

THE USE OF MULTIMEDIA MATH LESSONS
TO ESTABLISH A LEARNING COMMUNITY

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Abstract

This case study illustrates the process by which one school district will implement multimedia lessons in the math classroom to establish a learning community. Key employees of the district were interviewed and students in grade six math classes were shown a lesson and then asked to answer a survey. The theories of Human-Centered Design and Constructivism were applied and characteristics of each were analyzed as they relate to the multimedia lessons.

Table of Contents

Abstract	iii
List of figures	vi
Section 1: Entry Vignette	1
Section 2: Introduction	5
Literature review	5
<i>Journal article summaries</i>	5
Statement of the problem	12
Problem questions	13
The case study	13
Data collection	16
Analysis of data	19
Outcomes/development of themes	20
<i>Planning and communication</i>	20
<i>Availability</i>	22
<i>Maintainability</i>	23
<i>Teacher attitudes</i>	25
Section 3: Description of the case	27
Section 4: Theory	29
Human-centered design theory	29
Constructivist theory	33

Section 5: Assertions	36
Planning	36
Communication	36
Conclusions	37
Further developments	45
<i>Limitations</i>	45
Section 6: Closing Vignette	47
Appendix A: Glossary	48
Appendix B: Ethics Permission Form	50
Appendix C: Interview Form	51
Appendix D: Student Survey	52
Works Cited	53

List of Figures

Figure 1 – Data Collection Matrix _____	16
Figure 2 – The Production Process _____	27
Figure 3 – Recording the Lesson _____	28
Figure 4 – Lesson Menu _____	30
Figure 5 – Visual Clip From A Taped Lesson _____	35
Figure 6 – Sherburne-Earlville Grade 8 Mathematics Performance _____	41
Figure 7 – Grant Information _____	43

Section 1: Entry Vignette

It is April 2005 and Todd Griffin, Director of Instructional Technology for the Sherburne-Earlville Central School District, sits at his desk pensively. With all of the technological resources Sherburne-Earlville has (computers, ELMOs, projectors, digital cameras, digital video cameras), Todd is thinking about ways in which technology can be used as a resource in the middle school math classroom. Though he would like to see technology used as a resource in all classrooms, middle school math is the specific area that caused the school district to be placed on the SINI (School In Need of Improvement)¹ list.

There has to be something we can come up with to help kids – something that will be easily accessible, easy to understand, and something that will keep the students interested, *he thinks*.

He reflects on the past school year and the “Academic Learning Center” experiment.

A committee comprised of administrators (including himself), math teachers, a special education teacher, and a computer teacher, had been formed to address the SINI status. Observing the allure that computer games seem to have on children, the committee suggested converting one of the computer labs into an “Academic Learning Center” where math software would be installed on the computers. Middle school math teachers would be required to tie the lab into their curriculums and have their students use the labs as a part of classroom instruction. Unfortunately it was difficult for him to find software that was compatible with the Macintosh OSX operating system that the district had recently installed. Though a good idea in theory, he was never able to apply the concept.

¹ A school becomes a School In Need of Improvement when students fail to meet the Adequate Yearly Progress in a subject area for two consecutive years.

Todd thought, Even if we had found an adequate amount of compatible software, it doesn't follow the math curriculum that we have established here. Wouldn't it make more sense to have the technology piece correspond to what the students are actually learning? Does a middle school student even have the attention span necessary to play a math game for a period of 40 minutes?

Being in the field of education for almost 20 years and the father of two children, Todd knew the answers to those questions and they weren't good. The point of the technological resource, whatever it may be, would have to follow the teacher's curriculum map. It would also need to address the attention span of a middle school student. Anything else would be ineffective. These thoughts played over and over in his mind on a daily basis. Back to work, he thinks to himself and grabs a stack of paperwork.

It just so happened that the stack of paperwork he chose contains Technology Research Committee Grant proposals. As a member of the Grant Committee, Todd needed to read the grant proposals to decide which proposals he would recommend for awards. One of the grants is from a teacher right in the Sherburne-Earlville District. He reads the objective section.

The purpose of this proposal is to provide students in grades 6-8 with the opportunity to use technology to produce multimedia tutorials for middle school classes in Spanish and French. Students who create these tutorials will be enhancing their own learning by taking an active role in their educational experience. They will also be helping other students by creating a learning community at the middle school level. These tutorials will be used by the classroom teacher to reinforce skills taught, along

with providing a means of class review for the absent student. Tutorials will be presented via DVD using classroom computers as well as through the school's web site and streaming server.

He continues to read the New York State Learning Standards that will be addressed by these multimedia lessons. He grabs the New York State Learning Standards² poster from his bulletin board and reads the section on Mathematics, Science, and Technology.

Standard 2: Information Systems

*Key Idea 1: Information technology is used to retrieve, process, and communicate information and as a tool to enhance learning.

Standard 3: Mathematics

*Students will organize and consolidate their mathematical thinking through communication.

*Students will communicate their mathematical thinking coherently and clearly to peers, teachers, and other.

*Students will create and use representations to organize, record, and communicate mathematical ideas.

What a great idea, *he thinks*. Why couldn't this type of tutorial be applied in the math classroom as well? *He calls Barb Wright, the teacher who wrote the Technology Research Committee Grant and asks her to come down and meet with him. He pitches his ideas about adding math to the proposal and she agrees.*

² The New York State Learning Standards are set forth by the New York State Education Department. Teachers are required to follow the standards when writing lesson plans (New York State Department of Education).

Discussion

And so a math video project was born, a quest that will attempt to combine the math curriculum with technology resources in a way that will make lessons more meaningful to the students who use them. In response to the No Child Left Behind Act, more and more school districts are looking for ways of addressing student performance. “Through innovative budgeting and planning strategies, superintendents and principals everywhere are discovering creative tools for meeting the needs of all students. (Collins 42)” Multimedia lessons might be one of those ways for this district.

Section 2: Introduction

Literature Review

In the process of researching aspects of the thesis topic, several scholarly journals and online journals were reviewed. Since there were not articles specifically written about this type of multimedia lesson, the focus for research was placed on key ideas such as incorporating technology into the classroom, combining technology and the teaching of mathematics, and how teachers may feel about teaching with technology.

Journal Article Summaries

Earl Woodruff, Clare Brett, Ronald Macdonald, and Rodney Nason presented a paper “Participation in Knowledge-building Communities to Promote Teaching Competency in Mathematics” detailing a qualitative study in which one of the goals was to “encourage pre-service teachers with a self-declared anxiety toward mathematics to engage in a mathematical knowledge building community. (Woodruff et al.)” The participants were prospective math teachers enrolled in an experimental two-year certification course. Data was collected from three sources: “1) Database entries from the electronic conferences across the 2 years; 2) Responses to questionnaires and periodic interviews about mathematics, the role of technology and their sense of community within the program; and 3) Portfolio entries submitted over a two-year period in partial fulfillment of degree requirements. (Woodruff et al.)” From the study it was determined that by forming a community where these students could examine their anxieties and issues regarding math, they were able to work through them with the support of their peers. The multimedia lesson project being piloted in the Sherburne-Earlville district has a similar goal, which is to build a learning community made up of people who will provide support and assistance to students who are also learning math.

“Content delivery for a virtual high school,” by W Joy Lopez, a science teacher in Citrus, California for Visions in Education, which is a charter for home-schooled and independent study children. In the article, Lopez describes an educational setting where students engage in learning synchronously, asynchronously, and through periodic face-to-face meetings with teachers to complete hands on tasks. The key conclusions are that these students learn through a combination of online and traditional methods and that learning occurs in communities. Though specific data is not given regarding the success of the program, the author explains, “student and parent response is positive. (Lopez 33)” Laura Villarreal, the author of “A step in the positive direction: Integrating a computer laboratory component into developmental algebra courses,” is a math teacher at a community college in Texas. The article documents the department’s transition from the traditional educational format (lecture, modeling, and questioning), to Computer Directed Instruction (CDI), to Computer Assisted Instruction (CAI). Computer Directed Instruction was a self-paced program with an open computer lab policy where students “were given a list of computer assignments that needed to be completed by the end of the semester. (Villarreal 73)” Villarreal concludes that particular program was unsuccessful, due largely to the lack of student motivation to complete assignments. The college

transitioned into a Computer Assisted Instruction program, a combination of computer-based assignments and classroom instruction.

