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The design and development of a multimedia case-based environment on parental engagement

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The purpose of this paper is to present the rationale and principles that guided the design and development of PARENTS, a multimedia case-based environment. Following a development research approach, the tenets of constructivist learning, and the advantages of case-based instruction, we developed a multimedia program in which we utilized and incorporated the findings of the longitudinal study Ecologies of Parental Engagement (EPE). EPE focused on parents in high-poverty urban communities and the roles they play in elementary schools that are active in implementing reform-based science education. The main purpose of the multimedia program PARENTS was to help preservice science teachers to explore and reflect on themes of parental engagement in high-poverty urban school settings. In this paper, we present the design and conceptual framework behind the first prototype of PARENTS.

Conception et développement d'un environnement multimedia sur l'implication des parents fondé sur des études de cas
Le but de cet article est de présenter le raisonnement et les principes qui ont orienté la conception et le développement de PARENTS, qui est un environnement multimedia fondé sur des études de cas. En suivant une approche "recherche et développement", les principes de l'apprentissage constructiviste et les points forts de l'enseignement basé sur les études de cas, nous avons mis au point un programme multimedia dans lequel nous avons utilisé et intégré les résultats d'une enquête longitudinale – Ecologies de l'Engagement Parental (EPE). EPE a porté sur les parents se trouvant dans des communautés urbaines très pauvres et sur le rôle qu'ils jouent dans des écoles élémentaires engagées dans la mise en œuvre des réformes de l'enseignement des sciences. Le but principal du programme multimedia PARENTS était d'aider les enseignants de sciences en formation initiale à explorer et à réfléchir sur la thématique de l'engagement parental dans les écoles se trouvant dans des zones urbaines de grande pauvreté.

Entwurf und Entwicklung eines multimedia Fall- basierten Umfelds auf das elterliche Engagement
Dieser Beitrag soll die Gründe und Prinzipien aufzeigen, die zu Entwurf und Entwicklung von PARENTS, einer Multimedia-Fall-basierten Umgebung, geführt haben. Nach der Entwicklung eines Forschungs-Ansatzes auf den Grundsätzen des konstruktivistischen Lernens, und dem Berücksichtigen der Vorteile fall-basierter Anweisungen entwickelten wir ein Multimediaprogramm, in dem wir die Ergebnisse einer Langzeitstudie – Ecologies of Parental

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Engagement (EPE) – nutzten und einfügten. EPE ist auf Eltern in städtischen Gemeinden mit großer Armut ausgerichtet und auf ihre Rolle, die sie in Grundschulen mit reformbasiertem naturwissenschaftlichem Unterricht spielen können. Der Hauptzweck des Multimediaprogramms PARENTS war, in Ausbildung befindlichen Lehrern für Naturwissenschaften zu helfen, auf dem Gebiet des elterlichen Engagements in sehr armen städtischen Schulbereichen zu forschen und zu reflektieren.

Diseño y Desarrollo de un entorno multimedia basado en estudios de casos sobre el compromiso de los padres
El propósito del presente artículo es de presentar los fundamentos y principios que han orientado el diseño y desarrollo de PADRES, un entorno multimedia basado en estudios de casos. Siguiendo una metodología de investigación y desarrollo y también los principios del aprendizaje constructivista así como las ventajas de la instrucción basada en estudios de casos, hemos desarrollado un programa multimedia en el cual hemos utilizado y integrado los resultados de una encuesta longitudinal – *Ecologías del Compromiso de los Padres (EPE). EPE* trata de esos padres que viven en comunidades urbanas muy pobres y del papel que desempeñan en las escuelas primarias que se han comprometido a poner en práctica las reformas de la enseñanza de las ciencias. El objetivo principal del programa multimedia PADRES (PARENTS) era de ayudar a los futuros profesores de ciencias para explorar y reflexionar sobre la temática del compromiso paterno en las escuelas ubicadas en zonas urbanas extremamente pobres.

Keywords: parental engagement; science; preservice; teacher education; multimedia case-based environment; design principles

Introduction

This paper discusses the design and development of a multimedia case-based environment called PARENTS, which was developed for use in preservice science teacher education. PARENTS was developed as one of the products used to communicate the knowledge generated by the project Ecologies of Parental Engagement (funded by the National Science Foundation REC 9980592), that examines, in theoretically rich and practice-based ways, parental engagement in high-poverty, urban elementary schools, which are active in implementing reform-based science education. The research behind this project was reported in several venues (e.g., Calabrese Barton & Drake, 2000, 2002; Calabrese Barton, Drake, Perez, St. Louis, & George, 2004). PARENTS uses an interactive multimedia environment to communicate these findings. In the following sections, we provide an outline of why and how such an environment was developed along with the rationale and principles that guided its design.

