

Project Title: Health Sciences Virtual Reality Simulations

Timeline: July 1, 2018 through December 31, 2019

Amount of Funds Requested: ~~\$96,300.00~~ \$91,000

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Abstract of Proposal:

Southeast Community College proposes a project to create virtual reality (VR) simulations that can be used by all health sciences programs at community colleges, including dual-credit career academies, statewide. This would reduce duplicated effort by eliminating the need for each college to create their own VR simulations, be more economical, and provide consistency in VR instruction in health sciences programs across Nebraska. This project would create a total of six simulations in the 18-month project period. It would also identify consistent technology to use among all the community colleges leading to future development of simulations that can be shared and collaborated upon.

Project description:

This project will create open resource virtual reality (VR) simulations that will allow students to interact in patient situations that are similar to ones they will experience during clinicals, which is the portion of their education where they enter real medical settings to practice skills they have learned in class. The simulations prepare students to better care for live patients. In addition, the use of simulations enhances student learning by equipping students to experience a variety of situations that can't be guaranteed in the clinical setting. The simulations also will provide students with opportunities to collaborate with students in other disciplines as well as other students who are participating in a simulated experience.

This project will be guided by a 15-member planning committee, which will include health sciences faculty, IT professionals, the Nebraska Department of Education, and two health sciences educators from SCC's Career Academy. The planning team will determine the simulation scenarios based on evaluation of student situations where students consistently struggle. A total of six VR simulations will be created that involve at least four health care disciplines. Each simulation will involve a diagnosis, co-morbidities, psychosocial needs, and family interaction. Examples of diseases and scenarios that will be simulated are chronic obstructive pulmonary disease (COPD), congestive heart failure, renal (kidney) failure, diabetes, pneumonia, and others. There may be existing simulations created by faculty at participating community colleges that can be used as a starting point for some VR scenarios.

The project will include faculty and staff from all six Nebraska community colleges. Southeast Community College (SCC) will oversee the budget and lead the project. The project budget will support a designer/coder. This person, who will likely have a background in VR and 360 video editing, will be responsible for the technical aspect of creating the VR simulations, while the planning team will provide content for and write the simulations. The budget also will include VR technology tools for the participating community colleges.

The timeline of the 18-month project will include: 1) July 2018-December 2018, four to six months of writing scenarios and evaluating technology options; 2) January 2019-June 2019, six months of coding the simulations; and 3) July 2019-December 2019, six months of implementation with students at each community college and evaluation. During the coding phase, the simulations will be tested by the planning team and other health sciences faculty. The team will choose VR technology based on ease of use and minimal training requirements.

Once created, this will be a statewide, shared resource. All of the participating community colleges will benefit from and be able to use the VR simulations created through the project, saving time and money, and creating consistent health sciences learning tools for Nebraska. A database will be created of existing VR tools specific to health sciences that can be used by educators and students at community colleges and high schools. Community colleges will use the tools to provide a VR hands-on experience during campus visits with high school students and career days at high schools statewide. VR educational sessions will be offered at the Health Occupations Students of America (HOSA) conference, which will increase access to this technology in rural areas and expose secondary educators and students to two-year health sciences programs at community colleges. Lastly, the simulations will be made available to secondary educators at ESU Professional Development Collaboration Days. NDE also will encourage high schools, through its listserv, to reach out to community colleges to experience and use this shared, open resource VR technology.

In addition, the Nebraska Department of Education (NDE) will include the new VR technology as a resource in the Health Science state standards, which are in the process of being updated. The VR planning and implementation team has included representation from NDE so they can be better informed as revisions to standards are made. This will continue to support the focus on emerging technologies and educating students on use of new technology in health care-related fields.

Given an overall shortage of healthcare professionals in rural areas, the benefits to students in rural areas cannot be overstated; the VR simulations will be available to students in traditional face-to-face courses, but the simulations will also be designed as a stand-alone “module” that students can complete on their own as practice for a lab or clinical. For students in more remote locations participating via distance learning, this design feature increases accessibility.

This project also facilitates career pathways for secondary students since some of the VR simulations would be designed for credentials, such as certified nursing assistant (CNA),

phlebotomist, and medication aide, all of which are currently offered to high school students via dual-credit courses.