Villarreal notes that the major revision from Computer Directed Instruction to Computer Assisted Instruction occurred when there were students who had already taken a course in the Computer Directed Instruction format with a self-paced and open lab situation. These students were not receptive to the change and grades initially dropped in those courses. She argued that the change should not have been made in the second semester of a sequenced course. Since then students have only used Computer Assisted Training and, “the percentage of students passing this course has continued to rise and exceed the passing success rate of previous years by 3 percent. (Villarreal 75)” This article illustrated that a purely computer directed program was not successful. The program that was ultimately successful combined a computer lab with a traditional educational setting. Alan Perry, a high school English teacher for more than 20 years, recounts two experiments he conducted incorporating technology into his classroom in “Tech versus the Human Touch: Teacher Affect Is More Effective.” Two of his classes actively participated in the experiments. One class was experimental while the second acted as a control group. Using Shakespeare’s *Macbeth*, the experimental group worked at computers to research recommended web sites, used a TV/VCR to watch the BBC version of *Macbeth*, or used a CD-ROM for either, “an intensive critical and analytical guide to the play” or to research background on Shakespeare and the Elizabethan period. (Perry 183) The control group read the play aloud in a traditional classroom setting and participated in discussions with the teacher. In Phase II of the project, the experimental and control groups switched as they studied *Hamlet*. Perry discovered that test scores for the students who only used technology did not score as well on the test given at the conclusion of the units. Also, based on a survey the teacher used following the lessons, an overwhelming majority said that they would prefer to be taught through lecture and discussion.

According to Perry, “I still felt that technology, used correctly, could benefit my students, so last year I began requiring them to create PowerPoint presentations on whatever topics they selected for their research papers. (Perry 184)” In this experiment, students created their own multimedia projects to present to their classmates. The students’ response was positive and the author says, “the experiment was so successful that the PowerPoint assignment has become standard in all my classes, both college prep and regular-track classes. (Perry 184)” Perry concluded that the human element was necessary for learning to be successful and said, “Keep the technology, but don’t expect it to replace the human touch. (Perry 185)”

The human touch is a key component in the making of the multimedia lessons at Sherburne-Earlville. The lessons feature the students’ math teachers. Students are able to see their hands and hear their voices guiding them through a concept. The lessons are not meant to replace the teachers, they are meant to be a tool that incorporates technology into the classroom and supplements traditional teaching methods.

Corey Murray, assistant editor of *eSchool News Online*’s “Video on demand boosts students’ math scores,” describes a study that supports the idea that “short video clips that reinforce key concepts are effective in increasing student achievement. (Murray)” The study involved approximately 2,500 sixth and eighth grade students from four Los Angeles area middle schools. Teachers in the experimental groups “incorporated

approximately 20 standards-based, core-concept video clips into their daily lessons, while teachers in control group classrooms continued with their traditional lessons. (Murray)” Based on a comparison of pre-test and post-test assessments, it was determined that sixth grade and eighth grade students who were shown the video clips improved their test scores. Though the video clips used in this study are not exactly like those proposed in the Sherburne-Earlville District, the core concept of using video to supplement classroom learning and its potential success is supported.

“Filling educational gaps with online learning: An educationally, economically sound solution” by Sue Collins points out that on the heels of President Bush’s *No Child Left Behind Act*, schools are looking for ways to expand offerings to meet the needs of the students. According to Collins, online learning is a cost-effective way to do that. She gives the example of a low number of students who need to take a particular course. While it would not be cost-effective to hire a teacher for the subject area, it may be possible to connect to another school that has the resources to provide that class online. “Online learning fills that void in the educational program, giving students the courses they need to apply for college, or in some instances, graduate on time. (Collins 42)” This article acknowledges the *No Child Left Behind Act* and the need for cost-effective solutions for schools whose funding is so uncertain from year to year. The points made in the article support the idea that computers, specifically online learning, are an option to fill gaps in an educational setting. The author also points out that this is only a cost-effective option if the students have the access to technology necessary for online learning.

Another article addressing learning gaps is “Online learning fills void in nations coping with SARS” by Rhea Borja. In 2003, many schools in Beijing, Hong Kong, and Singapore closed due to an outbreak of SARS (severe acute respiratory syndrome). That is when an online project called the Virtual Integrated Teaching and Learning Environment (VITLE), which was being created at Hong Kong Baptist University, made its debut. This environment “allowed teachers to post their curricula online, write on digital whiteboards, and magnify their materials so students could read them on their computers. It also enabled teachers to see, hear, and speak to their students in real time. (Borja 6)” Borja notes that although the online project allowed many students to continue with their work and remain on schedule with their education, this method was not without challenges. For instance, student access to equipment and the Internet was a concern. She also noted the task of arranging an online class schedule that would work for both teachers and students. Though on a much larger scale, this article speaks to one of the principal potential uses of the multimedia lessons, keeping students current with instruction when they are unable to attend.

Orit Hazzan’s article “Prospective high school mathematics teachers’ attitudes toward integrating computers in their future teaching,” shows how a teacher’s attitude can influence whether or not technology is integrated into the classroom. Hazzan collected data from 94 prospective high school mathematics teachers during classes he taught on the use of computers in teaching mathematics. He taught the classes in a computer lab and collected his data from written responses and class discussions regarding both mathematical and pedagogical issues. Prospective teachers were asked to give pros and cons on the topics of classroom components such as the learner, mathematical content, learning environment, and class atmosphere as well as psychological aspects including

cognitive, affective, and social. Both positive and negative comments were shared. Hazzan found that “many prospective teachers have added a remark in the following spirit: It is worth integrating learning with computers together with learning and teaching without computers. (Hazzan 222)”

Though technology surrounds the teachers in the Sherburne-Earlville District that does not mean that every teacher uses technology in meaningful ways. According to Todd Griffin many teachers use technology, but it is often for teacher-directed activities with little exploration and not constructivist structured (see Constructivist Theory in Section 4). Activities also have strict parameters, which are mostly due to time constraints. Therefore, most meaningful learning takes place at home with surfing or gaming. Hazzan suggests that teachers need to be motivated to integrate computers into their classes.

In “Effects of technology integration education on the attitudes of teachers and students,” Rhonda Christensen found that teacher attitudes on computers in education depended largely on training in its use. She conducted a study where the subjects were teachers in three public elementary schools in Texas. Teachers at one school “received needs-based instruction in the integration of computers into classroom learning activities during the school year. (Christensen 414)” Teachers at the other two schools were used as comparison groups. They received normal district-level technology in-service training. Data was collected from the *Teachers’ Attitudes Toward Computers Questionnaire*. The questionnaire measured concepts such as computer importance, computer enjoyment, and computer anxiety. Three hypotheses were explored based on the data; “Hypothesis 1: Needs-based technology-integration education fosters positive attitudes toward technology among elementary school classroom teachers; Hypothesis 2: Teacher education in needs-based technology integration, combined with significant classroom use, fosters positive student attitudes toward information technology; and Hypothesis 3: Positive teacher attitudes toward information technology foster positive attitudes in their students. (Christensen 416-417)”

The lessons being proposed by the Sherburne-Earlville district are new. As with any new information, teachers will need to be trained to use them and how to incorporate them into their own classrooms. Once the teachers are trained, student use of the lessons will need to be supported and encouraged by the teachers. It will provide insight to apply these hypotheses to the Sherburne-Earlville district video program.

Statement of the Problem

According to Griffin, students in the Sherburne-Earlville Middle School earned below-average scores on the New York State eighth grade math exam in the 2002-2003 school year. The result of the below-average scores was that Sherburne-Earlville Middle School was categorized as a School in Need of Improvement (SINI) in the area of mathematics for a period of two years. In response to this categorization, Todd Griffin, the Director of Instructional Technology for the district, submitted an application for the state Title IID Grant, Enhancing Education Through Technology, to fund new projects and programs in the area of mathematics, which could then be applied to other subject areas. In the application, Griffin incorporated the idea of the multimedia math tutorials. He said the district has chosen to take advantage of its available technology resources to improve the math test scores and is

currently in the production stages of creating the multimedia math lessons to promote a learning community³.

Problem Questions

A case study of the Sherburne-Earlville School District was done to understand the process by which the district planned, is producing and will implement multimedia lessons in the math classroom.

Main Research Question

Will multimedia math lessons enhance the learning experience for students?

Issue Subquestions

- *How are the multimedia lessons produced and implemented?*
- *Can the product benefit the students?*
- *Are there challenges to implementing these lessons? What are they?*
- *Will the product meet the needs of the district?*
- *How will success be measured?*

Qualitative Research and The Case Study

According to John Creswell one reason to choose a qualitative research approach is to study a topic that needs to be explored (Creswell 17). The multimedia lesson is a new resource that will be introduced into this school. Based on the data reported in the Lopez and Villarreal articles (discussed in the Literature Review and cited in Griffin's Title IID Grant proposal), Griffin said he has "high hopes for the lessons to contribute positively to the classroom and ultimately raise test scores." Creswell also states that one should choose a qualitative approach "in order to study individuals in their natural setting. (Creswell 17)" Because the author is also a teacher in the district, most participants were easily accessible in their offices or classrooms.