Studies reveal that teachers do not systematically encourage family involvement, because they are not taught to do so (Hoover-Dempsey, Walker, Jones, & Reed, 2002). Little attention has been given to documenting how teachers' beliefs and practices evolve or change or to how (or if) teachers' changing beliefs and practices impact actual parental engagement or student learning. Findings by Civil, Andrade, and Anhalt (2000) indicate that to have meaningful impact on content-based instruction teachers must learn how to engage parents in content-specific experiences and activities. The Ecologies of Parental Engagement (EPE) project attempts to provide a deeper and comprehensive framework for a critical understanding of parental engagement in high-poverty urban schools that initiate reform-based science education. More specifically, the focus of EPE is on parents in high-poverty urban communities and

the roles they play in elementary schools that are active in implementing reform-based science education.

The challenging lack of current research that addresses the theme of preservice science teacher education in relation to parental engagement, along with the data that have been generated by the EPE project, justify the need of designing the multimedia case-based learning environment PARENTS. The purpose of this paper is to present the design and development of PARENTS, and discuss lessons we learned from working on this project.

Focus and purpose of PARENTS: a multimedia case-based environment for preservice teachers

PARENTS is a multimedia case-based learning environment. The main purpose of designing and developing the PARENTS environment was to help preservice science teachers explore and reflect on themes of parental engagement in high-poverty urban school settings. More specifically, we aim to help preservice teachers:

- Identify issues, problems, and ideas that are embedded in the multimedia environment by having them pose their own questions or dilemmas;
- Interpret those questions from multiple perspectives, using the various information resources provided in the product;
- Form their initial conjectures around the issues they identified and explored;
- Provide evidence and supporting information, gathered throughout their interaction with the environment, which will help them shape informed suggestions or solutions to their initial questions or problems as well as other "problematic situations" introduced by the system itself.

Beginning with these goals, our challenge was to design and develop a product that could be integrated into a preservice science education course, and serve as both a starting point and a resource for exploration, reflection, and discussion of the aforementioned issues. We expected that implementing and testing a prototype version with a small number of preservice science teachers would provide valuable insights to our main research questions:

- How are preservice science teachers' beliefs and ideas about parental engagement in high-poverty urban school settings crafted, mediated, or expressed within a graduate course that draws upon the PARENTS multimedia environment?
- What are the (1) design features and functions, and/or (2) content parts of such an environment that frame/enable/enhance students' thinking about parental engagement in high-poverty urban school settings? How (in what ways) is this achieved/done and to what degree? How does each feature, function and/or content part contribute to students' thinking?

In this paper, we will discuss the design philosophy and the lessons we learned from working on this project. The details of the research method, analysis, and findings, are not addressed in this paper. Our prototyping approach has relied upon two complementary frameworks: (1) development research and (2) constructivist case-based environments. We describe each of these influential frameworks below, pointing out how they have framed our prototype.

Development research

In particular, we have grounded our research in the theoretical framework of development research, which originated from Brown (1992) and Collins (1992), and was further discussed by Van den Akker (1999). In an analytical review of research methodologies in the field of instructional technology, Reeves (2000) provides a description of "development research" as illustrated in Figure 1.

Van den Akker (1999), as quoted by Reeves (2000), juxtaposes development research to the traditional empirical approaches to educational research and he stresses "an iterative process of 'successive approximation' or 'evolutionary prototyping' of the 'ideal' intervention is desirable" (pp. 8–9). Following Van den Akker's evolutionary prototyping idea that is embedded in the cyclical process of development research (Figure 1), as well as the fundamental tenet of collaboration among practitioners, researchers, and technologists (Reeves, 2000), we have proposed a solution (the trial version of PARENTS), which we have based on a tentative framework of design principles. We consider the research activities of this study as ways to improve PARENTS, in a continuous effort to come up with the most optimal version. The documentation and analysis of the research data informed all our steps throughout this design process.

Designing a constructivist case-based environment

Our attempt to create a design framework for PARENTS has also been informed by relevant theories from the field of instructional technology design as well as from major studies that addressed similar tasks. Constructivism and case-based instruction in teacher education, along with the goals that we have previously set, are two main themes that guided the design of PARENTS.

Constructivist learning environments

Knowledge construction requires not just a series of activities, but also articulation, expression, or representation of what is learned. The application of digital technology to education has produced a substantial rethinking of how educational experiences can be designed and delivered to more effectively meet the individual needs of learners. Therefore, we consider PARENTS a constructivist learning environment: "a place where learners may work together and support each other as they use a variety of tools

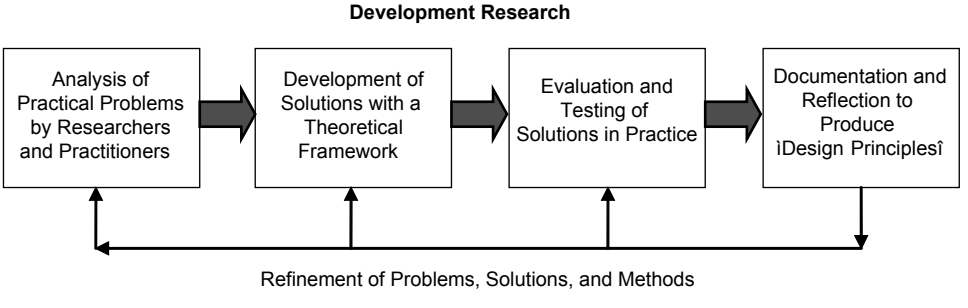

Figure 1. Development approach to instructional technology research (adapted from Reeves, 2000).

and information resources in their guided pursuit of learning goals and problem-solving activities" (Wilson, 1996, p. 5).