VISION AND PURPOSE:

1. Connections to the PFI Areas of Focus and Purpose Statement

Secondary-Postsecondary Transitions

- Create innovative learning tools that ensure students are prepared to enter postsecondary education both in career education and academic preparation: This project will strengthen secondary-postsecondary transitions in multiple ways: 1) by providing VR hands-on experiences to high school students during campus visits and career days; 2) by exposing secondary health sciences teachers to VR technologies at the HOSA conference; 3) by offering professional development opportunities on VR to secondary health science educators; 4) by encouraging high schools to reach out to community colleges to experience VR technology; and 5) by creating open resource VR technology for easy secondary and postsecondary access and use in the classroom.

Statewide Partnerships and Initiatives

- Plan and create a set of common learning tools that can be shared among health sciences programs statewide: This project includes multiple partners throughout Nebraska, including all six community colleges, the Nebraska Department of Education, Nebraska's ESUs, Nebraska high schools, and HOSA.

2. How is this activity innovative?

VR simulations are innovative teaching tools that have shown the ability to provide experience that support workforce preparedness. This tool, which can be used to facilitate distance learning, also has the potential to help address an issue that many rural states face: an overall shortage of health care providers. It allows educators to create learning experiences that are low-frequency yet high-acuity in health care, such as learning how to take care of a patient who may have a rare infection such as small pox. Improved critical thinking can be achieved in a virtual world. Collaborative and experimental learning through use of VR technology allows students to learn with a higher order of thinking. This technology is valuable for collaborative and problem-based learning by allowing students to function in an environment where they can make mistakes, learn from the experience, and repeat the experience correctly without harming patients.

3. Overall outcomes. After this training has been created and delivered, health sciences programs in all Nebraska community colleges will have access to shared, innovative learning tools. Primary outcomes include:

- a. Open resource VR simulations will be available for use by all community college and high school health sciences programs;
- b. VR simulation design will improve training access to students statewide, especially in rural areas;
- c. Increased collaboration between secondary and postsecondary staff and faculty;
- d. Improved preparedness for the health science workforce at the secondary and postsecondary levels; and

- e. Increased collaboration between multiple health sciences disciplines.

NEEDS STATEMENT:**1. Data which supports the purpose of the proposal.**

There is great interest in finding the proper learning strategy for use of virtual technology in teaching and learning. The use of virtual reality (VR) technology in education is widespread, and the body of research on the use of VR as a learning tool continues to grow.

One article compared the use of standard patients (SPs) to computer-based simulation (or VR) in training medical professionals.¹ The authors concluded that computer-based technologies could significantly enhance important aspects of medical education, and that younger health professionals in particular were likely to embrace these new technological approaches.

Researchers continue to explore how the use of this new technology fits into pedagogy in identifying the learning benefits of using VR tools. One perspective focuses more on learning outcomes and objectives, and on the kind of learning that any technical environment needs to support, including virtual reality simulations. There is a need for further research and design guidelines for creating lessons that incorporate VR technology so that effective use of the technology toward learning objectives can be achieved.²

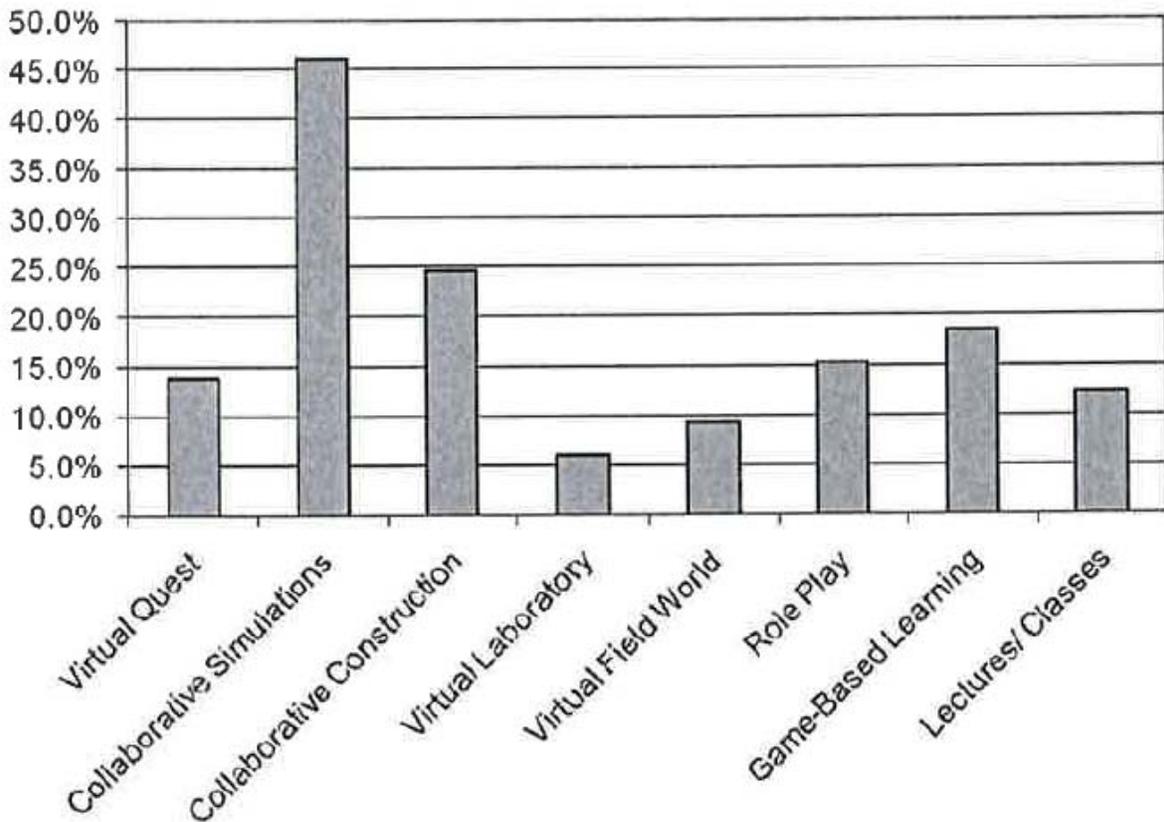
Another article compared 100 scientific papers on the use of virtual worlds in education and found that collaborative simulation activities were the most common (46.2%) uses among educational researchers³ (see Table 1). Virtual laboratories only make up about 6.2%.

