Project Title: Refocused Tangible Experience Design course

Applicant(s):

<table>
<thead>
<tr>
<th>Name</th>
<th>Telephone</th>
<th>College/Dept.</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>W. Michelle Harris</td>
<td>475-4487</td>
<td>GCCIS/ Interactive Games and Media</td>
<td>RIT</td>
</tr>
<tr>
<td>Stan Rickel</td>
<td>475-4745</td>
<td>CIAS/ Industrial Design</td>
<td>RIT</td>
</tr>
<tr>
<td>David Schwartz</td>
<td>475-5521</td>
<td>GCCIS/ Interactive Games and Media</td>
<td>RIT</td>
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</table>

1. **Project Summary:**

   We developed the original Tangible Experience Design seminar in response to a need for Industrial Design students to be introduced in a tangible way to the practices of interaction design. We are refocusing course to concentrate on practicing iterative design process and learning programming that instantiates that design. In the Department of Industrial Design at Eindhoven University of Technology, they've taken on a similar challenge in their CreaPro course. They begin introducing programming with the designer-friendly platform of the Processing language. Next, they introduce a customized programming interface for the Processing language so that students can program a specially-outfitted robot, the AdMoVeo for "hands-on experience in designing product behavior."

   We are adapting the Eindhoven approach but tailoring it to our own requirements and circumstances. In previous offerings of the course, we've already tried to guide them to smaller scale projects (mobile, wearable). However, it is clear (both from the decided non-portability of many resulting projects and from a review of their portfolios) most Industrial Design students are more comfortably expressive working at human scale rather than mini-robot scale.

   A safe method of allowing students to creatively control standard AC-powered components (of human scale) is applying the home automation tools of the X10 suite. X10s allow programmatic control of anything that plugs into a wall outlet - lights, fans and appliances. The X10 suite has a well-documented library for communicating with the Arduino microcontroller. We intend to follow the Eindhoven model in pre-building a variety of ready-to-run sensors, a few LEDs, a small speaker, and a connector for the X10 module in a package easily attached to the Arduino.

   We will use the Arduino application language as the language for introducing programming to our students. We will also adapt the AdMoVeo API code as a guide as we create Arduino libraries for the students that simplify working with the sensors and the X10.

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2. **Targeted Learners**  
The primary target audience will be first-year graduate and advanced undergraduate students in Industrial Design. Graduate students in Computer Graphics Design have frequently enrolled in the past also, and are a good fit for the revised version. The course will be offered to 10 - 25 students per academic year.

3. **Current Course or New Course?**  
This proposal is for applying research and lessons learned from a previously-run seminar, Seminar in Tangible Experience Design, to create an elective course in the Interactive Games and Media department.

4. **Anticipated Impact on Teaching and/or Learning**  
We expect to evolve an approach to teaching programming that allows students to evolve their creations in the physical world, and implement their design ideas with computer code-driven systems to create tangible, human-scale interactive experiences for their target audiences.

5. **Impact on Student Success**  
In prior offerings of the seminar, where design students and computing students took the course together, Non-programming students were not able to learn enough programming to implement their designs by attempting to adapt simple code examples, especially when they were trying to learn electronics simultaneously. Their lack of baseline programming skill learning prevented the mixed-discipline teams from being fully collaborative efforts. On the occasions when designer/technologist team balance is achieved, the collaborators naturally capitalized on their individual areas of expertise - designers concentrating on design, and technologists concentrating on technology - rather than applying new skills outside their comfort zone. When there aren't enough technologists to go around, the instructor and any technologist friends are pressed into duty to compensate. The course redesign seeks to change that proposition.

There is huge demand for gadgets, devices and “spaces” that help people interact seamlessly with digital services and information. The designers who create such products should be able to interface computers with real-world inputs and outputs and give people new ways of controlling and experiencing their devices and information. We feel this course is an important step in equipping design students to meet these evolving challenges. They won’t be expert programmers and electronics engineers, but they will understand how those technologies can be brought to bear in a way that designers who haven’t developed these basic skills cannot.