Cases and case-based instruction

PARENTS's design was based on the power of multi-media and case-based tools for promoting and scaffolding teacher learning and their advantages in teacher education: learner controlled environments, opportunities to revisit classroom events, multiple perspectives, and procedural support for instructional design and classroom teaching. Also, the nonlinearity of multimedia learning environments enhances the effective use of cases by allowing the user to revisit various sources of information and to build and store multiple links among various content parts. The core component of the PARENTS environment is a set of cases, presented in multiple formats (video, text, images), intended to present the issues of parental engagement in high-poverty urban (science) education settings and to guide teachers into a constructivist exploration of this multimedia environment. The PARENTS's cases draw upon the case-based learning traditions, as they offer users opportunities to practice analysis and contemplate action, utilizing multimedia cases as stimulants to personal reflection, and are designed for flexible use within a collaborative environment. Through the multimedia case materials, users have access to portraits of urban parents and their concerns about parental engagement, interviews, commentaries, specific reference to science activities and standards, research papers, articles, references to the literature, and assignments designed to help apply learning to practice.

Overview of PARENTS

The version of PARENTS discussed here consists of five main components (Figure 2).

(1) Introduction

In this initial screen, the users login to the program, and have access to all components of the environment through graphical or textual buttons, grouped in menu bars, accessible at any screen of the program.

(2) Challenge

Users are introduced to a multimedia case that sets the stage for a purposeful and intriguing exploration of PARENTS while suggesting the task and role of the users. The challenge asks the users to adopt the role of the teacher and record their initial reactions by using their i-Journal (described below). At the end of their exploration, the users revisit this initial challenge and propose solutions or suggestions to the challenge.

(3) Parents

This component presents the three parents who are featured in the cases (three cases for each parent) and provides the user with: a multimedia Parent *Portrait*, contextual information about the school the parent's children attended, and links to the three

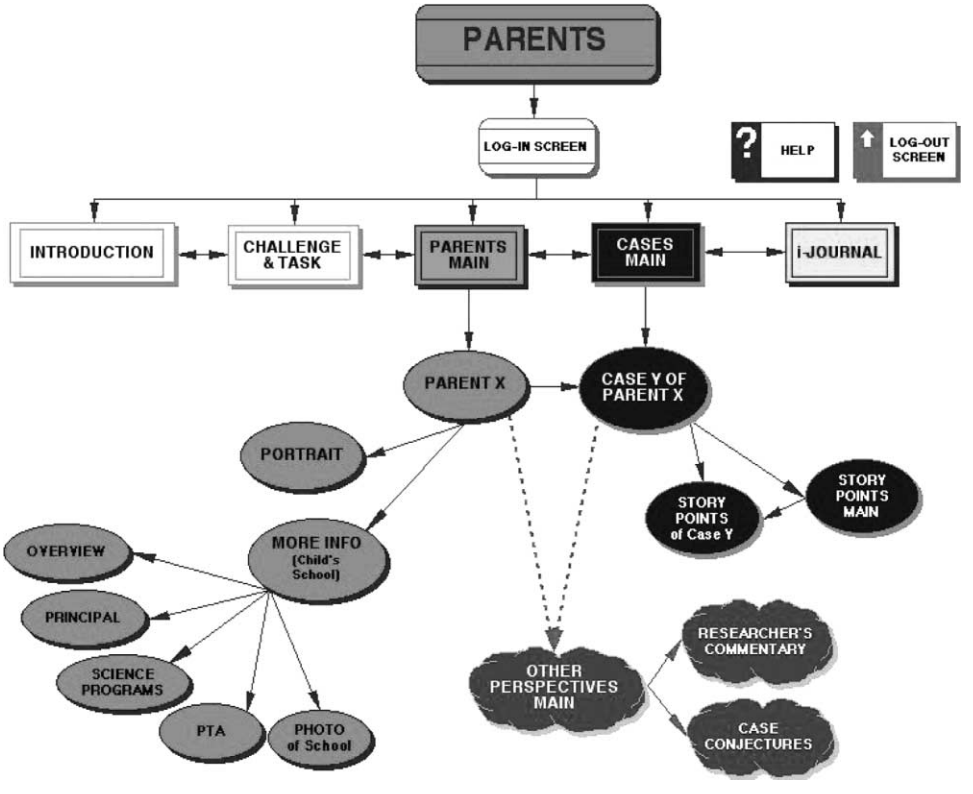

Figure 2. The system map of PARENTS.

cases of that specific parent. These three parents were purposefully selected to represent different ethnic backgrounds, different levels of engagement, and different reasons and challenges for engaging. *Cases* and *Parents* are cross-linked allowing the user to start their exploration by viewing the cases or the parents.

