an interesting effect on teachers during the planning process. When teachers setout to integrate technology, it seems as though the technology may become the focus of their efforts. Since the technology is the element of instruction that is likely the most novel for teachers, this is not unexpected. Using the UOP seemed to redirect the teacher's thinking to make the content area objectives (standards) the focus, as it should be. As a result teachers began to ask themselves, "How can I use technology to effectively teach this content?" instead of "How can I fit some technology into what I am doing?"

Teachers created curricular plans (Units of Practice) and implemented them. The workshops were effective in helping the participants prepare their Units of Practice. At the conclusion of each workshop day participants completed evaluations called exit tickets. This comment exemplifies the value of the training:

"Just speaking for myself, I would like to have our Saturdays be longer, perhaps six hours. I would use the extra time to work with my group on our project."

All teachers appreciated the workshops provided by the AZCOTT program because it provided training within a community of teachers who had similar interests. It helped them think about all of the components of a planned learning activity and thus prepared them to implement the integration of technology in their curriculum. This finding is consistent with the literature that suggest that adequate staff development is a key support for change (Becker, 2000).

Across the classrooms, we found positive changes in student engagement. Teachers noted that students were excited about learning. They displayed initiative by going beyond the assignment and by asking to use computers during free-time and after school. We also found general teacher concerns about noise levels in their classrooms or at least the beliefs that others would find the noise levels in their classrooms inappropriate. The noise that accompanies student engagement

may be a good problem, but it also was a real issue that continues to be on the minds of the participants. These findings are consistent with those of the earlier study of Apple's Classrooms of Tomorrow (Sandholtz, Ringstaff, & Dwyer, 1996).

It was apparent that these teachers were excited about what they were doing in their classrooms and convinced that it promoted students' learning. As a result they took what they had learned and shared it with their colleagues. They taught after school technology classes and often assisted their peers to solve technology-related problems. This was primarily evident at the school level, but it also occurred at the district level. For example, at a district technology staff development event, the superintendent of a school district with an AZCOTT classroom remarked "What a difference Ms. T's room has made to the district" and said they would find teacher substitutes for those wishing to visit and participate in that classroom. In another district, one teacher was selected to become a district technology integration specialist as well as continue teaching a section of her grade 7-8 gifted class.

The teachers recognized that adequate access to technology located in the classroom was an important contributor to their success. Having computers in the classroom, as opposed to a computer lab, allowed teachers to use the computers as tools for learning in a natural/organic manner, a process that may seem artificial if confined to scheduled lab times for computer use. For example the teachers said:

I was really surprised at the impact of having the technology in my classroom and the difference that made. We have a 33 station networked computer lab, so [we always had] access to computers. But the problem was I only got to go down there occasionally. Once a week I had my set time, but if anything happened that week, I lost that set time, I was stuck and could not use technology for that week. And that would happen quite a bit. Ms. Lo, Gr. 6

The computers and software need to become something that is open and available. People aren't going to use it if it's too restrictive. If it's in a locked cabinet they aren't going to come to check it out. We need to say, here it is. Come get it. (Mr. B, Gr. 2)

These findings are also consistent with the findings of Becker, 2000, who concluded that access to 5-7 computers in the classroom was a contributing factor to those teachers who regularly had students use technology in their curriculum.

Initially, it appears that technology has become an integral part of each classroom rather than a time set aside to go to the computer lab 40 minutes a week. We think this early success is due to the project's ability to address multiple interventions. Hall and Hord (2001) point out that change often is not centered on one innovation but many. In this case AZCOTT teachers had the support of their principals, participated in over 100 hours of high quality workshop training distributed over the course of a year, attended two local educational technology conferences, received technical support from their school districts, benefited from online support through interactions with their peers and PT3 project staff, enjoyed technical and curricular support from the project manager and her site visits, and received adequate access to technology and the Internet. Although we noted signs of early success, experts on the change process have found that the implementation of change often requires 3-5 years (Fullan, 1991; Hall & Hord, 2001). We plan to revisit these classrooms after the second and third years of the project and trace the developments of the teachers and the preservice students influenced by the AZCOTT classroom examples.

References

Becker, H. (1994) How exemplary computer-using teachers differ from other teachers: Implications for realizing the potential of computers in schools. *Journal of Research on Computing in Education, 26*, 291-321.

Becker, H. (November 15, 2000). Findings from the teaching, learning, and computing survey: Is Larry Cuban right? *Educational Policy Analysis Archives*, 8 (51) (http://epaa.asu.edu/epaa/v8n51/)

Carlile, B. (1998). *Personal communication with ASUW director of field placements.*

Fullan, M. (1991). *The new meaning of educational change.* New York: Teachers College Press

Hall, G., & Hord, S. (2001). *Implementing change.* Needham Heights, MA: Allyn and Bacon.

Sandholtz, J., Ringstaff, C., & Dwyer, D. (1996). *Teaching with technology: Creating student-centered classrooms.* New York: Teachers College Press.

Strauss, A. (1987). *Qualitative analysis for social scientists.* New York: Cambridge University Press.

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