6. **Measuring Impact And Reporting Findings**  
The seminar assessed interactive design process objectives with staged project deliverables, presentations and the final project. In the revised course, we will use those methods and also assess individual programming competency with several individual practical programming tasks and hands-on quizzes covering variables and data types, flow sequence, decision structures, iteration structures, methods, scope, arrays and objects. Students will be given a first- and last-week self-evaluation of their understanding of these same basic programming concepts based on instruments developed for assessing competence in 1st year programming courses\(^2\). We will also take note of whether any revised course students choose to take the related Physical Computing course, and monitor their transition and success in that setting.

A key aspect of our research and findings that we believe would be of interest to other faculty at the PLIG forums would be a discussion of how approaches for teaching programming have been adjusted (by ourselves and others) for design-major students.

Planned conference talk venues for disseminating our work:

- Industrial Designers Society of America International Conference and Education Symposium (August 2011)
- International Conference on Tangible, Embedded, and Embodied Interaction (January 2012)

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7. Project Rationale

A. Why it is not part of regular college business

This course is targeted, not towards the students of the Computing college (the normal college business), but to students in the Arts college. We believe that the cross-disciplinary collaborations that can occur as a result of creating a tailored experience for these students to learn programming will be worth the initial investment.

B. Relevance to required cluster, college, and/or department competencies

The Interactive Games and Media department is offering and developing related courses, and this course is being repositioned within their context. The redesigned course for design students will focus on interaction design process, high-level electronics prototyping, and beginning programming, so that they will then be prepared to collaborate with more technical students in the related courses. Those courses are as follows:

- 4080-433 Intro to Physical Computing: provides a rapid and simple technical introduction to basic electronics (components, circuits, microcontrollers, etc.). Emphasis is placed on applying HCI design concepts to physically-interactive product development. Incoming students need some programming experience, as they will create projects that blend electronics, programming and design.

- 4080-4XX (in development) Sociable Physical Computing: brings the successful student from 4080-433 introductory course together with students from Electrical Engineering Technology to create an environment for transdisciplinary learning. Student teams will learn to develop networked devices that encourage interaction amongst groups of people. A NSF/TUES grant proposal is in process to support the development of this course.

- 4080-4XX (in development) Alternative Game Interfaces: applies notions of reverse engineering education in which students create new game controllers (by adapting/rebuilding existing hardware) for innovative games. An initial seminar version of this course has already been offered.

The redesigned course will function as a more effective lead in and complement to these courses, where design students can (with basic programming skills established) work more effectively on multi-disciplinary projects in Alternative Game Interfaces, or explore prototyping with interactive electronics more directly in Intro to Physical Computing. From there, interested students would be prepared to work with Engineering Technology students in Sociable Physical Computing. The overall approach for this suite of course offerings is to bring in students from different disciplines with a carefully-phased build up of key student skillsets for more meaningful collaborations.

C. Relevance to other faculty and what it would take to transfer success to other faculty

We believe having a varied arsenal for teaching computer programming is useful even for faculty targeting technical-major students. While they may not use all the course materials, creating single-class experiences where students can control physical artifacts in their “natural” world by applying computing concepts (rather than using somewhat alien robots) would be a practical way to transfer our approach to the typical classroom. We also believe technically-versed design faculty would be able to build directly on our approach and adapt it to their needs.

Furthermore, we hope other complementary programs are encouraged to design curricula so that non-major students can build the complementary skills to enable transdisciplinary collaboration with majors in downstream courses.

D. Relevant credentials, experience of involved faculty/staff

Prof. W. Michelle Harris (Interactive Games and Media) teaches Introduction to Physical Computing, a class explores creation of interactive prototypes using recipe-based electronics. She developed the original Seminar in Tangible Experience Design course. Harris holds an M.P.S. degree from the Interactive Telecommunications Program at NYU's Tisch School of the Arts, pioneers in the tangible computing realm whose mission is to explore the imaginative use of interactive technologies.

Prof. Stan Rickel (Industrial Design) is the chair of the Industrial Design department, responsible for guiding curriculum for both undergrad and graduate students. Before becoming chair, Rickel was the graduate coordinator,
and first commissioned the Seminar in Tangible Experience Design course.

Prof. David Schwartz (Interactive Games and Media) teaches developed the Seminar in Alternative Game Interfaces course. A game controller developed by students in the course, the “Oh No! Banjo” has been featured in BoingBoing, PCWorld, the Game Developers Conference and (anticipated) the Computer Game Education Review. He is currently leading the effort to propose developing the Sociable Physical Computing course with funds from the NSF/TUES grant program.