(4) Cases

The cases constitute the core of PARENTS. The user may choose to view these cases in any order. Each case is presented in text and video formats. The user may simultaneously read the corresponding transcript of the video in an attached text window. Using the video control buttons and time line, they may view the entire video clip of each case or skip to a specific point. Video clips may be bookmarked and saved in their i-Journals. While at the case screen, users are prompted to use their i-Journal to record their initial questions, interpretations, and conjectures around the cases.

(5) i-Journal

The i-Journal is a note-taking and organizing tool, and is accessible from any screen of the program. The i-journal provides the user with scaffolding by prompting the user to reflect upon their questions, their interpretations of the cases (using space and capital as organizing constructs), their conjectures, and the evidence they have gathered throughout the environment in support of their conjectures.

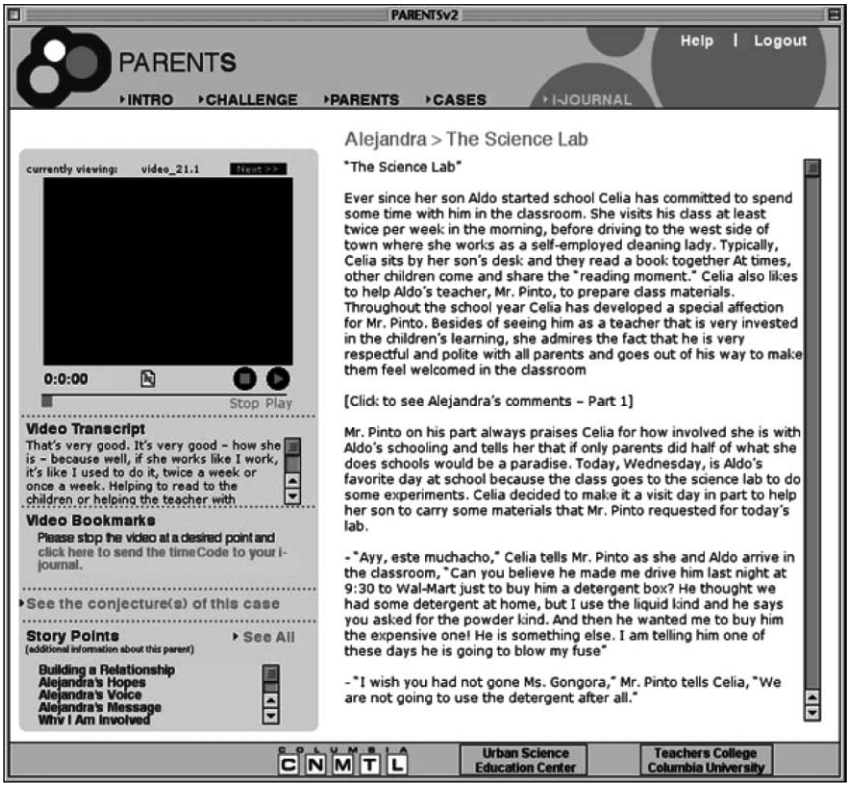

Figure 3. An example screenshot from the "The Science Lab" Case.

Additional sub-components of PARENTS include the *Other Perspectives* pages, where we provide our research group's view on the issues discussed by each parent, and the conjectures that the writing of each case was based upon. The visual *Help* guide that is also provided in the system informs the user about the available features and tools, and how they can utilize them (Figure 3).

Design conceptual framework

Drawing upon constructivist beliefs and the advantages of case-based learning and instruction, we describe a set of principles that have guided the design of PARENTS. These design principles appear in a variety of constructivist learning environments, but we group and present them in a way that serves the purposes of this study.

Authenticity

The need to present learners with authentic tasks and provide them access to authentic information is essential in constructivist learning environments (i.e., Black & McClintock, 1996; Schank, Fano, Jona, & Bell, 1993). Jonassen (1999) suggests that authentic problems are those that represent a meaningful challenge to the learners and engage them to think like a member of the practice community. For our purposes, the users of PARENTS are faced with roles and challenges that will be of real interest: they adopt the role of a teacher in order to explore authentic cases of real parents

discussing issues of parental engagement in schooling. This role is described in the very first screens of the PARENTS: the *Introduction* and the *Challenge* (through a video and a text format). Moreover, given that the users are teachers-to-be, they encounter real-life situations (i.e., sample questions that were raised by real parents) in a purposeful and motivating way (Reisbeck, 1996).

Interpretation and argumentation construction

In their approach to constructivist design, Black and McClintock (1996), emphasize the importance of having "students construct interpretations of observations and construct arguments for the validity of their interpretations" (p. 26). Instead of using the term "learning environments", they refer to designing "study support environments" and they state that "the core of study is the hermeneutic activity of constructing interpretations" (p. 26). We expect the preservice teachers to act as "investigators" and problem solvers in a realistic scenario, and generate learning themselves. They are required to "engage in argumentation and reflection as they try to use and then refine their existing knowledge [and beliefs] as they attempt to make sense of alternate points of view" (CTGV, 1993, p. 16). The i-Journal is the user's electronic pad: a digital note-taking and note-organizing tool. It helps the preservice teachers to record, save, and retrieve their notes at any stage of their exploration.

