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Designing multimedia videocases to improve mathematics teaching with technology: "technology integration into mathematics education" project

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Abstract

Teaching is a complex process and it is important to acquire complex sets of skills related to many knowledge domains during preservice teacher education to be effective beginning teachers. Research show that teachers are not equipped to properly integrate integrate technology into their instruction. One solution to developing complex knowledge and problem-solving skills in education and other professions has been the use of cases. Although the process of developing the videocases has evolved to be robust and replicable, it is difficult and complex. This paper describes the development and the design of a multimedia videocases for use in preservice elementary mathematics teacher preparation in Turkey.

Keywords: Videocase; technology integration into mathematics; multimedia videocases; videocases in mathematics; TME2; designing multimedia environments; best practices.

1. Overview and Perspective

Due to the complexity of teaching process, it is important to acquire complex sets of skills related to many knowledge domains during preservice teacher education to be effective beginning teachers. Research show that teachers are not equipped to properly integrate integrate technology into their instruction (Morsund & Bielefeldt, 1999, Strudler & Wetzel, 1999; Topp, Mortensen, & Grandgenett, 1995). National Center for Education Statistics (2002) report that only 27% of in-service teachers feel well enough prepared to integrate educational technology into their courses (Brush, 1999). Ministry of Education in Turkey report that 59% of K-12 schools and 93% of K-12 school students have access to network resources (http://www.meb.gov.tr/ADSL/adsl_index.html) and it is clear that these students must have access to and use technology.

Because technology integration seems complex and teachers find difficult to use it in their classes, some r strategies have been emerged. One solution to developing complex knowledge and problem-solving skills in educat and other professions has been the use of cases (Hayek & Tanase, 2002; Jonassen & Hernandez-Serrano, 2002; Stepi Ertmer & Lane, 2001; Ball & Lampert, 1998).

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Case studies have been used to develop complex knowledge and problem-solving skills in education and were often presented in text form in the past. Videocases, as a new scientific approach and transformations of cases to digital forms, have been increasingly used in today's educational research areas particularly to support teachers with the opportunity to develop technology knowledge and skills. Teachers must be well-prepared to use these tools to be able to have necessary complex skills necessary in today's education.

The National Council of Teachers in Mathematics' Standards states, "Technology is essential in teaching and learn mathematics; it influences the mathematics that is taught and enhances students' learning" (NCTM, 2000). Teach must be well-prepared to use technological tools to be able to have necessary complex skills necessary in toda education. Case-based videos have been used to help teachers gain skills and knowledge in the application of technol and in mathematics pedagogy (Ball & Lampert, 1998; Hayek & Tanase, 2002; Olkun, Altun ve Deryakulu, 2006).

Although the process of developing the videocases has evolved to be robust and replicable, it is difficult complex (Oksuz, Savenye, & Middleton, 2003; Li, Oksuz, Middleton &Savenye, 2003; Kurz, Llama, Savenye, & 2003; Llama, Kurz, & Savenye, 2003). Since it is a complex endeavor and that learners may become "lost" in th environments (Hill and Hannafin, 1997) such learning environments require significant resources to aid learners, and such resources may take the form of tools, scaffold, etc. Evidence suggests that well designed cases, which supp learners in this type of learning environment, can provide preservice teachers with opportunities to observe and inte with teaching and learning situations that they may not view during internship or practicum activities in K-12 classroo (Savenye et al., 2003). This has the potential to broaden their repertoire of experiences in ways that, if cases are desig well, may lead to more and better technology integration and more and better mathematics learning in their classroo This also helps for potential implementers with assurances that the cases work as intended, and under what conditi (see Middleton, Gorard, Taylor, & Bannan-Ritland, 2004).

The purpose of this paper is to discuss the initial development of the "teaching mathematics practices" videoc database and describe the components of its digital platform.

2. Introduction to the Technology Integration Into Mathematics Education Project

Similar to the "Preparing Tomorrow's Teachers to Use Technology (PT3) grants" in USA, to improve teacher preparation programs in respect to allow educators to more effectively integrate technology into their mathematics teaching, the Technology Integration Into Mathematics Education (TME2) program at Adnan Menderes University (ADU) was awarded a 3- year, $120 000 implemention grant by the Scientific and Technological Research Council of Turkey (TUBITAK). This Project involves a collaboration among schools and ADU to provide preservice and inservice teachers with access to a rich videocase database of mathematical instructional materials and also methods for utilizing these materials. Preservice and inservice teachers will be expected to access these rich videocase database via WWW, get ideas of how to integrate technology into education in innovative ways and integrate these materials into their instructions.

The primary goal of this project is to develop a database of "best mathematics practices" videocases related to technology integration into mathematics instruction in elementary grades and use these videocases in preservice and inservice teacher education and training practices. This project is the first and unique one in Turkey when considering the topic and the method which will be used.