The project also lent itself to analysis because it is a unique project in this geographic area. Technology is abundant at Sherburne-Earlville. Teachers and teaching assistants are assigned a Macintosh laptop to use while they are employees of the

³ "A community is a group of individuals who share common interests and identity. (Lopez)" In this case, the learning community is a group of individuals who share the interest of assisting a student in the area of mathematics.

district. Each classroom is equipped with at least four iMac computers, an ELMO document camera and a projector. Middle school math classrooms each have a laptop cart with approximately 20 notebook computers. The laptop carts were funded in year one of the Title IID Grant. There are two Macintosh computer labs in the middle school, which contain 44 iMac computers. There is a smaller Macintosh lab used by high school art students, two Macintosh labs in the elementary school and two in the middle school/high school library, and a PC lab used by the high school computer applications teacher. All computers are upgraded regularly according to the school's technology plan. According to Todd Rutan, Delaware-Chenango-Madison-Otsego Board of Cooperative Educational Services Technology Integration Specialist, "There is not another school in the Delaware-Chenango-Madison-Otsego Board of Cooperative Educational Services District that possesses the amount or types of technology resources found at Sherburne-Earlville." Therefore, multimedia lessons like those proposed in this study do not exist in this area of New York State. The case study is bounded by the school district that was studied (Sherburne-Earlville) as well as the timeframe, from January to May 2006.

The Sherburne-Earlville School District is a very rural district located in Central New York State, about midway between Binghamton and Syracuse. According to Sherburne-Earlville District Clerk Gina Muhlfield, in the 2005-2006 school year, there were 1,784 students in the district and 165 employees. Forty percent of the students in this district live at or below the poverty level. An average of 18 percent of the students receive special education services and between two and four percent of students drop out of school.

Significance of the Study

This study is especially significant at this time as school districts nationwide are struggling to comply with the *No Child Left Behind Act*. Implemented in 2001, this federal law was created on the principle that "all children deserve a high quality, challenging education that gives them the skills and knowledge they will need to succeed in today's world." (New York State Education Department) One of the pillars of this act is accountability for results, "all schools must make Adequate Yearly Progress. Adequate Yearly Progress is the minimum level of performance school districts and schools must achieve every year." (New York State Education Department) Because Sherburne-Earlville students did not meet their Adequate Yearly Progress in mathematics in the 2002-2003 school year, the middle school became a "School In Need of Improvement". Though no longer on the School In Need of Improvement list, Griffin says that district administrators and faculty are continuously searching for ways to ensure that students meet or exceed the Adequate Yearly Progress to avoid becoming a "School In Need of Improvement" again.

Data Collection

For the purposes of this study, data was collected from a variety of sources. Figure 1 is a data collection matrix illustrating the sources from which data was collected.

Information Source	<i>Interviews</i>	<i>Observations</i>	<i>Documents</i>	<i>Websites</i>
Todd Griffin, Director of Instructional Technology	3		12	
Gayle Hellert, Superintendent	3			
Jill Lee, Middle School Principal	1			
Kevin Vibbard, Math Department Chair	1			
Amy Palkovic, Grade 6 Math Teacher	1		1	
Barb Wright, Teacher Digital Communications	1		1	
NYSED and US Dept. of Education Resources				2
Gina Muhlfield, District Clerk				
Todd Rutan, BOCES Tech. Integration Spec.				
Math Students, grade 6			76 surveys	
Scholarly Journal Articles			11	

Figure 1: Data Collection Matrix

All subjects interviewed are personnel of the Sherburne-Earlville Central School District and are instrumental in some area of the project being studied. The author began working with Todd Griffin in the summer of 2004 on a project that preceded the multimedia lessons. Both Griffin and the author were members of a team created in 2003 by then Superintendent Steve Szatko. The team consisted of Superintendent Szatko, along with two assistant superintendents, the retiring middle school principal, the middle school assistant principal, the incoming middle school principal, a middle school computer lab teacher (the author), the high school principal, the elementary school principal, a special education teacher, two middle school math teachers and a high school math teacher. The purpose of the team was to brainstorm ways in which the district could incorporate technology into the math curriculum. After several months of meetings, the team suggested an Academic Learning Center.

Griffin recounted that the idea of the learning center was that the district would research and purchase math software to be installed in one of the middle school computer labs.

Math teachers would be required to include computer lab time into their lesson plans and curriculum maps. Run by the computer teacher, students would periodically go to the lab during their regularly scheduled math classes and use the math software based on their current unit of study.

Many of the math teachers interviewed said that they were not receptive to the addition of the lab requirement into their class time. Amy Palkovic stated, "I scarcely have time to cover all of the required material, let alone add another piece into the curriculum."

Another obstacle was software incompatibility. Much of the software the teachers requested was not yet available for the Macintosh OSX operating system, which the district had recently adopted. In addition, the teachers said they did not feel that the software on the market would correspond to their curriculum. Palkovic said, "With the software I've looked at there are usually concepts integrated that I have not yet taught in my classroom or it does not follow the sequence of my lessons." Finally, according to Griffin, by the spring of that school year the district learned of financial cuts made to the Title IID Grant making it impossible to keep that particular computer lab open. The project was abandoned.

Now a Spanish teacher, the author remains on the school's technology committee and continues to work on technology projects with Griffin. It is through that committee that the author learned of the new attempt to integrate technology into the math classroom via the multimedia lessons. An initial meeting with Griffin led to the discovery of the faculty members who would be responsible for creating the lessons, teachers Barbara Wright and Amy Palkovic. Principal Jill Lee and Department Chair Kevin Vibbard were key members of the Academic Learning Center experiment, and now have a connection to the multimedia lessons by virtue of their job responsibilities. It is important to note that these lessons will not be implemented or available until the 2006-2007 school year. In order to obtain some student feedback, Palkovic played a lesson for her sixth grade math students who then rated the lesson using a rubric. Subsequent interviews took place with Griffin to clarify points made by other interviewees and to gain additional specific knowledge about the grant.

Analysis of Data

Five district employees were interviewed and asked to discuss their roles in the project. The roles ranged from supervisory to participatory. Interviewees were also asked to discuss what they foresee as the benefits and challenges of the project.

In addition to completing interviews, Amy Palkovic administered a survey. Palkovic is a math teacher teaching five classes of heterogeneously grouped students in grade six. For the survey, seventy-six students were shown a lesson from one of the unit disks and asked to respond to a series of questions based on a rubric. The questions were based on the themes developed during interviews (which are detailed in the section "Outcomes/Development of Themes"). Below are the questions along with the results.

1. Do you think this lesson would be useful for quiz/test review?

very useful 24, useful 34, somewhat useful 13, not useful 2, don't care 3

2. Do you think this lesson would be useful to help you catch up with work when you are absent?

very useful 44, useful 23, somewhat useful 9, not useful 0, don't care 0
3. Do you think you would use these lessons if they were available to you?

yes 42, no 11, don't know 23

4. Is it helpful that your own math teacher is in the video?

very helpful 16, helpful 24, somewhat helpful 17, not helpful 9, don't care 8

5. Does the DVD look like it is easy to use?

very easy 57, easy 11, somewhat easy 5, not easy 1, don't care 1, no answer 1
6. Was the lesson easy to understand?

very easy 47, easy 21, somewhat easy 7, not easy 0, don't care 1
7. Were there enough examples?

more than enough 14, enough 55, not enough 5, don't care 2

8. Were the examples easy for you to understand?

very easy 47, easy 23, somewhat easy 4, not easy 1, don't care 1
From the results, it became clear that the majority of students believed the lessons would be helpful for both review purposes and to provide instruction when a student is absent. In the comment section of the survey, one student wrote, "I love this idea – especially how you could use it when you're absent because you miss two whole classes." Students also found the disks to be easy to use and, as another student commented, "They [the lessons] were easy to understand." They indicated that it was helpful to hear their own math teacher in the lesson, there were enough examples, and that the examples were easy to understand. One student did write, "Have more examples." While 42 students indicated that they would use the lessons if they were available, 11 said they would not and 23 said they didn't know. It may be beneficial for teachers to decide how they will introduce and incorporate the lessons into their classrooms. Students may not use the lessons if it is not mandatory for them to do so.

