Using Design Personas to Inform Refinements to Software for Science Learning

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Abstract: Design personas are a technique of participatory design intended to provide design teams with memorable, vivid representations of users' needs and practices. In this paper, we describe the process of creating personas to inform refinements to the design of software designed to help elementary students create concept maps of science topics they were studying. Drawing from interviews with children, parents, and teachers, the aim of these personas was to help the design team develop refinements to help children use the software effectively if it were to be assigned as homework.

Context

In this study we used *design personas* (Courage, 2005; Pruitt, 2006) to help a design team improve software intended to promote upper elementary school students' conceptual learning in science. Design personas are vivid representations of users' needs and practices, embodied in characters designers can relate to and utilize as they discuss design requirements and refinements (Grudin & Pruitt, 2002). Personas give designers powerful means to reason about design issues (Cooper, 2004; Dantin, 2005; Nieters, Ivaturi, & Ahmed 2007). The personas involve students in the design process in a way that accounts for children as a special user group (Bruckman & Bandlow, 2003), and emphasizes the roles they play in the design process (Druin, 2002).

The study focused on *Teachable Agents* (TA), a software that enables students to create an agent and to teach it science content through the creation of concept maps that constitute the agent's brain. The software has different feedback features and the students can also have their agents participate in a game show to test their agent's knowledge (Chase, Chin, Oppezzo, & Schwartz, in press). Tested initially in laboratories and recently in classrooms, the team that developed the software is interested in extending its use into home settings; to see whether it will help students learn more by engaging with the concepts in multiple contexts.

Approach to Developing Design Personas

A challenge of this particular design effort was to conceive how elementary-aged children engaged in multiple contexts, including school and home. Our personas describe learning dispositions, likes, technology use, and parental involvement associated with different activities. By characterizing the learning dispositions of children in different contexts, we aimed to provide the design team with a better sense of children's motivational goals (Ames & Archer, 1988; Pintrich & Schrauben, 1992; Urdan & Maehr, 1995) as well as other data that could inform the design of particular features to appeal to a diversity of children. By considering parents' involvement in different activities, we sought to anticipate issues that could arise from assigning TA as homework, given parents' and children's preferences for mutual engagement in homework and technology-based activities.

To develop the personas, we conducted case studies of 10 students in which we compared the data about their informal activities with how they engaged in TA. We conducted two 1-hour long interviews with each student and two with their parents. We also incorporated data from logs about their engagement with four TA-specific features: chat, feedback via a grid showing correct and incorrect links between concepts, game show, and concept map edits. Each of the four design personas aggregated data from 2 to 3 students.

Samples of Design Personas

The design personas focused on user type characteristics that were deemed most relevant to TA-specific features mentioned above. The following are excerpts from the four design personas that were created.

Brainy Bethany loves learning about new things. Being very inquiry-oriented, she is comfortable not knowing the end result of an information-finding effort and does not limit herself to one form of finding information. Bethany feels she knows her mind very well, and she is constantly reasoning about her surroundings.

Social Susie is motivated by social participation in virtually all her activities. She can be sensitive to critique but she also very reliant on others' input and opinions and relies quite a bit on guidance from adults. She prefers practicing instead of advancing to more complex levels of learning. Even though she participates in many sports, she is not motivated by competition at all.

Hangback Hubert wants to do well, and he worries about failing in front of others. Hubert depends on the guidance, structuring, and feedback from others and gets overwhelmed and anxious in an open-ended environment. He needs clearly articulated goals but he can also be motivated by intellectually stimulating aspects such as puzzles and strategy-like activities. He is not very competitive,

Gamer Gabe makes a game of whatever he is doing, which gives him a strong sense of agency in the world. Gabe likes to get things right. He doesn't so much like "learning" the varied games he plays (videogames, computer games, puzzles, board games), but is rather driven by a need for novelty. He finds homework boring, because it's repetitive. Gabe is social, but prefers smaller, trusted groups of people, especially when the social context is activity-centered (like playing games together, for example).

Implications for Refining the Design of the Software

For each of the personas developed, our team generated suggestions for design implementations. Overall, the user profiles represented by the personas suggest more integration of TA's main features and more flexibility in their particular functionalities.

The chat feature is not likely to appeal to *Bethany* in the same way it might others, because she is an independent learner and seeks help efficiently on her own. Likewise, Bethany would likely see through the game show; instead of using it as a motivating vehicle for improvement, she is likely to discover and use alternate methods of getting feedback to check to see if the links she has made between science concepts are correct. If the design team incorporated additional ways for Bethany to search for information outside the site that could help her learn about the concepts, the software might be more appealing to her.

Personalizing the agent and integrating it more in the TA landscape might be more motivating for *Susie*. It would probably help her to de-emphasize the competitive aspect of the game show and make it more social. Susie's sensibility toward criticism may be dealt with by making the agent more "alive" and strengthening its role as ego buffer

Hubert would likely prefer to communicate with friends and others that he already trusts. Perhaps the grid in its present form is too much like a grade for Hubert, leading him to focus more on the game show, where the outcome reflects less on him directly and more on his agent. If it was possible for the game show to retain its quality of high structure but integrate it more with other features, it could provide opportunities for Hubert to involve himself with his map and his agent's learning in a more productive way.

As a sophisticated gamer who takes interest in game-specific problem solving strategies, *Gabe* might benefit from integrating the game show strategy with the agent's knowledge. To leverage learning goals against achievement and game strategy goals for Gabe, TA might shift the balance from the explicit achievement functions and capitalize more on strategy and game playing features with learning goals.

The best test of personas' usefulness is whether the software refinements lead to the desired engagement with the key aspects of what makes the software a powerful learning tool. Such a study is planned for the 2009-10 school year, as a collaborative endeavor between our research team and the design team.

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