Multiple perspectives

Multiple perspectives are provided in order to convey the complexity that is embedded in the knowledge domain, and to illustrate the interrelatedness of the ideas (Spiro, Feltovich, Jacobson, & Coulson, 1992). The users of PARENTS can access multiple representations or analysis of the issues that are derived by the cases of parents, as well as commentary from other actors in the school settings. Once the preservice teachers view their challenge and task, they can "meet" each parent presented in this multimedia environment, first by viewing the parent's "*Portrait*": a document that presents each parent's biographical/family information, her educational background, and labor/work background information. Short video clips (of the parent talking) related to her portrait are also provided. Moreover, at every screen of each parent, there is available additional contextual information (information about the school the parent's children attended grouped under a general link called "*More Info*") that aims to help the users form their interpretations from multiple perspectives, provided in a multi-modal way (video, text, and images): (1) Principal's Commentary, (2) School and Community Settings, (3) Science Programs of the School, (4) Related Policy documents, and (5) a P.T.A. Description.

Rich, multi-modal, non-linear information resources

Throughout the design and development of the current version of PARENTS, we have tried to utilize multiple modes of representation of information (Honebein, 1996). Both the "*Introduction*" and the "*Challenge*" screens that we described before are presented in dual formats: a user might choose to watch a narrated scrolling-text version or a plain text version of these pages (opening in a different window). Most importantly, the core of this environment, i.e., the parents' "*Cases*", consist of both text and video. We chose to have the parents themselves comment on the cases and

discuss other related issues (we called those "*Story Points*") using the video format, an immediate and powerful way to communicate the concerns, beliefs, and ideas of these three parents to the preservice teachers. Additionally, we have organized information in a way that provides preservice teachers autonomy and control in selecting their own paths of exploration. This is facilitated by the non-linear (or hypermedia) character of PARENTS: all the components are cross-linked and accessible from almost every screen of the interface.

Scaffolding and support

Beyond all the aforementioned design principles, in the current version of PARENTS, we also included specific tools such as symbol pads (i.e., the note-taking/organizing *i-Journal* component), a visual help guide, and contextual information relevant to the cases and issues that are embedded in the system (i.e., the "*More Info*" section). Another important feature that accompanies every video presentation (i.e., video commentary from the parents on the cases) in PARENTS is the video book-marking tool. While watching a video, the users can bookmark the clip at specific points that they consider important or useful. The generated bookmarks are automatically sent and saved in the i-Journal from where they can be referred to for later use (i.e., as supporting "evidence" of the user's conjectures or suggestions).

Multimedia case-based learning and instruction

For the current version of PARENTS, we have incorporated the stories from three parents who participated in the EPE project: Alejandra, Miranda, and Gloria (pseudonyms). These parents expressed their hopes, motivations, obstacles, accomplishments, and support for parental involvement with the schools and the education, including the science education, of their children. These stories reveal how urban parents struggle to find ways to help their children connect to schooling, find a place for their ideas and voices to be heard, and gain access to the science that their children need to learn.

Evaluation of PARENTS

The version of PARENTS described above was arrived at after several iterations. Not only did we base PARENTS on our design framework but also on the result of various prepilot tests we have performed with a small number of preservice science teachers, experienced teachers, and graduate students in science education. Using our development model, we also incorporated feedback in the content and design from the project's advisory panel, which consisted of researchers in the fields of science education, parental engagement, and technology. We should clarify that, since this is not a controlled study design, it could not yield claims about precise effects. In terms of user learning, we are not looking for precise effects rather we are documenting growth in thinking. Further discussion on the research analysis and findings is out of the scope of this paper.

In the section that follows, we provide an analysis of user feedback in three key areas: (1) system navigation, familiarity and technical difficulties, (2) the key dimensions of the multimedia design: I-Journal, video, multiple perspectives, etc. and (3) integration of PARENTS into a teacher education course.

The major theme that emerges across each of these areas is that while students sometimes struggled with the technical difficulties of the prototype version of PARENTS and some issues around system navigations, they also valued (and felt challenged by) how the learning environment scaffolded their thinking by: (1) asking them to view parents in new and different ways; (2) structuring their thinking around parents through semi-structured evidence-based reasoning, reflection, and keeping notes; and (3) making ideas and experiences concrete through real life examples (video and text). The nuances of this tension (theme) emerge in the presentation of each section below.

System navigation and the users' familiarization

Besides the PARENTS technical problems and glitches that occurred, the users provided positive comments when they were asked to comment on the navigation of the system, as well as on how easy or not they were able to familiarize themselves with the whole environment.

The i-Journal

The PARENTS's digital notepad, i-Journal, had malfunctioned, causing both the feelings of frustration to some of the users, and most importantly losing their saved notes. However, besides to this unfortunate technical problem, we have collected the users' comments on their experience with this component of PARENTS, an experience that proved to be quite controversial among the users. The i-Journal offered the users the place to type their notes in five different sections (windows), and basically reflected their initial exploration task and a "course of thought" that we aimed to encourage them to adopt:

(1) **Questions**: Identify issues, problems, and ideas that are embedded in the multimedia environment, by having them pose their own **questions** or dilemmas;
(2) **Interpretations**: **Interpret** those questions from multiple perspectives, using the various information resources provided in the product;
(3) **Conjectures**: Form their initial **conjectures** around the issues they identified and explored;
(4) **Evidence**: Provide **evidence** and supporting information, gathered throughout their interaction with the PARENTS multimedia environment, which will help them shape informed suggestions or solutions to their initial questions or problems; and
(5) **General Notes**: a place where users could type un-classified or draft thoughts and ideas, which they could revisit and process later.