Outcomes/Development of Themes

Upon completion of the interviews and surveys, the data collected was analyzed. Four main themes surfaced: *planning, availability, maintainability, and teacher attitudes.*

Planning and Communication

According to Griffin, though there was a great deal of planning and research involved in the writing of the Title IID Grant, there was not a lot of planning for this project because administrators (including the grant writer, Griffin) said they did not believe the district would be awarded the grant money. Once the grant was awarded, Griffin said he began thinking about what could be done with the money to address the district's math issues. Digital Communications teacher Wright had written a grant for a smaller project to have her video production classes create multimedia tutorials for middle school French and

Spanish classes. When Griffin reviewed the grant, he said he realized that the principles could just as easily be applied to math.

In September of the 2005-2006 school year, the process began. According to Barbara Wright, the current creative process came about by trial and error. Initially a camera was set up in the classroom and full math classes were recorded in real time. Wright would edit the raw footage. The participants found that background noises (i.e. student activity and tones signaling class changes) were distracting and difficult to remove. Also Griffin and Wright agreed the videos were too long. Since core classes in the middle school are taught in a block format, video footage for one lesson was approximately 80 minutes in length and included extraneous classroom activities that may not be relevant to the students viewing the video. Going back to Griffin's assertion (in the opening vignette) that lessons need to be short enough to hold the attention of a student, it was decided that they would be more inviting if they were shorter and only included key concepts. Lessons were then reduced to core concepts and the corresponding video was shortened to approximately five minutes. Over the course of the school year, Wright and Palkovic met weekly to arrive at the current process.

Now that the pilot is near completion, Griffin stated that the planning will continue as the remaining middle school math courses are archived. He said the plan is to create multimedia lessons for grades seven and eight over the summer of 2006 so that they are available for implementation in the fall of 2006. He continued by saying that a great deal of planning and communication will need to happen between Wright and the three other math teachers in the middle school. For the project to be completed by summer's end, Griffin said there will need to be a recording scheduled planned around various other summer activities (i.e. staff development and vacations). Both Griffin and Wright agreed that the teachers involved should plan by reflecting upon the year's lessons and reducing them to key concepts and examples.

Availability

According to Griffin, lessons will be installed on all math carts – each middle school math teacher has a cart of approximately 20 notebook computers. Students will be able to use the archived lessons in their math classrooms whether it is during their scheduled classes or during their free time. Lessons will be available in both Macintosh computer labs (over 40 computers). In addition to using the lab with math teachers during math class for specific activities, students are allowed to go to the lab during study halls or after school where they could view the math lessons as needed.

Griffin continued by saying that besides being installed in classroom carts and computer labs, students will also have access to lesson disks. If the carts or the labs are not available, a student will have the option of signing out a disk as they would a library book. That option will allow students to view lessons in other classrooms or the library's computer lab. Students will be allowed to take the disks and view them at home or at a public library. The disks will also be made available to families. At any time a parent or guardian can request a complete set of disks which will be provided free of charge by the district. Family members can view the lessons and use them to assist their children with missed lesson, homework, or test preparation at home.

Finally, Griffin stated that lessons will be available on the school's website (www.secsd.org) via streaming video. All computers in the school district are Internet accessible. Classrooms that do not have the lessons installed in the computers can still be used to access them from the website. In addition to using the disks at home, families with Internet access can view the lessons from home. All interviewees were excited about the availability of these lessons. Jill Lee stated, "It's always a wonderful thing when students aren't bound by location."

Despite the availability of the lessons the teachers interviewed pointed out that there is no guarantee that students will utilize them. Palkovic said, "We as teachers can encourage the students to access the lessons when they are absent or to prepare for tests, but that doesn't mean they will do it." Vibbard added, "Unless we make it an assignment, like homework, our students may never see them." Both teachers agreed that all teachers involved should meet prior to releasing the lessons to discuss a plan of action as to how the lessons will be presented to students and what teacher expectations are for student use.

Maintainability

The maintenance of this project will be a challenge from a financial standpoint. Griffin stated that funds were cut from the Title IID Grant for two of the three years. According to Griffin, the original grant awarded \$125,000 each year for three years totaling \$375,000. In the first year one third of the funds were cut. A quarter of the money was then taken from year three and added to year one. Despite the cut, funds from the first year provided for the laptop carts in every math classroom. There was no money cut from year two. Projects funded included the multimedia lesson project as well as the purchase and installation of distance learning equipment. The 2006-2007 school year is year three, the grant has been cut again by 47%, leaving \$40,614. Year three funds will be used for staff development and the purchase of symposiums. A symposium is like a computer screen that can be written on and projected, similar to the features of an interactive white board. It can also record sound. Griffin said that symposiums will be used for, among other projects, the creation of additional multimedia lessons. They will eliminate the need for videotaping.

According to Eric Turner of the district's Computer Services department, sufficient money is needed to sustain and repair equipment needed to create and run these lessons, most especially the servers. Turner said that in the 2005-2006 school year there were many problems with the servers in this district. Software and applications are constantly being introduced and upgraded. Student projects are becoming more technology inclusive. The servers are being stretched to maximum capacity. Turner said that almost daily a server would fail, computers would freeze, and students would have to discontinue working. At times their work would be lost. He continued by saying that it is expensive to maintain and upgrade the servers. Wright added that money is also needed to sustain the software used in producing the lessons as well as for a continuous supply of materials such as DVDs and cases for lessons that go out into the public. Wright also pointed out that occasionally courses have changes in curriculum. She noted that curriculum changes can occur based on state mandates or changes in textbooks. Lessons are being created according to the current course curriculum maps. If curriculum

changes are made, lessons may need to be changed as well. To prepare for possible changes in the order in which material is taught, Wright said that the sixth grade math lessons no longer have titles such as “Unit 6 Lesson 2.” Instead they are being titled according to concept, “Fractions Unit.”

Finally, Griffin said that staffing changes are a reality in any school district. Adding more math teachers or more courses, at least in the area of math, will necessitate further lesson archiving. Each teacher is responsible for creating his/her lessons and, as Palkovic and Wright stated, it takes several hours to produce one unit.

Teacher Attitudes

Interviews with faculty indicated that at this stage of the project, not everyone is a willing participant. All interviewees revealed that at least one teacher in the department, who teaches grades six and seven and is also the department chair, has said he is not interested in participating in this project at all. During his interview he presented it this way, “I haven’t heard anything about plans for working over the summer. I’m not sure if there are funds available for curriculum work. I told Barb [Wright] to offer the opportunity to the younger teachers. They need the money more than I do.” The eighth grade math teacher said he would rather see PowerPoint lessons used for his curriculum and explained that he felt the Digital Communications teacher should put those together (Wright has an English Language Arts background, not math).

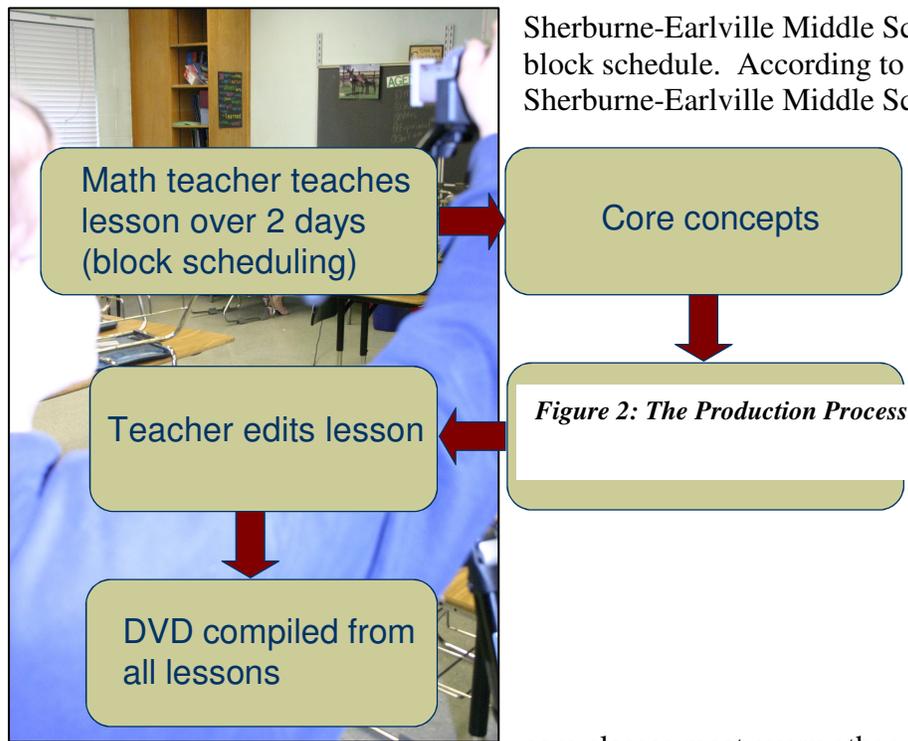
According to Griffin, initially the superintendent was not interested in the project either. However, he said once she saw the first unit’s DVD, she thought it was great. Now she wants to see the project expand, first throughout the entire math department and then into other disciplines.

