ISEN Faculty Booster Grant: Project Research Report
Household Resource Consumption and Learning: Design and Research

June 2010 – May 2011
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Project Overview:

For this project, we requested support to conduct background research and planning in preparation for two grant proposals to be submitted to the National Science Foundation in 2010-2011. Our goal was to conduct interviews and observations with a small number of families in the Chicago area to form an understanding of household resource consumption habits. We also proposed to develop a preliminary conceptual model in an effort to explain and predict the role of interactive resource monitoring and control technology in domestic settings.

This project is part of a larger research agenda with two driving research questions. First, how can we design technology to engage entire families, children as well as adults, as in the management of household resource consumption? And second, how can we design technology to support inquiry learning in homes around issues of sustainability? With interest in eco-feedback and management technology growing, we believe these are critically important questions that have received insufficient attention from the research community.

2010-2011 Project Accomplishments:

Grant Proposals

As proposed, we submitted two grant proposals to the National Science Foundation in the past year. The first proposal was an NSF CAREER submitted by the PI (Horn). The proposal was favorably reviewed but not funded. Based on reviews from the CAREER proposal Horn and Stevens submitted a second proposal to the NSF Cyberlearning program. This second proposal is pending, and we will notify ISEN when we know the funding outcome.

Horn, M. CAREER: Conservation Kids: Families, Learning, and the Next Generation of Eco-Feedback Technology

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<tr>
<th>Agency:</th>
<th>National Science Foundation (CAREER 08-557)</th>
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<tr>
<td>Submitted:</td>
<td>July 20, 2010</td>
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<tr>
<td>Status:</td>
<td>Declined</td>
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<td>Direct costs:</td>
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Horn, M.S., & Stevens, R. EXP: Augmenting Household Technologies for Learning and Whole Family Participation: Heating and Cooling Control as an Exploratory Case
Family Interviews

With the help of ISEN support, we were able to conduct 20 interviews with Chicago-area families in the past year. The interviews were conducted in family homes and concerned practices of energy and water use. We are now in the process of analyzing the video data collected. Here is a brief summary of our preliminary results:

- Our hypothesis that home thermostats tend to be adult-only devices was supported by the interview data. The families we interviewed did not have formal “hands-off” rules about thermostat operation. Rather, there seemed to be a mutual, unspoken understanding between children and adults. In some cases, we observed conflict between family members when the expectations were violated—for example, one youth reported touching the thermostat to his father’s surprise.

- In most cases children and adults are largely unaware of the magnitude and impact of their own consumption. When asked to estimate water consumption, for example, families’ estimates were often off by an order of magnitude or more. Only rarely did families attempt to calculate water consumption using arithmetic. While these findings are consistent with the literature, our investigation will contribute to an understanding of the process by which family members develop these estimates together.

- Families had a variety of ways in which they built consensus around water and energy estimates. We observed the frequent use of argumentation and evidence, which supports the idea that carefully designed eco-feedback technology may help families engage in inquiry learning activities in the home.

Publications

We are in the process of preparing manuscripts based on our analysis of interview data. We are also presenting a poster at the 2011 Interaction Design and Children (IDC’11) conference in Ann Arbor, Michigan this June.


We will notify ISEN of future publications related to this work.

Technology Development and User Testing

We used the family interviews as an opportunity to iteratively test and refine eco-feedback and management technology that we are developing. In the past year, we developed two functional prototypes. The first is a point-source water meter that uses a microphone
attached to a faucet to estimate water flow (water volume is roughly proportional to the audio volume of water flowing through the faucet):

Second, we created a programmable thermostat interface prototype for the Apple iPad. To program the thermostat users “paint” temperature settings on top of a weekly calendar. Our prototype is based on a detailed task analysis, interviews with families, and usability testing with paper prototypes. The software is implemented using web-enabled technologies (HTML 5 and JavaScript) and could realistically function as a front-end for an existing Internet-enabled programmable thermostat.

Finally, we are testing “paper prototype” information displays for programmable thermostats.