The above structure of the i-Journal was the target of a lot of the users' comments. We detected two major issues that occurred: (1) the users' resistance to follow the "course of thought" that was reflected and proposed by the four main categories of the i-Journal, and (2) some users did not realize and utilize the capability of the i-Journal to simultaneously offer the space to write and view two different categories/themes of notes.

However, we should state that throughout the users' comments, we detect their struggle to understand the value of the design and structure of the i-Journal, which was

the major factor that caused their frustrations. Moreover, besides the users' criticism on i-Journal, both their frustrations and the positive comments from some users point out their effort to appreciate and understand the value of this semi-structured approach, which actually helped them, in a less direct way, to value the importance of evidence, reflection, and the actual process of keeping notes; a process that proved to be very "labor-intensive", since "it pushes you to think harder than you would naturally."

Examining the issue of the "course of thought" suggested by the four main categories/headings of the i-Journal, we detected that the majority of the users expressed either their confusion on distinguishing the nature of each theme, or their disagreement on the actual structure *per se*, while proposing their own ideas for restructuring or improving the i-Jounal component. Lastly, we also collected controversial comments on the usage of a digital note-taking tool versus a typical paper notepad.

The video aspect of the PARENTS environment

As we discussed in previous sections, the design of the PARENTS environment was mainly based on the principles of case-based learning, and more specifically its core consisted of multimedia (video and text) authentic cases of parents in high-poverty urban settings. In this section, we present how the users' reaction and comments on this video aspect of the PARENTS environment. We detected that the great majority of the users characterized this multimedia case-based presentation of authentic information as "interesting," "helpful," and "influential" to their thinking and exploration of issues around parental engagement in high-poverty urban areas.

The group and class discussions and the online forum

In this first pilot use of PARENTS, we promoted collaboration through (1) group collaborations, and (2) whole-class discussions that took place during the three lab sessions of the graduate course. Throughout the users' comments we detected the importance of having such activities interweaved with the exploration and interaction with the PARENTS environment. In our initial design goals we had also included an online part of the PARENTS environment. We intended to have an online component, a forum, where users could post their work and participate in threaded discussions or chats, where they could negotiate their ideas, questions, and suggestions. However, the extremely limited time that was available for the production of the first prototype of PARENTS forced us to delay the development of this component and include it in the next version of the software.

Multiple perspectives

The collaboration between users and the negotiation of their ideas and suggestions on the issues derived from their interaction with PARENTS environment, both during the group and class discussions, had also produced another positive outcome: the chance to acknowledge, appreciate, and discuss the multiple perspectives of their classmates. Based on the tenant of presenting additional multiple perspectives to the users, the PARENTS environment also helped the users by providing them with: (1) the perspectives of the research group who contributed in the creation of PARENTS

(commentary on the conjectures or issues that the video cases were based and written on) and (2) contextual information relevant to the cases and issues that were embedded in this multimedia environment (information about the school and its science programs, the principal, the community, policy issues, etc.). We advised the users not to access the researchers' commentary prior to completing their first steps of exploration through the PARENTS environment, since we did not want the preservice teachers to abandon their own initial beliefs or ideas in favor of what the researchers – that might be viewed as "experts" – were suggesting or commenting on.

Synopsis

As noted before, we considered this study the first pilot step of a continuous process of design, development, and evaluation of the prototype version of PARENTS. In accordance to the "development research" approach we adopted, we documented the common themes of (1) positive value and outcomes derived from the users' experience with PARENTS (as it was integrated in a graduate teacher education course) as well as (2) the issues and problems that emerged from the users' comments and suggestions, which need to be considered in the next phase of development of the PARENTS environment. We synopsized the above themes of outcomes and suggestions into Table 1, which will serve as a guiding framework for future research and development of PARENTS.

Conclusions and future directions

As we stated in the beginning of this study, the main purpose of designing and developing the PARENTS environment was to help preservice science teachers explore and reflect on the themes of parental engagement in high-poverty urban school settings. In order to face this challenge, we drew upon the research on designing constructivist case-based learning environments, while following a development research approach. We also acknowledged the power and advantages of multimedia and case-based tools for promoting and scaffolding teacher learning, which prior research has shown in other more general fields of teacher education. The first implementation of PARENTS was another research case that shows the effectiveness of such digital case-based learning environments in lessening the gap between the theory (presented in the field of teacher education courses) and the preparation of future teachers to enter the real world of schools and education. However, the design and development of PARENTS could be viewed as a pioneer step to the interrelation of the fields of parental engagement in high-poverty urban settings and preservice teacher education.