This reflects one of the major needs in health care education: a need for collaborative learning strategies. It also reflects a potential area for growth: the use of VR in laboratory activities, particularly toward the end of distance learning as it applies to rural community access.

Several advantages were noted, including:

- Facilitated collaboration when conducting educational activities face-to-face;
- Achieving constructive learning;
- The ability to achieve higher-order thinking, such as analyzing, evaluating, and creating;
- Virtual-world learning experiences can be even more interactive than real-world learning experiences;
- Use of VR can achieve educational goals that are hard to achieve in the real world; and
- Positive feedback regarding the use of VR in building virtual labs and conducting discovery and knowledge-building activities.

Table. 1: Summary of Educational Activities in the Reviewed Literature



Virtual reality experiences have even expanded into the world of touch, where one virtual simulation tool, the Bangor Augmented Reality Education Tool for Anatomy (BARETA), combines augmented reality (AR) technology with models produced using Rapid Prototyping (RP). This technology aims to provide an interface more intuitive than a mouse and keyboard, and to elevate such a system as a viable supplement to traditional cadaver-based education.⁴

2. Need related to the data.

Use of virtual simulations in teaching and learning have shown great potential and can be a valuable contribution for collaborative and problem-based learning. Researchers and educators are using these innovative tools in traditional and familiar ways, but the full potential of these tools has yet to be utilized. Virtual worlds offer strong support for group work and learner interaction, allowing geographically separate students to be aware of other people in virtual worlds working to solve the same problems.

SCC's past experience with VR includes Second Life, which was used in a project to successfully create modules in a virtual world to teach students how to use manufacturing tools. This project would build on that experience. The data above reflect one of the major needs in health care education: a need for collaborative learning strategies. They also reflect a potential area

for growth: the use of VR technology in laboratory activities, particularly for distance learning. This project addresses both.

Health science is by nature collaborative. Combine that with the lack of health care professionals in rural areas, and that means that technology and creative education tools become even more important to help alleviate the shortage. VR simulation technology can help by giving students virtual “real-world” experiences that closely resemble actual scenarios, and interact with and get feedback from fellow students, even if they are participating in the exercise remotely from another location.

One issue the data point out is that, while there continues to be significant research and experimental activities on various aspects of VR technology in educational settings, the use of VR technology is now widespread. Providing access to this technology will soon be an expectation. This technology is largely limited to schools that can afford to purchase it, creating a disparity between schools and limiting access to students in less affluent districts or service areas. This project seeks to minimize that disparity and provide access to all secondary and postsecondary schools across the state.

Some disadvantages, such as the cost of acquiring VR technology and effort required to establish best practices for incorporating VR technology, have been noted. However, this project would address both of those. Costs would be reduced by the collaboration among individual community colleges and high schools to share and gain access to resources that have been created collaboratively. There also would be considerable time savings by pooling effort in the creation process. In addition, best practices for classroom management of this new technology will also be shared, alleviating frustration after implementing VR technology in lesson plans.