Not all teachers indicated that they are embracing the idea of the project or seeing its potential benefits. These types of attitudes could hinder the continuation and expansion of the project. Hazzaan and Christensen both addressed the challenge of teacher attitudes towards technology integration. In both studies, participants indicated that they believed it was worthwhile to incorporate technology into the classroom. Their studies stressed the importance of training and educating both teachers and students. In Hazzaan’s study one prospective teacher wrote, “The computer can supply information, but we may lose its potential if we do not educate our pupils to use that information. (Hazzaan 222)” In Christensen’s study, the teachers who had more intense and specific training had a more positive attitude towards using technology in their classrooms and also increased their usage in the classroom.

Griffin said that some teachers have expressed the fear that these taped lessons could replace the need for faculty in the classroom. Based on data reported by teachers Villarreal and Perry (detailed in the Literature Review and the Measured Outcomes sections), the most success was realized when teachers used a combination of traditional classroom instruction and technology. As Perry points out, “Most students can use technology at home with computers, the Internet, television, VCRs and DVD players, compact disks and CD-ROMs, electronic games, cell phones, and an array of other gadgets and gizmos. But what they need most – interaction with a caring, concerned adult – is all too often unavailable. (Perry 184)” Griffin agreed, saying these taped lessons are not intended to replace any teacher, they are meant to aid all teachers.

Section 3: Description Of The Case

In an ongoing effort to meet the Adequate Yearly Progress required as part of the *No Child Left Behind Act*, the Sherburne-Earlville School District is creating multimedia lessons that will be incorporated into the middle school math classroom beginning in the fall of 2006. Figure 2 illustrates the production process. It begins with Amy Palkovic, sixth grade math teacher, teaching a lesson.



Sherburne-Earlville Middle School follows a block schedule. According to Jill Lee, Sherburne-Earlville Middle School Principal,

Figure 3: Recording the Lesson core classes meet every other day for 80 minutes as opposed to every day for 40 minutes. Palkovic teaches a lesson for two days and then narrows the lesson to its core concepts. She then lets Wright know she has a lesson ready and schedules a time for a Digital Communications student to record. At the scheduled time, the student meets Palkovic in her classroom. Palkovic teaches the entire lesson with the ELMO document camera and the image is projected onto a large screen. Using a Sony Handy Cam digital video camera, the student trains the camera on the screen and records the images from there (See Fig. 3). Those who view the lesson are able to see Palkovic's hands and the information she writes while they are hearing her voice.

Footage from the recorded lesson is then transferred into Wright's computer and edited. Reducing the lessons to approximately five minutes and recording in a quiet classroom make little or no work necessary in the editing process. When all lessons in a unit have been recorded, Wright then burns the lessons onto a DVD. By the end of the 2005-2006 school year, all units for grade six math will be compiled onto a complete set of disks.

When a disk is inserted into a computer or DVD player, or the lesson is accessed from the school's web site (www.secsd.org), a menu appears that includes all of the lessons in a particular unit (if viewing from the web site, students must also choose a unit). Students are then able to select the lesson of their choice. Lessons can be viewed in any sequence and played as often as necessary.

Section 4: Theory

Human-Centered Design Theory

In Information Design, Mike Cooley states that the Human-Centered Design Theory “rejects the notions of the ‘one best way’ and the ‘sameness’ of scientific ideas and suggests instead forms of science and technology that would be culturally specific. A great emphasis is placed on the importance of diversity, providing motivation to reflect and enhance cultural educational, and even product diversity. (Cooley 64)” According to Cooley, Human-Centered Systems exhibit the following characteristics: coherence, inclusiveness, malleability, engagement, ownership, responsiveness, purpose, panoramic, and transcendence. Though not created according to this specific system, the format of the disks and the lessons display these characteristics.

Coherence

Coherence means “rendering highly visible what is going on and what is possible. (Cooley 68)” Before each lesson is recorded for use on the disk, it has been taught several times in the classroom. Only the point of the lesson is captured along with relevant examples – only what the teacher knows works.

Also, when the disk is inserted or a unit is chosen from the web site it is apparent what the user’s options are. Each lesson is clearly named according to its content (e.g. Topic 1: Adding & Subtracting Fractions).

Inclusiveness and Engagement

Inclusiveness refers to how inviting a system is and whether a person feels “part of a community of activities with which you are familiar. (Cooley 68)” When the disk is inserted, the menu appears as animated fish swimming in water. It is very visually inviting and the sound of water that accompanies the menu is soothing. The activity choices are short and clear. The menu overall is inviting and can be easily comprehended by the viewers. Because the lessons are taught by a familiar math teacher, the manner in which a lesson is presented and the format of the activities included are familiar to the student.

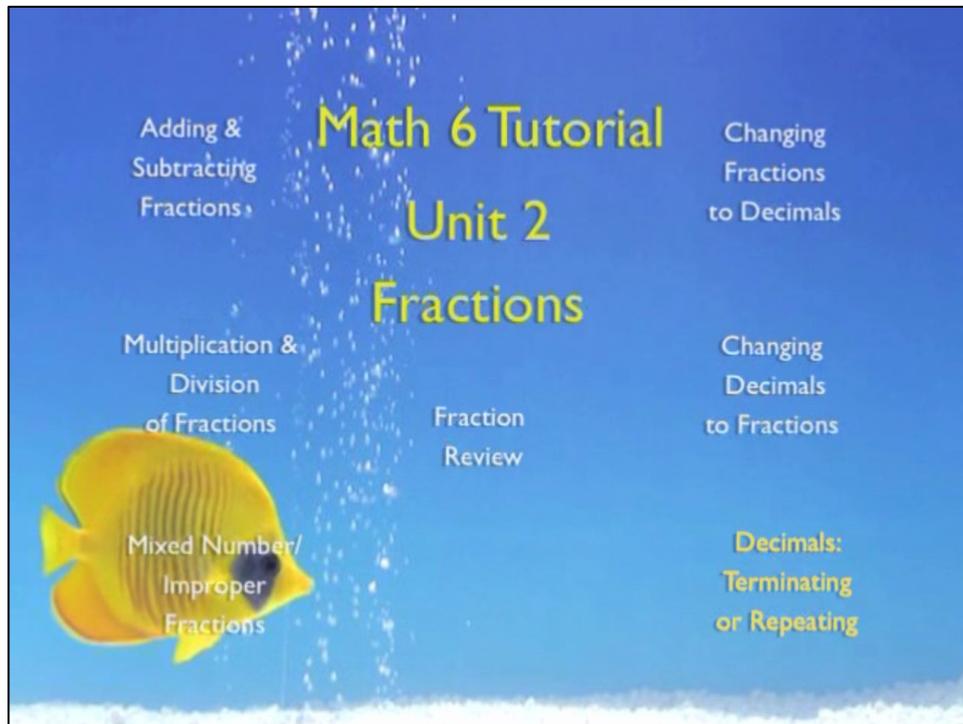


Figure 4: Lesson Menu

Engagement also refers to the sense that one is being invited to participate (Cooley 68). The lessons feature the calm voice of the resident sixth grade math teacher, Amy Palkovic. She keeps all lessons concise while giving several explanations and examples that are easy for students and their families to understand.

Malleability

A system is malleable if the user is able “to pick-and-mix and sculpt the environment to suit one’s own instrumental needs. (Cooley 68)” All topics included in a lesson are available on the unit’s disc or on the web site. A student, or a family member helping a student, can click on the lesson of his/her choice. The lessons can be used if a student has been absent and has missed a lesson, as well as if a student needs reinforcement or re-teaching of a certain lesson. The disk can be used as a tool when reviewing for unit tests and final exams. Lessons can be viewed in any sequence and can be viewed as many times as the viewer chooses.

Ownership

Ownership describes a “feeling that you have created and thereby own parts of the system. (Cooley 68)” As opposed to software that is created at an unfamiliar company and mass-produced, these lessons are tailor-made for this school’s curriculum. Though not created by the students, students do take part in the taping process. Also, the units feature lessons taught by their own math teacher, or another math teacher in their grade level with whom they are familiar. The lessons therefore become more personal to the students.