E. How this innovation is in your discipline or program

We see Interactive Games and Media and Industrial Design as quite complementary programs. Today’s digital innovations are moving from desktop computers into the physical realm of the “natural” world. Furthermore, the traditional design artifacts of the “natural” world are often becoming digitized – enabling communication and personalization. It is critical that students in both disciplines are prepared to work together and collaborate successfully in this evolving workplace.

8. Project Timetable

Summer 2009:

- Course development by Harris in consultation with Rickel and Schwartz.
- Electronics specialist student will test, plan and package electronic sensors and X10 connectors.
- Programming specialist student will program Arduino library code

Fall 2010:

- Submit revised course to curriculum committees

Winter 2010:

- Offer course and assess

Spring 2010:

- Review assessment data to refine the course content
- Prepare peer-reviewed conference talks on findings
The principal investigator's department or college or unit must provide matching funds to demonstrate broad faculty and administrative support for the project. Funds can be used to cover release time, pay student workers, and/or purchase supplies and services (such as CD pressing, video production, digitizing, photography). Funds will generally not be available for activities consistent with normal college business, overload pay, scholarly research, capital equipment purchase or travel - though the latter will be considered if a clear connection to the project can be demonstrated.

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<th>Amount</th>
<th>Budget Officer Verification</th>
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<tr>
<td><strong>SALARIES (for parity, $4,500 per release)</strong></td>
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<tr>
<td>Adjunct Faculty Compensation</td>
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<td>Summer Salaries - Faculty</td>
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<tr>
<td>Benefits: RIT – 8.0%</td>
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<td>NTID – 8.5%</td>
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<td>ITS: $82.80/FTE; adjuncts are charged at .33 FTE</td>
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**Student Compensation**
- Programming specialist (20 hrs) | $2000 |
- Electronics specialist (30 hrs) | $3000 |
- Other Compensation - Professional services | $________ |
- Other Compensation - Consultants | $________ |
- Other Compensation - Honoraria | $________ |

**SALARIES TOTAL** | $5000 |

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<td>Software</td>
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<tr>
<td>Laboratory</td>
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<tr>
<td>General</td>
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**SUPPLIES TOTAL** | $3000 |

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<td><strong>SERVICES</strong></td>
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**SERVICES TOTAL** | $0 |

**TOTAL BUDGET REQUEST** (for PLIG monies) | $4000 |

**MATCHING FUNDS FROM DEPARTMENT/COLLEGE** | $4000 |

Department Head and Dean's signatures required.

*Example: $5,000 requested from PLIG monies; $5,000 will be supplied by the college(s)*
Request for Full Proposal Requirements

Pages 1-4

1. Title and summary of proposed project.

2. Targeted learners or population (include cluster, departments, year level, number of learners impacted).

3. Is this for a current course or new course?

4. Anticipated impact on teaching and/or learning.

5. How will your project impact student success (i.e., retention)?

6. How you will measure the impact, how you will report your findings, and what you will share about your project in a faculty forum.

7. Present a rationale for your project, as it ties to the intent of the grant, including:
   a. why it is not part of regular college business
   b. its relevance to required cluster, college, and/or department competencies
   c. describe how your project is relevant to other faculty and what you think it would take to transfer your success to other faculty
   d. relevant credentials, experience of involved faculty/staff
   e. describe how this innovation is in your discipline or program

8. Provide a timetable of the development of the project.

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1. Using attached form, complete a detailed budget for the project. Signatures of appropriate budget officers need to be included. Department Head signature is required for single department projects. **College Deans’ signatures are REQUIRED for interdepartmental (Adaptation and Implementation Program) projects.**

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1. If co-funders are involved, attach statement(s) of support.

2. Letters of support from appropriate administrators are to be included.

Please Note:

No hand written proposals will be accepted.

Absolutely no proposals will be accepted after 4:30 p.m. on Friday, March 19, 2010. Hand-deliver 13 copies of the grant proposal (4 pages maximum, plus attachments) to Susan DeWoody, 1530 Wallace (Bldg. 5). Also, email your full proposal and budget to her at skdetc@rit.edu. NOTE: PLEASE DO NOT USE YOUR OWN FORMAT, BUT CONFORM TO THE ABOVE FORMAT. Thank you!

Proposals and final reports will be posted on the web.