

Elements of Case Design for Hypermedia Environments in Teacher Education

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Introduction

Our interest in the design of cases is motivated by the need to develop tools for elementary teachers that will help them understand how students think about forms of mathematics typically unfamiliar to teachers, like geometry, space or measure. In designing case-based hypermedia tools, our goals are to exemplify not only student thinking, but also, core mathematical ideas. We agree with others (Merseth, 1996; Barnett & Friedman, 1997) that case-based methods for teacher education afford opportunities to develop knowledge of exemplary practices and to learn how to analyze and reflect about classroom contexts. Building off of our earlier work that focused on the design of mostly example-based hypermedia systems that helped teachers to learn (Koehler & Lehrer, 1998), we have developed a small number of design principles for selection and development of cases for case-based hypermedia systems for teachers. These design principles play a prominent role in our current work in progress in which we look closely at case-based hypermedia's role in the development of teachers' epistemology of measurement instruction in the primary grades.

Case Design

Following over five years of work in professional development conducted within the field of mathematics education, we have developed cases of *student reasoning* about elementary mathematics. Within this general locus, we have developed a number of selection principles for choosing among many hours of classroom video. These selection principles were informed by a triangulation of our previous years of experience, by literature in a variety of fields (cognitive psychology, education, educational technology, etc.), and by two empirical studies (Horvath 1998, Koehler & Lehrer, 1998). This triangulation has resulted in a set of design principles that at this point represent "lessons learned" that now guide our development efforts (Tab. 1).

Assessing the Design Principles

While our thinking about design principles for cases has been helpful, we found that these principles were of little use without an overarching design for the computer environment in which we planned to implement our professional development activities. Our previous work has suggested a small set of design principles that are important for creating hypermedia tools for teachers (see Koehler & Lehrer, 1998). The set of case design principles we have proposed here and elsewhere (Koehler, Petrosino, & Lehrer, 1998) are considered important next steps for incorporating cases into these hypermedia tools.

Our current efforts have focused on creating two versions of a hypermedia system aimed at helping elementary teachers think about measurement instruction in the primary grades. The first system is built around an earlier set of hypermedia design principles (Koehler & Lehrer, 1998). This system uses video footage primarily to exemplify the bigger ideas. The second system is being constructed in accordance with both the hypermedia design principles as well as the case design principles we have proposed here. Both of the systems share a large percentage of text and case video footage, but differ in the ways in which the video (cases) are used. Practically speaking, compared to video examples, video cases provide longer looks at classrooms, are accompanied by more interpretation, and have hypermedia links directly embedded in the digitized video to allow readers to explore ideas as they arise.

Studies in progress are aimed at investigating how participants using the case-based system differ from those using the example-based system on a variety of measures including: the ways in which they interact with the system itself,

the order in which information is visited, how video is used, what is learned about the domain of measurement, what is learned about student thinking, and what is learned about classrooms.

Design Principle	Justification	Benefits
Cases Should be Grounded in Practice	Teaching is grounded in practice, so instructional cases about teaching should also be grounded in practice. It is for this reason that video cases should be created from footage that comes from real classrooms with full-time professional teachers	<ul style="list-style-type: none"> • Cases capture the richness and complexity of practice • Grounded cases are more realistic and relevant to practicing teachers
Cases Should Tell “Mathematics Stories”	We claim that cases are stories. As math stories, the actors should be teachers and students. The plot of the story should revolve around children’s attempts, with the help of teachers to “mathematize” some aspect of experience and make sense of it. These stories can be historical, showing the development of children’s thinking over time.	<ul style="list-style-type: none"> • Stories are engaging and more memorable • Stories facilitate the “mathematization” of experience • Stories can be used to show the history and development of student thinking
Cases Should be Annotated with Interpretation	Like stories, cases need to be interpreted: Video footage does not “speak for itself”. Annotation should highlight the big ideas in the case: the encapsulated mathematics, the models of student thinking, and the decisions that teachers make.	<ul style="list-style-type: none"> • Interpretation helps teachers to understand the case • Interpretation helps teachers to see the big ideas contained within the case
Cases Should Anchor Further Exploration	Cases should anchor further exploration into other episodes of learning [CTGV 1990]. Episodes anchored to the main story line of the case provide a more varied developmental landscape than might be expected by simply following the main lines of the case narrative. Thus, cases should provide opportunities to explore both the current and related topics in depth.	<ul style="list-style-type: none"> • Cases can provide both the details of learning as well as the big picture • Cases permit connections to related ideas, other teachers, and other classrooms.

Table 1: Design Principles for Cases

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