Robot Diaries: Encouraging and Enabling Technological Creativity

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Abstract: The ubiquity of new technologies has led many educators and researchers to wonder about the best way to prepare students for participation in a digital world. The *Robot Diaries* workshop provides an opportunity for adolescent girls to engage with technology in creative ways. Preliminary analysis suggests the workshop enables three patterns of creative technology engagement: technical, integrative, and expressive. These findings have implications for understanding the range of fluency pathways available in such settings.

Research conducted on out-of-school technology use suggests that even school-aged children have frequent access to technologies such as computers, game systems, and mobile phones (Sefton-Green, 2006). But what type of engagement do most children experience with technology? A survey of British children between the ages of 9 and 18 suggests that the most common computer activities in this population include writing and searching the Internet, while more creative endeavors such as making websites, animations or films were reported less frequently (Kent & Facer, 2004). Were we to characterize the technology engagement of the students interviewed by Kent and Facer, those that primarily engage with computers by using word processing programs or searching the Internet might fall into the category of technology 'consumer' (Resnick & Rusk, 1996). In other words, they are comfortable navigating and utilizing existing technologies but stop short of creating or designing. These consumers represent the mid-point on a continuum of technology engagement, with non-users of technology on one extreme and fluent technologists on the other. Existing research provides rich descriptions of individuals at multiple points along the continuum (e.g., Barron, 2006; see also NRC, 1999).

The question remains of how best to encourage movement along the fluency continuum. The current work explores this question by defining habits of mind associated with fluent technology engagement, and examining the implementation of a learning environment designed to support them. *Robot Diaries* is an out-of-school workshop that promotes the development of technological fluency through participation in creative robotics (see Hamner et. al, 2008, for a description of earlier workshops).

Research Context

The Robot Diaries workshop is designed to support the development of three habits of mind consistent with fluent technology engagement:

- Approaching technology both as a tool and as a creative medium, and understanding how to express one's own interests with, in, or through technology.
- Understanding how to engage in a design process.
- Seeing one's self as competent to engage in acts of technological creativity.

In the workshop, middle school-aged girls (roughly ages 10-13) build expressive communication robots using a combination of crafts and robotic materials (e.g., motors, LED's, sensors). Each girl designs and builds her own programmable robot, which can use light, sound, and movement to tell stories, express emotions, make statements, or otherwise engage in communication (see figure 1). A networking site allows workshop participants to share their robot programs with other members of the group.

The data presented in this paper are drawn from a Robot Diaries workshop run as part of a homeschool enrichment program. Participants were seven homeschooled students (all female) between the ages of 9 and 14. Two homeschooling parents ran the workshop. The instructors, both female, were trained on the curriculum and technology prior to the start of the workshop. Each instructor had a daughter in the workshop. Researchers observed the workshop, conducted interviews with participants, parents, and instructors, and collected workshop related artifacts (e.g., design journals, video journals) for analysis.

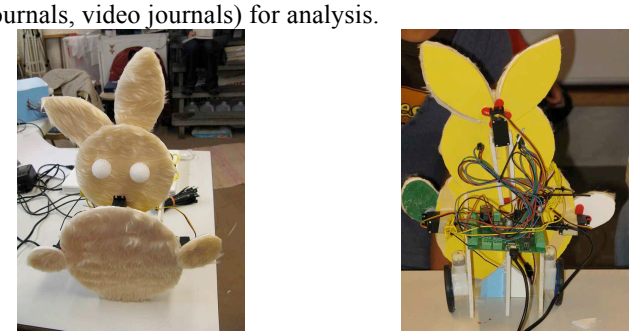

Figure 1. Technology built by a participant during a *Robot Diaries* workshop (front and back views).

Research Questions

The primary research questions for Robot Diaries concern the workshop's ability to forward the habits of mind identified above. For each habit of mind, we can ask: (1) Did participants move towards this understanding, and (2) What aspects of the workshop facilitated their movement? The current paper examines participants' movement towards the first habit of mind, seeing technology as a creative medium.

Preliminary Findings

Amabile's (1996) definition of the term 'creative' provides a useful framework for understanding technological creativity: "a product or response will be judged as creative to the extent that (a) it is both a novel and appropriate, useful, correct or valuable response to the task at hand, and (b) the task is heuristic rather than algorithmic" (p. 35). This definition, which emphasizes the novelty (to the individual) and appropriateness or value of the response, leaves room for the creation of technologies that respond or react to situations, circumstances, or events in functional or aesthetic ways.

A preliminary analysis of the Robot Diaries workshop data suggests three primary categories of creative response to the technology: technical, integrative, and expressive.

Technical Creativity

Technically creative responses include those that required participants to adapt their technical knowledge to achieve a particular outcome. For example, the creator of the robot pictured above wanted her robot to move on wheels, but was concerned that the two wheels would not properly coordinate if they needed to be programmed separately. Her solution was to plug the wires for each wheel into the same port, so that they were subject to the same programming controls.

Integrative Creativity

Participants achieved 'integrative creativity' by integrating the technology with a personal or fictional narrative. Examples of integration with a personal narrative include one participant's spoof of a presidential campaign commercial (in her commercial, the robot expresses its support for a candidate in the 2008 election), and another participant's 'trick or treat' robot which was dressed up for Halloween and used its sensor and speaker to request candy from passers-by. Examples of a fictional narrative include creating a 'persona' for the robot, such as one participant's desire to build a robot whose actions suggest it is afraid of the dark.

Expressive Creativity

Participants achieved 'expressive creativity' by developing novel ways of communicating emotion in their robots. Examples include one participant's use of light patterns to simulate moving feet on her robot.

Conclusions

Preliminary analysis suggests that Robot Diaries participants displayed a variety of creative responses. This analysis helps us understand the range of fluency pathways that may exist inside such a community. Future analysis will examine the prevalence of each pathway and consider the impact of workshop design.

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Acknowledgments

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