Dee Family Technology Awards
Proposal for Funding
Due April 1

Project Title: **The Design and Development of a Mixed-Reality**

Interface toTeach Techniques for Administering Local Anesthesia

Project Director: **Kami Hanson**

Department(s): **Dental Hygiene**

College(s): **Dumke College of Health Professions**

E-Mail: **khanson4@weber**   **Extension:** **6831**

Other Members of the Project Team: Undergraduate research students,

On-campus Technical Support – Alan Lewis, Imprint Interactive – Expert in Virtual

Design, Utah State University support Brett Shelton, PhD – Major Professor for my PhD

Instructions:
1. Please complete each section in the space provided. The justification section should not exceed two single-spaced typed pages.
2. You are required to obtain the signature of an ARCC representative for your college, indicating that she/he is familiar with the proposal, and can speak to it during funding deliberations.
3. Your department chair's signature is also required, indicating that she/he supports the proposal, and that the proposal is in keeping with departmental goals related to information technology and its applications to the academic mission of the institution. Your Chair's signature also indicates her/his commitment to help support the project financially if so indicated on the budget page.
4. The form below must be emailed (without signatures and in PDF format) and a hardcopy mailed to the ARCC chair, David Ferro, dferro@weber.edu and MC 2401 by April 1.

ARCC Representative:
   I have read the proposal and discussed it with the Project Director.

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ARCC Representative

Comments:

Department Chair:
   The Department has reviewed this project within the context of overall information technology planning within the Department. If the budget page indicates financial support from the Department, I agree to commit those funds to this project.

_____

Department Chair

Comments:

College Dean: (only necessary if co-funded at college level)
   I have reviewed this project. If the budget page indicates financial support from the College, I agree to commit those funds to this project.

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College Dean

Comments:

Justification

Your proposed project should be described as clearly and succinctly as possible in the spaces provided below. Be sure to review the "Criteria for Funding" document. *The entire justification section should not exceed two single-spaced pages.*

Abstract (project summary):

Over the last year I have worked closely with a team of designers (major professor for my doctorate, undergraduate research dental hygiene students, WSU on-campus technical support and commercial off-campus technical support) to create an educational interface that will allow students to learn techniques for the administration of oral anesthesia in a virtual realm. We are incorporating the use of an augmented reality (AR) environment instead of a purely virtual system because of the benefits of the user having a "sense-of-self" in space in an augmented realm; hence, the use of the verbiage "mixed-reality" technologies in our title.

Once the system was designed we started the development process. As is the case with most research and development processes we've had to keep in mind design considerations and budgetary constraints with concomitant design tradeoffs. One of our goals in the original design was to provide our users with sensory feedback (haptics) while utilizing the AR environment. Because of the high cost of haptics in our original plan we have developed other more economical options to try to simulate the same experience. As a result, we have decided to simulate haptics with the use of a real manikin for proprioceptive feedback while the 3D virtual object is displayed superimposed over the manikin for visual feedback. In order to do this, we need to use two magnetic tracker systems to create a realistic experience for the user. Our previous budget allowed for the purchase of one tracker, but not for two. The purpose of this proposal, is to request the additional funding for one more tracker

Objectives and goals of this project:

Objective: Learning the techniques for the administrating local anesthesia for dental procedures is a complex conceptual process that requires the consideration of anatomical spatial and dimensional acuity. The traditional method of instruction and assessment is with the use of human subjects for repetitive practice. With the advancements in immersive technologies and specifically mixed-reality, an alternative to the use of human subjects as practice is possible and theoretically holds many advantages over traditional forms of instruction. My research is an investigation into the potential of learning the techniques for administering local anesthesia utilizing mixed-reality technology. Learners will experience the iterative cycle of multiple sensory explorations of 3D objects rendered in virtual space. After the investigation into the use of mixed-reality technology for learning in this context, I will research the nature of this technology as it is integrated into traditional methods of instruction.

Research Program Overview: Thirty senior dental hygiene students will be recruited from a course on local anesthesia. These students will learn techniques for the administration of two cranial block injections. Students will participate in a designed dental instructional exercise using a mixed-reality interface that will allow them to manipulate 3D images rendered in virtual space. The virtual 3D objects will be superimposed over the real environment, that of a formal, familiar dental chair and operatory. The students will be digitally recorded and observed for analysis by expert clinicians and researchers. Members of the research team will interact with the students as they interface with the virtual objects as a way to provide the learner with support and instructional direction. In addition, students will be given a pre- and post-treatment test as well as complete a post-treatment questionnaire. The findings of this research will impact the dental education community and the instructional technology community by illuminating the cognitive processes and physical skills that may be mediated through advanced visualization technologies.

Identify specific courses and/or programs that will directly benefit from this project:
(You may also want to describe how specific courses may be enhanced by this project.)

This project will benefit multiple courses within the department of dental hygiene. In addition, I have spoken with Allen Hanburg in the department of Nursing for future collaboration of our mixed-reality technologies with the new Technologic Nursing Lab. There are various opportunities for future collaboration not only within the DCHP but also the physics advanced visualization lab and computer sciences as well.

If applicable, describe how this project will help to increase faculty productivity or enhance competency in some area of information technology.

The focus of this project is not faculty productivity but rather the utilization of emergent technologies to bridge the cognitive disconnect for learners between didactic instruction and hands-on learning. In addition, this project furthers my education and efforts towards my dissertation and doctorate degree.

Describe how the success of this project will be evaluated.
(If reports or publications are anticipated from this project, please indicate such.)

 I plan to disseminate my research findings as well as publish on the process of the development and design of mixed-reality applications by non-technical educators. In addition, I plan to present nationally and internationally on this topic.

Timeline:
(If funded, when will this project be implemented?)

 This project is already in full swing. We just need to solve the problem of this snag for an additional tracker. We plan to have the interface finished this summer and for full implementation and research this fall 2006.

Budget

Note: Please be as specific as possible regarding requested hardware, software, or other resources. If funds are being committed from other resources, please so indicate.

Purchases	Dumke Grant & Dumke Summer Stipend	DH Dept	Dee Family Tech Grant Request	Total
VR Engine Dell XPS M170		$3,000		$3,000
Graphic Display HMD	$989			$989
Software and Database	$7,000			$7,000
Creation of 3D Objects and VR Activity	$4,900			$4,900
Magnetic Trackers	$3,400		**$3,400**	$6,800
Customized Integration Programming	$2,000			$2,000
Webcams	$149.00			$149
Totals	$18,438	$3,000	**$3,400**	$24,838

Total Amount Requested for This Proposal: **$3,400**