Responsiveness and Purpose

According to Cooley, responsiveness is “a general sense that you can get the system to respond to your requirements. (68)” Having access to math lessons on disk can empower the students. The lessons can be viewed according to the needs of the student. Lessons can be viewed if instruction has been missed due to absence, or to supplement classroom instruction for reinforcement, or even to review for comprehensive exams. The disks can also be used by family members who wish to assist their students at home, but are not sure of the information.

Similar to responsiveness, purpose means that, “the system is capable of responding to the purpose the user has in mind. (Cooley 70)” One of the main reasons for producing the lessons and making them available to students and their families is to encourage students to stay current with instruction. Initially students may view a missed lesson out of a sense of duty or to fulfill a class requirement. However, once a student views the lesson and understands the process of, for example, solving an equation, s/he may then feel it is possible to complete written assignments and future classroom examples.

Panorama

Cooley states that, “good embedded systems should also provide windows or apertures through which one can take a wider or more panoramic view. (70)” Sherburne-Earlville’s middle school follows a block schedule, so the classes only meet every other day. If a student misses one day, s/he is essentially missing two class periods. First and foremost the multimedia lessons are intended to help students stay current with classroom instruction. Once the student views a lesson, it may encourage him/her to use the disk to review previously learned material and to review all the lessons for comprehensive exams.

Transcendence

Finally Cooley states, “When operating the system, the user should be encouraged, enticed, and even provoked to transcend the immediate task requirements. (70)” Using these school-specific lessons could lead to a broader and more stable base of knowledge – their most important tasks being to close gaps in instructions, to provide reinforcement to those students who may need additional instruction, and to provide basic skills to families of students who want to help at home. If the lessons cause the students to feel successful, students may then try similar activities in other situations, be it during classroom instruction, online games, or math software out on the market that is not specific to their own curriculum.

Constructivist Theory

Interpreting, not recording

One premise of Constructivist Theory is that, “learning is active and occurs not by recording information but by interpreting it based on one’s prior experiences. (Neo 6)” Another is that, “concepts cannot be transmitted from teacher to learner by means of words. (Chen 19)” Philip Leinbach was the eighth grade math teacher the year that Sherburne-Earlville did not meet its Adequate Yearly Progress. His primary method of instruction was lecture followed by examples from the book. Unfortunately that method was not sufficient for that group of students and they were unable to retain the information needed to achieve the minimum scores on the state test.

Learning Environment

The learning environment is very important to constructivists. “Knowledge is highly related to the environment in which the learner experiences and constructs the knowledge. (Chen 19)” With regards to the environment where video is viewed, students will most likely view the lessons at school or at home. Students are familiar with the classrooms where can be viewed as well as with the teachers who may be present at the time of viewing. With regard to the lesson environment, lessons are taught by the students’ own teachers, using examples in a format that is typical of their classrooms. Students have a level of comfort from knowing what to expect from their teachers. In

addition, students can view the lessons at their own pace. They can start and stop at will and replay as often as needed. This could be especially beneficial to slower learners as they will not feel pressured or intimidated if they do not understand a concept quickly.

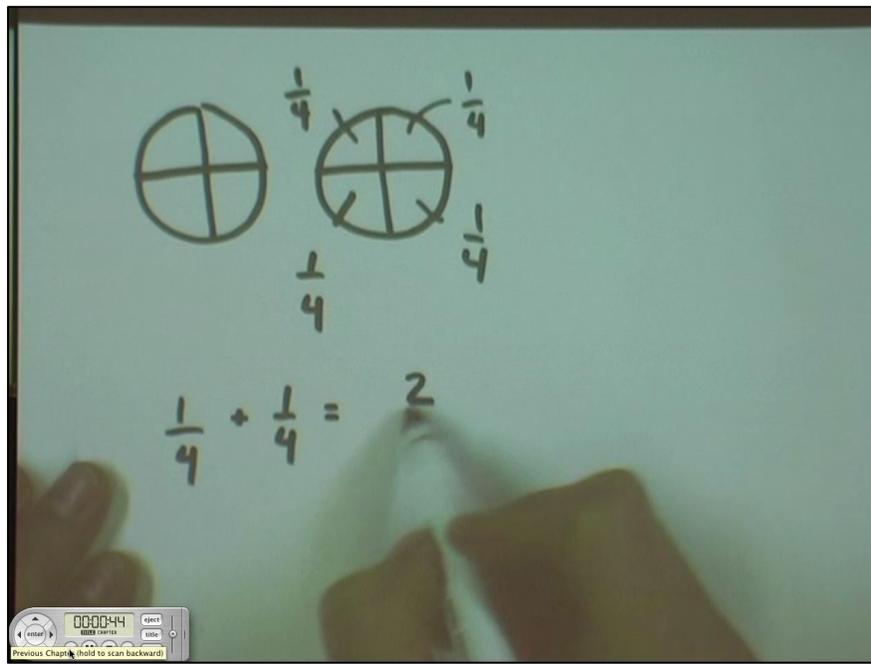
Beyond Information Given

The “BIG” concept means that the, “teacher would directly introduce the concepts, provide examples, and then engage student in activities that challenge them to apply and refine their initial understanding. (Chen 20)” In each multimedia lesson, the teacher introduces the mathematical concept and then gives several examples. It may be useful to add a worksheet that will provide something concrete for their notes and also additional examples to try before speaking with the teacher next.

Teacher Role

A fourth tenet of the Constructivist Theory is the role of the teacher. In Constructivism, learning is more student-centered. “The teacher is no longer perceived as the sole authority, but rather as a facilitator. The amount of guidance depends on students’ prior knowledge levels and experiences. (Neo 6)” As a student studying to obtain a teaching certificate, professors stress the necessity for varied lessons. As a teacher, the author observes students tuning out and becoming distracted everyday. Teachers cannot stand and talk for 40 minutes and expect their students to listen for the entire time or to retain everything that is said. It is not until various activities are added to illustrate the lesson that it becomes meaningful. These multimedia lessons are designed to encourage student-centered learning and can be another resource for teachers to use, both in and out of the classroom, to keep students engaged in their learning process. “One of our goals when we create these lessons is that they are formatted simply enough for students to view and understand, even if there isn’t an adult available to help them,” stated Griffin.

Figure 5: Visual clip from a taped lesson



Section 5: Assertions

Planning

For the future

Now that a process has been established for the creation of the lessons, it should be reviewed to ensure that it is the most efficient. Also, it has taken an entire school year to create a complete set of units for the sixth grade curriculum. A plan will need to be outlined if lessons are to be created for seventh and eighth grade in the course of one summer.

For maintenance

It is inevitable that curriculums will change, whether it is the order in which content is covered or the actual content that will be covered in a grade. As previously mentioned, in an attempt to prepare for changes lesson labels are being changed from titles like “Unit 2” to “Fractions Unit”. A plan should be created for procedures addressing changes in curriculum or content.

Communication

Most teachers are not aware of the superintendent’s feelings about this project or of what her visions are for its future in the district. The superintendent should meet with department chairs and with each department at each building (elementary school, middle school, and high school) so that ideas and concerns can be exchanged and addressed. There are teachers in the math department, the department that led to the School In Need of Improvement status, who are not interested in participating in the creation of lessons for their curricula. In addition, there are teachers who are afraid that video lessons such as these will eliminate the need for teachers in the classroom. Explaining the project, its purpose, and its potential benefits could erase any misconceptions.

Conclusions

Benefits

Sherburne-Earlville Middle School students are following a block schedule. If a student misses a class, s/he is actually missing two classes. Most students do not see their teachers the next day to ask about missed work and most teachers do not have the time to appropriately explain what was missed. These multimedia lessons can be used to keep students current with information and assignments even in the event of absence. As Borja illustrated, the addition of technology resources allowed students in some countries affected by the SARS outbreak to stay current with their education. Sherburne-Earlville, as with any school district, has students absent for extended periods of time for

medical reasons, family trips or suspensions. Other families choose to home school their children. Borja reported that students who used the Web-based virtual classrooms were able to re-enter schools without being behind in instruction. The vice-principal of one of the schools said, “In Hong Kong, at least, virtual classrooms have been effective, and some schools such as Yan Chai may use online education permanently for after-school learning. (Borja 6)”

Students can also use the lessons as a reinforcement tool, especially when preparing for unit exams, comprehensive finals and state tests. It is difficult to remember what was taught early on in the unit or the school year. This can be a tool for review, both in school and at home.

Finally, parents can get involved. There are parents who would love to help their children at home, but are not sure of the math. These lessons are geared toward sixth grade students, family members can most likely grasp the information and will then be able to assist their children.