To achieve the project's goals, the following activities are considered: Selecting teachers to be participated in this project; giving training and workshops to selected teachers with regard to the integration of technology into their teaching and learning activities; developing lesson plans through a partnership among project personnel, researchers and teachers; selected teachers' presentation of these lesson plans in their own classes; videorecording these class practices along with teacher prerinterviews and postinterviews; gathering expert (Method expert, field expert and technology expert) comments regarding these practices; documenting teacher's own reflection for his/her own practice; and finally, using these videocases in preservice and inservice teacher education as well as delivering them via internet to provide access to all educators.

The production of each videocase involves the coordination of at least three levels of design, beginning with the core intellectual case of how to capture and characterize a teacher's practice, up through the successive levels of design of a video documentary, and finally the design of the multimedia system. The model of this process is outlined by oksuz (2004) as follow;

The Videocase Design —the multimedia structure and delivery system— integrating and defining each case des and Video design within a common interface, readily useable tools, search and retrieve functions, and the ability for

user to annotate the video and use it as a record of their own learning (Table 4). The structure allows teachers to acc the lessons, videos and materials by clicking along a sort of "timeline" of each lesson.

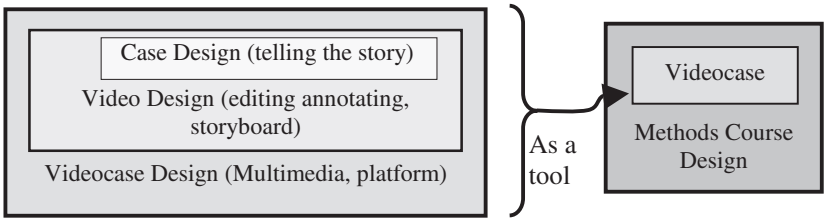

Figure 1. Nested levels of videocase design and its' application to methods courses.(Oksuz, 2004)

2.1. Building the case

One of the important elements in any design and TME2 design process is accounting for both the specific utility of the case for immediate adaptation and its generality as a tool across a wide range of possible instructional goals. These adaptations may include developing videocases for not only technology integration but also other areas in which teachers perform exemplary practices, or not only for mathematics but also in other domains such as science, language art, or special education.

2.1.1.Phases of design

TME2 videocases have three primary phases of production: Case Design; Video Design; and Videocase Design

Table 1. Design types in "Best Mathematics Practices" videocase database.

Case Design	***Video Design***	***Videocase Design***
• Lesson Plan • Equipment • Artifacts • Video Record	• Pre-Interview • Lesson (Edited with an eye towards capturing key theoretical aspects of technology integration) • Post-Interview	• Lesson info • Pre-Interview • Actual Lesson • Post-Interview • Follow-up • Student's reaction • Search

As it can be seen in Table 1, each design phase has its essential elements and requires different logical processes to generate ideas and to test their applicability and adequacy. The design of the lesson, creation of the artifacts are done by the project designers and implementation of the lesson is done by the teacher. Thus, each case is unique and compatible with and bounded by design parameters by documenting the essential elements of the lesson such as lesson plan, equipment and artifacts (Table 2).

Table 2. Design elements in case design in "Best mathematics Practices" videocase database.

Case Design		
Lesson Plan	Equipment	Artifacts
• Rationale • Lesson Preview • Grade Level • Objectives • Standards (addressed) (Mathematics) • Materials • Procedures • Formal Investigation • Assessment	• Computers • Software • Overheads • Smart boards • Projectors • Internet • Others (Calculators,Televisions, Projectors, etc)	• Movies • Power point presentations • Websites • Worksheets

As can be seen in Table 2 (see the first column), the format design of the Lesson Plan options enables another teacher to adapt the lesson under his or her own classroom conditions. These plans include information about everything such as materials, websites, presentations, software options, and assessments that teacher would need, and follow systematic instructional design principles to insure maximum applicability (cf. Dick, Carey, & Carey, 2000; Sullivan & Higgins, 1983).

The video design is the second phase in which the rough footage is edited so that a teacher's pre-interview, videotaped behavior in the lesson, and post-interview are coherent and allow the user to see what, in the early stages of lesson planning and design, caused or enabled the behavior of the class and the learning of the children, and what, of the teacher's aspirations, went wrong and what she would do as a result (see Table 3).