This developmental research study, being the first step of this process, showed that the current prototype exhibits a set of limitations that will be taken under consideration into the next phase of its development, where several improvements or modifications will be made. The prototype of PARENTS provides users with access to multiple perspectives through different parents' stories, cases grounded in each parent's story, contextual information in support of the stories (i.e., overview of school science program, parent program, etc.), and researcher commentaries. In addition, multiple data sources and data formats are used in each of these presentations. For example, parent portraits, cases, commentary on cases, and story points are presented in both text and video.

Table 1. Synopsis of lessons learned.

Positive aspects	Issues for improvement
System navigation and the users' familiarization	
• Easy to navigate and get familiarized with	• Further simplification
• User-friendly and well structured	• Pull down menus for sub-sections
• Clean and simple layout	• Less text heavy
• Multimodal presentation of information	• Bigger text fonts
• Explanatory introduction	
i-Journal	
• Simultaneous viewing and working on two different categories of notes	• Final development of the functions of saving and retrieving users' notes
• Easy to use and keep track of notes	• Labor intensive – possible simplification
• Digital vs paper note-taking ability; digital is easier, less time consuming, more convenient, and accessible	• Further explanation of its sub-categories (pop-up screens) and familiarization with its features
• Ability to have both the main system screen and the i-Journal available and accessible	• More time needed learn to use
	• Disagreement, confusion, and resistance to the proposed structure
The video aspect (video cases, video story points, and commentary)	
• One of the most "interesting," "helpful," "beneficial," and "influential" part to users' thinking and exploration	• Consider the length of the cases (text heavy – more video commentary)
• Presentation of "authentic," "unfiltered," and "realistic" information (watch and listen real parents with real voices, expressions, gestures, passions, and real issues)	• Provide a synopsis for each case
• Getting to know the parents and their situation/issues on a more "personal" level	• More video cases should be added to convey and present more related issues (consider having cases of parents of other ethnicity and gender – fathers, white/Caucasian high poverty urban parents)
• Considerate of users' "tastes" (video+transcript)	• Consider using the same parents/names for both cases and the video commentary
• Puts a "face in all the theory"	

Table 1. *(Continued)*.

Positive aspects	Issues for improvement
Collaboration and negotiation of ideas	
The group and class discussion	*The online forum*
• Enhanced the emerging of new ideas, reasons, and practical suggestions	• A necessary component for addition
• Enriched the diversity of users' perspectives and multiple angles of viewing the issues	• Serve as a resource for homework and further study
• One of the most "influential," "challenging" parts of the users' experience	• Complimentary role: Further enhance and enrich the group and class discussion
	• Extending the use and benefit of the system to people from other geographical areas or settings (non-urban)
Multiple perspectives (researchers' perspectives, contextual information)	
• A "helpful," "interesting," and "necessary" component	• Consider adding perspectives of the teachers and the children of the related school (as well as video commentaries from administration, policy makers, PTA, etc.)
• Helped users to see the whole picture better, and make the connections between issues	• More time is needed to access, "digest," and reflect on this additional information
• Opportunity to see multiple dimensions from a diverse spectrum of people	
• Understanding the complexity, interrelatedness, and significance of issues	
The integration of PARENTS in a teacher education course	
Making the theory real and the education more relevant	*Extending the usage of* PARENTS*: more time, more spaces*
• Multimedia cases make the theory on parental engagement more real (puts a face on the theory)	• Built-in the whole course curriculum
• It enhances the relevance of the education of preservice teachers to real school life	• Allocate more time and put emphasis on the discussion part
• Brings real parents and issues in the classroom	• PARENTS can be used in multiple contexts (e.g. professional development, other graduate teacher education courses, and to non-urban or "non-poor" settings).

In future versions of PARENTS we intend to enhance the function of multiple perspectives in three ways: (1) to include new commentary on specific cases and on parental engagement (more generally) from the perspectives of key stakeholders (i.e., teachers, administrators, policy makers, etc.) and to refine and import into PARENTS three new father-centered cases based on previously analyzed data (from the EPE project); (2) to design a set of 9–12 new teacher-centered cases with accompanying scaffolding information (i.e., teacher portraits, contextual information, multiple perspectives commentary); and (3) to design a "generative case-building" component that would allow users to use PARENTS in the study of their own parental engagement practices in science education and to build and share their own cases with their local learning community (i.e., other teachers in their building).

Moreover, we will consider adopting a different production format for the next version of PARENTS environment. Instead of working towards the refinement of a hybrid format (which will consist of a stand-alone multimedia DVD that will be interrelated to an online forum component), we could re-design and develop PARENTS by employing an e-learning platform that will deliver and present the whole environment in an online format. An e-learning, online version of PARENTS will be more easily accessible to users both during their in-person graduate class experience as well as in other setting and time on their demand (more interaction with the environment for further exploration, reflection, and online discussion while not in classroom).