A goal of the personnel involved with this project is that the lessons will establish what Griffin refers to as a “learning community”. In this case, the community is made up of all of the people who will play a role in the math education of the students. The students will be able to use the lessons in their math classrooms, in the math labs, in the computer labs or in their homes. Parents and guardians will also have access to the lessons. Every person who connects with the students regarding their math education will be a part of the community.

Lopez and Woodruff both discuss the importance of a learning community in fostering educational concepts. The educators who began the Visions High School Academy identified three beliefs when designing their program which was a combination of synchronous, asynchronous, and face-to-face instruction: “1. Learning occurs in communities. In order to increase learning, individuals need to increase their involvement in the other communities; 2: Learning requires greater participation in communities; and 3: Participation ensures the survival and growth of communities. (Lopez 30)”

In the study conducted by Woodruff and his associates, the hypothesis was, “that by participating in a knowledge building community, students will feel learning empowered and thus able to advance on their mathematical knowledge. (Woodruff et al.)” The community in this case was a group of prospective math teachers who had a self-declared anxiety towards mathematics. The team found that the students (prospective teachers) who were actively engaged in the community were able to “provide support to peers in the form of resources and teaching strategies. (Woodruff et al.)” That is the goal of the multimedia lessons as well, that those who use them will become a learning community of teachers, students, and families. The students will benefit from shared resources and the encouragement and support of others in their learning process.

Challenges

One of the challenges of this project is time. It is time consuming to create and produce these lessons. During the school year, teachers would be required to give up planning periods to have their lessons recorded, something most teachers will admit is not popular.

To record lessons over the summer will then be asking teachers to give up some of their vacation time, also not popular.

As with any educational project, funding is an issue. The funding from the Title IID Grant is only available for a three-year period. Maintaining and expanding this project will then become a part of the ever-shrinking school budget. Discontinuation of funds means that there may be no expansion to other disciplines, or the project could be cut entirely.

Some teachers are resistant to change. In the case of this school district, the department chair is not willing to participate at this point. According to Todd Griffin, teachers have commented that they fear the videos will replace them in the classroom. It is difficult to continue and expand projects when those in charge are not involved. It is even more difficult when employees fear that technology will replace them.

Finally, it is unknown yet whether or not the students will actually use the multimedia lessons. Since the lessons will not be available until the next school year, there is not a plan in place for student use. How will the videos be promoted? Will the teacher make watching the video mandatory if a class is missed? How will the teacher know if the student has used a video? Will family members support and encourage their children to use the lessons? A product cannot be useful if it is not being used.

Meeting the needs of the district

Though currently not on the School In Need of Improvement list, the superintendent reports that the district is constantly reviewing state exam scores and encouraging staff development in an effort to remain a school in good standing in all areas. Again, since the lessons are not yet available, it will be difficult to assess whether the district needs are met. The superintendent, a former special education teacher, has viewed the initial lessons and said that she believes they will be very useful. She presented them at the spring staff development day and expressed her enthusiasm about their potential as a strategy for increasing math test scores. She has also stated that the project should be expanded.

Middle Level Mathematics
Sherburne-Earlville

Performance at This School	Counts of Students					Mean Score
	Level 1 517–680	Level 2 681–715	Level 3 716–759	Level 4 760–882	Total Tested	
May 2003	35	68	35	6	144	695
May 2004	18	56	59	2	135	706
May 2005	13	60	58	6	137	714

Middle-Level Mathematics Levels — Knowledge, Reasoning, and Problem-Solving Standards	
Level 4	These students exceed the standards and are moving toward high performance on the Regents examination.
Level 3	These students meet the standards and, with continued steady growth, should pass the Regents examination.
Level 2	These students need extra help to meet the standards and pass the Regents examination.
Level 1	These students have serious academic deficiencies.

Figure 6: Sherburne-Earlville Grade 8 Mathematics Performance as reported by the New York State Education Department April 2006

Figure 6 shows The New York State School Report Card for Sherburne-Earlville Middle School as reported by the New York State Education Department (2006 statistics are not yet available). By incorporating strategies such as the taped math lessons, the superintendent said one district goal is that by June 2007, all students will achieve a Level 3 or above on the State Math Assessments.

In reference to specific goals of the Title IID Grant, “the district must improve performance in mathematics K-12 with a focus on middle school” and “the district must provide resources to enhance learning and empower teachers and students.” One of the strategies outlined in the grant proposal to achieve those goals is that, “Students will participate in math projects where the students create multimedia presentations, archived lessons and project reports using technology resources.” So the lessons certainly meet the needs of the district in that respect.

Measured success

In the future, success will be measured by local and state test scores as well as by the comments from parents and people in the community. According to Griffin, the Sherburne-Earlville community is quite vocal about its dislikes.

All measurable outcomes outlined in the Title IID Grant are due to be critiqued by grant evaluators at the district’s Board of Cooperative Educational Services (BOCES) affiliate between September of 2006 and June of 2007. The project will be evaluated according to the Title IID Project Matrix. The matrix consists of several categories, a few of which are detailed in figure 7.

Project Goals/Objectives		
The District must improve performance in mathematics K-12 with a focus on middle school		
Strategies and Activities	Evaluation Questions	Measurable Outcomes
All participants will develop and implement a project to integrate distance technology or archived lessons into instruction.	Is student achievement in mathematics improving where distance technologies and/or archived lessons are being used effectively?	The participating teachers will continue to develop classroom instruction where students will demonstrate their level of understanding of the key performance indicators identified in the mathematics and technology standards.
Provide follow-up opportunities to teachers for reflection and sharing through curricular departments, grade level teams and Curriculum Council.	Do teachers have strategies for evaluating how distance technology and/or archived lessons supported student learning?	Teachers acquire a variety of technology-enhanced instructional strategies and identify the impact on student learning.
Use appropriate technology to develop a greater understanding of mathematics and problem solving skills.	Is the effective use of technology facilitating the acquisition of skills by the students?	Students acquire information and create knowledge through discovery learning and higher-order thinking.
Locate, collect, create, publish, evaluate information and interact with peers through mathematic multimedia projects and distance learning technologies.	Is the effective use of technology facilitating the acquisitions of skills by the students.	Students are engaged in greater levels of collaboration, creativity, and content production.
Identify available online resources for math skills remediation and publish findings for stakeholders	Are students more engaged in learning where technology is being used effectively?	Students receiving Academic Intervention Services will utilize technology to meet individual student needs.

Figure 7: Grant Information

Though the success of the project cannot be measured at this stage, others who have done research and/or conducted experiments where technology has been incorporated into the classroom in conjunction with traditional methods have reported success. As an instructor at a community college, Laura Villarreal has taught using the traditional method, the computer-based method, and finally a combination of the two by combining traditional methods with computer lab component. Based on a 1998 study comparing Computer Directed Instruction (CDI) and Computer Assisted Instruction (CAI) test performance, “the exam average was higher in the classes taught in the CAI format. (Villarreal 74)”

Perry and Murray reported similar findings; students were successful in classrooms where traditional methods were combined with technology. An exam given at the end of Perry’s *Macbeth* experiment revealed that, “Eleven of twenty-three students using technology [alone], but only two of twenty-one students in the lecture-discussion classes

failed.” (Perry 183) Though he did not offer concrete data when recounting his PowerPoint experiment, he does say that once he required his students to create multimedia presentations in addition to regular classroom instruction, “the experiment was so successful that the PowerPoint assignment has become standard in all my classes, both college prep and regular-track classes.” (Perry 184)

Murray investigated schools that incorporated video clips via the unitedstreaming video-on-demand (VOD) service and saw a boost in math test scores. “...sixth grade students whose teachers showed them video clips during instruction improved an average of five percentage points more than students in the control group during post-testing. Eighth grade students in Los Angeles improved an average of three percentage points more than students in the control group. (Murray)” Just like Sherburne-Earlville, these Los Angeles schools were looking for a way to increase test scores in an effort to meet the requirements of the *No Child Left Behind Act*. The Los Angeles schools chose a method incorporating video, similar to what Sherburne-Earlville is proposing and they report success.

Further Developments

For the 2005-2006 school year, the goal is to complete lessons for all units in the grade six curriculum. In the summer of 2006, the plan is to create lesson for all units in the grade seven and grade eight curricula.

In the 2006-2007 school year the sixth grade lessons will be promoted to students and families and put into use. The goal is to then begin archiving lessons in high school math classes. Finally, it is possible that the project could be expanded into other disciplines. At the conclusion of the 2005-2006 school year, administrators will ask for volunteers from subjects other than math to participate in the creation of multimedia lesson on a voluntary basis.