Table 3. Design elements in video design in "Best mathematics Practices" videocase database

Video Design		
Pre-Interview	Lesson	Post-Interview
• Grades, levels, student scores, subject-matter, and topic • Strengths of the lesson • Preview of the lesson • Technology and materials used • Standards that addressed • Teaching methods • Preparatory work • Other	• Introduction • Presentation • Activities (Student participation and teacher facilitation) • Assessment and evaluation • Wrap-up	• Overview of the lesson • Unexpected events • Next topic • Assessment (Time of the assessment, Format of the assessment, Assessment & relationship to standards) • Advice to other teachers • Possible changes next time • Alternatives • Adaptations for Special Ed. Students

Even though many researchers have begun to develop videocases to aid teachers in learning about technology Hayek & Tanase, 2002.), few of these projects involve such components as interviews, lesson plans, and extens teacher comments (Savenye et al., 2003; Talley, 2002). Barab and his colleagues (Barab, MaKinster, Mo Cunningham & The ILF Design Team, 2001) in their use of videocases have extended these discussions to the forma of on-line communities to support teachers in discussing and applying their virtual visits to each other's classroo Strength of such learning communities appears to have a relationship with learning achievement (Moller, Har Downs, & Godshalk, 2003). As it can be seen in Table 3, the enacted Lessons provide much of the necessary informa visually for effective integration of technology or effective ways of teaching and learning in a short-term cont However, the reasons a teacher would use a particular tool or technique, problem or question at a particular time are explicitly available in a video stream. The interviews, artifacts, and explicit links to standards lesson plans make th reasons overt and analyzable by novices (Savenye et al., 2004). It is also expected that seeing teachers modeling w designed lessons, and having access to their lesson plans, will aid preservice teachers in actual implementation as t matriculate into their own classrooms (cf. Eastmond, D., & Ziegahn, L., 1995; Hirumi, A., & Bermudez, A., 1996).

To ensure that each videocase includes everything another teacher would need to deliver it (Sullivan & Higg 1983) , systematically designed videocase plan format will be used. This videocase design format is illustrated in Tab below.

Table 4. Design elements in the videocase design in "Best Mathematics Practices" videocase database

Videocase Design						
Lesson-Info	Pre-Interview	Actual Lesson	Post-Interview	Follow –up	Studnt's Reaction	Search
• Lesson info (teacher, subject, grade, etc) • Lesson materials (lesson plan, Powerpoint presentation, etc) • Teacher bio • Make Comment	• Play whole video • Class description • Lesson description • Technology materials used • National standards • Effectiveness • Teaching Methods • Preparatory work • Other • Make comment	• Play whole video • Intro • Presentation • Activity • Closure • Make comment	• Play whole video • Lesson summary • Self-reflection • Unexpected events • Next topic • Assessment • Advise • Alternatives • Adaptations • Other • Make Comment	• Method expert • Technology expert • Mathematics expert • Teacher • Make comment	• Play whole Video • Reaction • Likes • Dislikes • Suggestions • Other • Make Comment	• Make search

The Videocase Design —the multimedia structure and delivery system— integrating and defining each case des and Video design within a common interface, readily useable tools, search and retrieve functions, and the ability for user to annotate the video and use it as a record of their own learning (Table 4). The structure allows teachers to acc the lessons, videos and materials by clicking along a sort of "timeline" of each lesson.

As can be seen in Table 4, each case begins with a description of the lesson, the teacher, the lesson plan and all les materials. The viewer may then choose to access (either completely or in segments labeled by topic) the videotaped p interview with the model teacher, who describes the lesson, the technology to be used, intended achievement results, how the lesson meets national curriculum standards. The actual lessons are all accessible either whole videos, or, ag in segments. Each case includes, too, a videotaped post-interview in which the teacher discusses what occurred in lesson, adaptations, and assessment issues. In addition, each case includes three reaction videos from the participa students about their reflection to the lesson in respect to "likes", "dislikes and "suggesstions". Finally, each case has capacity to include commentaries from experts in methods and content, as well as in technology.

At this point TME2 project at ADU do not have any finished cases but intended to have at least 25 finished cases along with a handbook for potential implementers can be developed with assurances that the cases work as intended, and under what conditions.

3. Concluding Comments

Outcome studies have shown that preservice teachers have a richer set of experiences seeing the application of technologies to instruction (Savenye et al., 2004, Pollard, Johnson, & Whitehead, 2001). We anticipate that access to our videocases allows preservice and inservice teachers to project more and deeper plans for integration in their mathematics lesson plans and other course assignments. Thus preservice and inservice teachers are expected to demonstrate an increase in both quality and frequency of technology integrated into their teaching. They will have a chance to see technology integration practices in innovative ways using a full range of technologies. Moreover, the use of cases can be used to be instrumental for methods instructors in that they can choose particular examples to illustrate, in a pragmatic setting, how theoretical considerations play out in classroom instruction. However, the authors of this paper must also stress that the cases are no direct substitute for field experiences, but are tools to allow focus, breadth of experience, and access to a wide variety of teaching and learning situations.

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