Last, in regard to the integration and effective use of this multimedia case-based environment in a preservice teacher education setting, we will take under consideration the users' suggestions on extending the use of PARENTS throughout a longer time period, which would ideally start and be parallel to the preservice teachers' "student teaching" experience, and provide ample time sections for group and class discussions of the preservice teachers' ideas and experiences. In such an ideal situation, a revised version of PARENTS could be a built-in component of a teacher education course, a way that: (1) would allow a more comprehensive and insightful exploration of the emerging issues around parental engagement, while revealing their importance and debunking their complexity; and (2) consequently start bridging the theory to the teaching practice.

Researchers and developers need to consider the actual influence that such a digital environment could have on the practice of the teachers. In short, what PARENTS offers is a multimedia, semi-structured, and powerful space for exploration and reflection on the issues of parental engagement in education and science education. Integrated in a teacher education course, PARENTS can also provide the spark or the common anchoring experience to its users to explore multiple perspectives, debate and negotiate their ideas, questions, and suggestions with their fellow preservice teachers for future action that would enhance, promote, and transform the notion and process of parental engagement in schooling. However, we still need to examine how the advantages of PARENTS can be enacted or utilized by the teachers in the real world of the school, and especially in a high-poverty urban school. As the preservice teachers stated, PARENTS helped them put a face on all the rigid or abstract theory they usually are encountered with during their graduate courses. On the other hand, we would like to explore how such an environment could actually help preservice teachers transfer their informed and evolved ideas and suggestions, and the "theory with a face" to the field of teaching practice and more importantly in their relationships and role with the real parents of their students.

References

Black, J.B., & McClintock, R.O. (1996). An interpretation construction approach to constructivist design. In B. Wilson (Ed.), *Constructivist learning environments: Case studies in instructional design.* Englewood Cliffs, NJ: Educational Technology Publications.

Brown, A.L. (1992). Design experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings. *The Journal of the Learning Sciences, 2*(2), 141–178.

Calabrese Barton, A., & Drake, C. (2000). *Ecologies of Parental Engagement project.* NSF Grant Proposal: REC 9980592.

Calabrese Barton, A., & Drake, C. (2002). Parental engagement and science education: The stories of parents. A panel presented at the American Education Research Association, New Orleans, LA.

Calabrese Barton, A., Drake, C., Perez, J.G., St. Louis, K., & George, M. (2004). Ecologies of Parental Engagement in urban education. *Educational Researcher, 33*(4), 3–12.

Civil, M., Andrade, R., & Anhalt, C. (2000). Parents as learners of mathematics: A different look at parental involvement. In M.L. Fernández (Ed.), *Proceedings of the Twenty Second Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education (Vol. 2,* pp. 421–426). Columbus, OH: ERIC Clearinghouse.

Cognition and Technology Group at Vanderbilt (CTGV). (1993). Designing learning environments that support thinking: The Jasper series as a case-study. In T. Duffy, J. Lowyck, & D. Jonassen (Eds.), *Designing environments for constructivist learning.* Berlin: Springer-Verlag.

Collins, A. (1992). Towards a design science of education. In E. Scanlon & T. O'Shea (Eds.), *New directions in educational technology* (pp. 15–22). Berlin: Springer.

Honebein, P.C. (1996). Seven goals for the design of constructivist learning environments. In B. Wilson (Ed.) *Constructivist learning environments: Case studies in instructional design.* Englewood Cliffs, NJ: Educational Technology Publications.

Hoover-Dempsey, K., Walker, J., Jones, K., & Reed, R. (2002). Teachers Involving Parents (TIP): An in-service teacher education program for enhancing parental involvement. *Teaching and Teacher Education, 18*(7), 1–25

Jonassen, D.H. (1999). Designing constructivist learning environments. In C.M. Reigeluth (Ed.), *Instructional-design theories and models Vol. II: New paradigms of instructional theory.* Mahwah, NJ: Erlbaum.

Reeves, T.C. (2000). *Enhancing the worth of instructional technology research through "design experiments" and other development research strategies.* Paper presented at the Educational Research Association, New Orleans, LA, April.

Reisbeck, C.K. (1996). Case-based teaching and constructivism: Carpenters and tools. In B. Wilson (Ed.) *Constructivist learning environments: Case studies in instructional design.* Englewood Cliffs, NJ: Educational Technology Publications.

Schank, R.C., Fano, A., Jona, M. Y, & Bell, B. (1993). *The design of goal-based scenarios.* The Institute of the Learning Sciences, Technical Report #39.

Spiro, R.J., Feltovich, P.J., Jacobson, M, & Coulson, R.L. (1992). Cognitive flexibility, constructivism, and hypertext: Random access instruction for advance knowledge acquisition in ill-structured domains. In T. Duffy & D. Jonassen, (Eds.), *Constructivism and the technology of instruction: A conversation.* Hillsdale, NJ: Erlbaum.

Van den Akker, J. (1999). Principles and methods of development research. In J. Van den Akker, N. Nieveen, R.M. Branch, K.L. Gustafson, & T. Plomp, (Eds.), *Design methodology and developmental research in education and training* (pp. 1–14). The Netherlands: Kluwer Academic Publishers.

Wilson, B. (Ed.) (1996). *Constructivist learning environments: Case studies in instructional design.* Englewood Cliffs, NJ: Educational Technology Publications.