Limitations

This study is limited first and foremost by its subject matter. At the time of the research, the multimedia math lessons were being created to target the middle school, specifically grade six. Additionally, the study was conducted in one rural school district.

One objective of this research was to determine if the lessons would enhance the learning experience for students. A major limitation of the study is that it was bound by time. The lessons are still in the creation process and will not be available to students until the fall of 2006. Furthermore, the remainder of the middle school math curriculum needs to be archived and plans have not yet been discussed regarding the time commitment or possible funding for summer work to complete them.

Though the middle school plans to make the lessons available in the fall, at this time there is no concrete plan for implementation or for advertising their availability. Ideas such as making an announcement at the sixth grade orientation and in school newsletters have been discussed, but there have been no meetings scheduled with administrators to make any decisions. In addition, once the lessons are made available, there is no plan for how they will be used by teachers.

Finally, it will take time to measure the true success of the lessons. Will the students even use them? It will take at least a full year to determine if the lessons have any effect

on keeping students current or aiding them by reinforcing concepts. It may take at least that long to determine any effects on local and state test grades.

Section 6: Closing Vignette

It is the spring staff development day. The superintendent takes the microphone from the speaker and says, *“Thank you Mr. Doushinsky for your riveting presentation on blood-born pathogens. Next we’ll here from Todd Griffin. He’s going to speak to you about the status of the Title IID Grant and an exciting new project that he has been working on.”*

Todd begins, *“As you may recall, part of the money for year two of the grant was for the creation of multimedia math lessons. Barb Wright has been working on these lessons with Amy Palkovic and they will have all sixth grade lessons completed by the end of the school year. I’d like to just play you a lesson from one of the units.”*

Todd inserts the disk into his laptop and the menu appears. He clicks on “Fraction Review.” The audience of administrators, faculty and staff watch as Amy’s hands appear on the screen. She talks about dividing a circle into pieces and then adding them together while she visually illustrates what she is talking about. Three minutes later the lesson is complete and the audience erupts into applause and discussion. He tells the audience about the potential benefits of the lessons, the implementation timeline, and intention of expanding into other disciplines in the coming school year. While he is talking he looks out into the sea of faces and they appear interested. When the full-session staff meeting concludes he returns to his office.

On their way past his office, teachers begin to stop in and offer their praise for the work that has been done. Others stop to ask if that is something that can be done in their classrooms as well. As the final staff members disburse to their next assigned meetings, Todd leans back in his chair and smiles as he thinks about all of the possibilities a project like this has to offer.

Appendix A: Glossary

Analysis of Themes – “following description, the researcher then analyzes the data for specific themes, aggregating information into large clusters of ideas and providing details that support the themes.” (Creswell, 1998); themes that emerged from the results of the data collection were analyzed in this section of the thesis

Assertions – “this is the last step in the analysis where the researcher makes sense of the data.” (Creswell); the data provided in the interviews were analyzed in this section of the thesis

Asynchronous – refers to a mode of instructional delivery where information is given and received at different times (i.e. using discussion boards) (Lopez)

Bounded System – “the case selected for study has boundaries, often bounded by time and place.” (Creswell); this case study is bounded by the district involved, Sherburne-Earlville, and the time period between January and May 2006 in which the study took place

Case – “ the ‘bounded system’ or ‘object’ of study.” (Creswell); the case in this study is the use of multimedia lessons in the mathematics classroom to establish a learning community

Case Study – “in qualitative research, this is the study of a ‘bounded system’ with the focus being either the case or an issue that is illustrated by the case.” (Creswell); in this case, it is an in-depth study of the process of creating and implementing multimedia lessons at this school district

Coherence – one of the nine Human-Centered Design characteristics as described by Cooley (2002); refers to letting the user know what is going on and what is possible

Engagement – one of the nine Human-Centered Design characteristics as described by Cooley (2002); the quality of inviting the user to participate in the system

Heterogeneous Group – in education, refers to a group of students of various ability levels

Inclusiveness - one of the nine Human-Centered Design characteristics as described by Cooley (2002); the characteristic of including the users in the system and inviting them to feel a part of a community of activities

Issue Subquestions – “subquestions in a qualitative study that follow the central underlying question... written to address the major concerns and perplexities to be resolved, the ‘issue’ of a study. (Creswell); this study involves five issue subquestions that follow the main research question
Learning Community

Malleability – one of the nine Human-Centered Design characteristics as described by Cooley (2002); the possibility to shape the system to suit the specific needs of the individual

Multimedia – The use of computers to present text, graphics, video, animation, and sound in an integrated way

No Child Left Behind (NCLB) – “a federal law to improve education for all children.” Under NCLB, the New York State Education Department must make sure that every school is helping its students improve academically.” (New York State)

Ownership – one of the nine Human-Centered Design characteristics as described by Cooley (2002); refers to the feeling that the users own part of the system, which gives them a sense of belonging

Panoramic - one of the nine Human-Centered Design characteristics as described by Cooley (2002); the quality of providing windows through which the user can take on a more panoramic view of the system to acquire boundary knowledge

Purpose - one of the nine Human-Centered Design characteristics as described by Cooley (2002); the ability of a system to respond to the purpose a user has in mind and to encourage the user to go beyond it

Qualitative Research – “an inquiry process of understanding based on a distinct methodological tradition of inquiry that explores a social or human problem.” (Creswell)

School In Need of Improvement (SINI) – a school that has not met Adequate Yearly Progress in a subject area for two consecutive years

Server – a machine that processes and delivers the requests of users

Synchronous – refers to a mode of instructional delivery where information is given and received in real time (Lopez)

Theme – concept that emerges from interviews, observations, and other data collection methods

Transcendence - one of the nine Human-Centered Design characteristics as described by Cooley (2002); the quality of provoking the user to go beyond the immediate tasks

Appendix B: Ethics Permission Form

ETHICS PROTOCOL FOR CASE STUDY RESEARCH

Case Study: The use of multimedia math lessons to establish a learning community

Joanne Blenis

This authorization is being requested in part to fulfill requirements of the State University of NY Institute of Technology's Human Subjects Research Review Board as well as state and federal regulations regarding the use of human subjects in research. The project involves a case study that may be used in my master's research at the SUNYIT Information Design and Technology Master's program. Excerpts or rewritten versions may also be submitted to professional journals for publication. The case study involves one school district's use of multimedia math lessons to establish a learning community. The work involves participant and non-participant observations, one-on-one and group interviews, and scheduled visits.

I can be reached at 607.674.7380, which is at Sherburne-Earlville High School, where I am a full-time faculty member. I would be happy to answer any questions about the project.

I would like to reassure you that as a participant in this project you have several, rights.

- **Your participation in these studies is entirely voluntary.**
- **You are free to decline to answer any question at any time,**
- **You are free to withdraw from the study at any time.**

My notes from meetings, interviews, and observations will be kept strictly confidential. Excerpts from these notes may be made part of the final thesis.

Copies of the final publications will be supplied whenever possible and as requested. I would be grateful if you would sign this form to show that you have read its contents.

_____ signed
_____ printed
_____ dated

Appendix C: Interview Form

Interview Form

Project: Case Study: The use of multimedia math lessons to establish a learning community

Time of Interview:

Date:

Place:

Interviewer:

Interviewee:

Company:

Position of Interviewee:

Age: 18-25 26-35 36-45 46-55 56-65 66+

Questions:

1. *What is your involvement in this project?*

2. *Do you foresee the multimedia lessons as being beneficial to the students?*
 - a. *If so, how?*

3. *Do you foresee challenges to implementing these lessons?*
 - a. *If so, what might they be?*

4. *Do you believe the lessons will meet the needs of the district in the area of mathematics?*

5. *Do you believe these types of lessons could be used in other disciplines?*

Appendix D: Student Survey

Using Multimedia Lessons in the Math Classroom IDT599 Survey

Please answer the following questions after Ms. Palkovic shows you a quick math lesson.
Circle your answer.

Do you think this lesson would be useful for quiz/test review?

very useful useful somewhat useful not useful don't care

Do you think this lesson would be useful to help you catch up with work when you are absent?

very useful useful somewhat useful not useful don't care

Do you think you would use these lessons if they were available to you?

yes no don't know

Is it helpful that your own math teacher is in the video?

very helpful helpful somewhat helpful not helpful don't care

Does the DVD look like it is easy to use?

very easy easy somewhat easy not easy don't care

Was the lesson easy to understand?

very easy easy somewhat easy not easy don't care

Were there enough examples?

more than enough enough not enough don't care

Were the examples easy for you to understand?

very easy easy somewhat easy not easy don't care

Comments:

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