Project Title: Evaluation of VREP High School Engineering Intervention
Research Thrust Area: Design Education
Research Team: Stephen Gilbert (IMSE), Judy Vance (ME), Richard Stone (IMSE), Janis Terpenny (IMSE), Seda Yilmaz (Art & Design)

Need and Industrial Relevance:
U.S. Industry is in dire need of more workers in STEM fields (US Dept of Commerce, 2011, "STEM: Good Jobs Now and for the Future"). To address this need, a variety of initiatives attempt to interest middle- and high-school students in STEM topics. This research proposes to evaluate one particularly interesting initiative called VREP, which specifically targets the underachieving student who may not flourish in a traditional classroom environment, but does well working on projects. Since 2006, VREP has had strong anecdotal success motivating over 500 students to learn 3D modeling skills which could make them strong CAD engineers in the workplace.

Project Goals:
VREP (Virtual Reality Educational Pathfinder) enrolls students in over 50 schools in a self-paced, teacherless course in which they use peer-mentoring and the Internet to learn how to create and animate 3D models. Their projects must be designed with a school teacher as the "customer," e.g. the project will be used in a class. Students who have participated in VREP have demonstrated increases in self-confident and engagement with school, but there have not been sufficient resources to conduct a controlled comparison study of how participation in VREP affects STEM course proficiency within high school and longer term STEM course enrollment in college. This research seeks to validate VREP’s success quantitatively and explore how VREP could scale to larger numbers and to other skill areas.

Objectives:
This project will evaluate VREP's impact on students on a number of specific factors:
- Does VREP lead to higher GPAs?
- Does VREP lead to enrollment in the college-bound math and science tracks?
- Does VREP lead to enrollment in higher tier colleges?
The research will also seek the critical factors for VREP success in terms of demographic and environmental variables, e.g. type of school implementation, race/ethnicity, rural vs. urban school, gender mix, etc.
Approach and Methods:
This project will collect data from a sample of the more than 50 schools participating in VREP, including student transcripts, GPAs, college enrollment status, demographic information, and other relevant variables. **Permissions to use these data are already in place.** A web-based database of anonymized student data will be created. Researchers will compare VREP graduates’ attainment in undergraduate engineering with attainment of demographically similar non-VREP students to establish the impact of this high school intervention on engineering proficiency.

To build relationships between VREP students and partner companies, VREP Showcase events (annual gatherings of students) will feature visits by company representatives.

Outcome/Deliverables:
Outcomes include the academic and the practical:
- **Evaluation of VREP**, a publication-quality report noting the critical characteristics for success with statistics and thorough data analysis.
- **Guide to a Successful VREP**, a practical handbook with suggestions for implementation of VREP and related similar programs
- **Heightened industry relationships** between students and partner companies

Impact:
The success of this effort will significantly expand the research on techniques for engaging youth from diverse backgrounds with STEM education as well as building on research that involves self-directed learning and teaching via design. Addressing two of the Grand Challenges for Engineering described by the National Academy of Engineering ("Advance Personalized Learning" and "Enhance Virtual Reality"), demonstrating the robustness of VREP will provide a evidence for an alternative schooling model, a method of assessing students’ skill sets in a motivated context so that they achieve increased self confidence. Finally, by participating in this research via the Center for e-Design, industry partners will have access to the impressive group of VREP participants for employees.

Project Duration (plan and timeline):
- Task 1: Observe and analyze implementations of VREP (environmental context)
- Task 2: Develop Student Data Database
- Task 3: Collect and enter VREP student data (transcripts and statistics)
- Task 4: Analyze data
- Task 5: Write report, publications, connect students with internships

<table>
<thead>
<tr>
<th>Tasks 1, 2, 3 in parallel</th>
<th>Task 4</th>
<th>Task 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 mos</td>
<td>6 mos</td>
<td>9 mos</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12 mos</td>
</tr>
</tbody>
</table>

Proposed Budget:
$48,000 for one graduate student for data collection and analysis, faculty time, hourly pay for database development, and travel to VREP locations.