3. Stakeholders impacted by the activity and how they will be served.

The activities benefit multiple stakeholders statewide. High school educators will receive access to open resource VR simulation technology and lesson plans for use in the classroom and VR professional development opportunities through the ESUs. High school educators also will be exposed to VR technology at an annual conference. High school students will be exposed to VR technology in the classroom, at college visits, and in college classrooms. The Nebraska Department of Education will have updated VR technology information for Health Science state standards. Community college instructors and high school educators will have access to a database of existing VR tools that they can use in their classrooms. Lastly, all of the participating community colleges will benefit from and be able to use the VR simulations created through the project, saving time and money, and creating consistent health sciences learning tools for Nebraska.

GOALS AND OBJECTIVES

Goal: Create open resource virtual reality (VR) simulations and related tools that can be used by health sciences programs, both students and educators, at community colleges and high schools statewide.

Objectives

1. Create 6 open resource VR simulations.
2. Incorporate open resource VR simulations into events for high school students (e.g. career days, campus visits, etc.).
3. Collaborate with ESUs to offer VR professional development opportunities to secondary educators, and market open resource VR materials via NDE, ESUs, and at least one conference.
4. Provide educational, hands-on VR technology experiences for secondary educators at HOSA conference.
5. Provide VR technology content to NDE for incorporation into updated Health Science state standards.
6. Coordinate with community college health science instructors and high school health academy teachers to create database of existing VR technology tools.

Activities**Objective 1:**

- a) By Dec. 31 2018, scenarios will be written, and VR technology options will be evaluated.
- b) By June 30, 2019, VR simulations will be coded.
- c) Begin implementation of simulations with students by July 1, 2019.
- d) By Dec. 31, 2019, evaluation of simulations will be complete.

Objective 2:

- a) By Oct. 1, 2019, open resource VR simulations and database will be made available as a station or presentation at career fairs/campus visits/conferences.

Objective 3:

- a) By July 31, 2019, a marketing campaign to ESUs will be conducted to sharing the open resource VR tools/database for educators to use starting in fall 2019 and beyond.
- b) By July 31 2019, a go-live date for web page with VR database and VR simulations will be provided to stakeholders so it can be announced to all Nebraska secondary and community college educators via the NDE listserv, ESUs, and annual HOSA conference.

Objective 4:

- a) In spring 2019 and fall 2019 HOSA conferences, exposure to VR simulations will be provided as an interactive breakout session for students and educators to explore the use of VR for learning in health care.

Objective 5:

- a) By Dec. 31, 2019, VR technology content will be provided to NDE for incorporation into updated Health Science state standards.

Objective 6:

- a) By July 2018, work on the database will begin, and open resource VR tech tools will be continuously added through the course of the grant.

- b) By July 31, 2019, the database will be available to ESUs, high school academies, community college educators, and high school teachers so they can search and utilize the tools based on the course objectives.

Program Detail:

PFI funds will be used to 1) create virtual reality (VR) simulations and related tools that can be used by health sciences programs, both students and educators, at community colleges and high schools statewide; 2) create a database of existing VR tools specific to health sciences that can be used by educators and students at community colleges and high schools; 3) to provide a VR hands-on experience during campus visits with high school students and career days at high schools statewide; 4) to offer VR technology educational sessions at the HOSA conference; 5) to provide VR simulation technology to secondary educators at ESU Professional Development Collaboration Days; 6) to provide VR technology information to the Nebraska Department of Education (NDE) for incorporation into the Health Science state standards; 7) to coordinate with NDE to communicate to high schools about VR technology experiences at community colleges; and 8) to coordinate the creation of lesson plans on VR technology for use by secondary educators in the classroom.

IMPACT ON CAREER AND TECHNICAL EDUCATION

1. Number of students, teachers, and/or partners involved

- About 60 community college health sciences instructors exposed to VR through their programs.
- As many as 70+ high school health sciences teachers would be exposed to VR through ESU professional development events, the HOSA conference, and career college visits.
- As many as 2,000 high school students could benefit from exposure to VR technology in their classrooms, at college visits and at HOSA conference.
- About 1,200 students in health sciences programs at the community college level
- Partners will include all six Nebraska community colleges, Nebraska high schools, ESUs, the Nebraska Department of Education, and HOSA.

2. Impact of the activity on student learning and/or professional growth.

Research shows that when virtual reality simulations are used in the classroom, there is effective student engagement and learning, as well as facilitation of higher-order thinking and problem solving. Through this project, students at the secondary and postsecondary levels will have increased access to VR technology. This not only exposes them to current and expanded use of this technology in educational settings, but it also increases student access in rural areas and levels the educational “playing field” but allowing those from lower socio-economic backgrounds to benefit from exposure to and the use of VR technology.

High school teachers and community college instructors will benefit professionally from access to a collaboratively, and therefore less expensively, created teaching tool that brings innovation and emerging technology into the classroom. They will have opportunities to learn through hands-on experiences how the technology works. The availability of the VR

tools will be free and announced statewide for health science educators across Nebraska to use and incorporate into their lesson plans.

3. **Relevance to the Nebraska Career Field Model, Economic and/or Workforce Development.** The benefits of VR simulation technology in educational settings include knowledge acquisition, collaboration skills, creativity in problem solving, and higher-level reasoning. These teaching tools provide a high-quality and successful educational experience. More students will not only learn the technical skills needed in their chosen health science career through their exposure VR simulation technology, but they will also be better prepared for the collaborative, always evolving environment of real-world jobs. In addition, it can help increase training opportunities for students in health care professions to increase workers in those fields in rural areas.

Statewide Impact:

1. **How will the activity reach secondary and/or postsecondary consortia members?**
Nebraska Department of Education will utilize their communication tools to inform Nebraska high schools about the new VR simulation tools, the VR tool database, and how to access these tools for their classrooms. ESUs also will communicate with high schools about professional development opportunities about VR technology. Community colleges will communicate directly with high school students about VR technology during campus visits and career days. The FHP/HOSA conference will likewise be used to communicate with secondary teachers and students about the new VR technology tools.
2. **Nebraska Career Clusters or Fields addressed.** This project addresses several careers within the Health Sciences career cluster. The project will create six VR simulations pulling from at least four health sciences careers. This serves a dual purpose not only by introducing the technology into the health sciences curriculum but also by recognizing that an interdisciplinary approach better prepares health science students for the work place by providing a more realistic simulation where health professionals from different backgrounds will be interacting with each other.
3. **External stakeholders/partners**
The VR network team will cooperate with NDE to communicate the VR technology tools to high schools and ESUs statewide. Medical centers; HOSA; critical access hospitals, clinics that would hire these students who have participated in VR learning experiences during their education.

Proposed delivery method. Delivery of VR simulations will take place in the classroom, both via face-to-face methods and via distance learning. Some of the tools can be completed outside the classroom, for example on their mobile devices or in labs before or after class times.

EVALUATION

Evidence of the impact based on the project goals and objectives

Goal: Create virtual reality (VR) simulations and related tools that can be used by health sciences programs, both students and educators, at community colleges and high schools statewide.

Objective 1:

- a) By Dec. 31 2018, scenarios will be written, and VR technology options will be evaluated.
- b) By June 30, 2019, VR simulations will be coded.
- c) Begin implementation of simulations with students by July 1, 2019.
- d) By Dec. 31, 2019, evaluation of simulations will be complete.
 - a. Survey of students on how well it supported their learning

Objective 2:

- a) By Oct. 1, 2019, VR simulations and database will be made available as a station or presentation at career fairs/campus visits/conferences.
 - a. Evaluate educators and students in both high schools and community colleges that implemented VR simulations in their lesson plans.
 - i. How easy was it to use?
 - ii. How well did it support your learning
 - iii. Would you recommend it to other educators/students?
 - iv. Did it allow them to provide an experience that otherwise students would not get or provide it in a way that enhanced traditional teaching methods?

Objective 3:

- a) By July 31, 2019, a marketing campaign to ESUs will be conducted to sharing the VR tools/database for educators to use starting in fall 2019 and beyond.
- b) By July 31 2019, a go-live date for web page with VR database and VR simulations will be provided to stakeholders so it can be announced to all Nebraska secondary and community college educators via the NDE listserve, ESUs, and annual HOSA conference.
 - a. Measure hits on the database.
 - b. Conduct web analytics on VR open educational resource (OER) materials.

Objective 4:

- a) In spring 2019 and fall 2019 HOSA conferences, exposure to VR simulations will be provided as an interactive breakout session for students and educators to explore the use of VR for learning in health care.
 - a. Conduct evaluation of students and educators at breakout sessions.

Objective 5:

- a) By Dec. 31, 2019, VR technology content will be provided to NDE for incorporation into updated Health Science state standards.
 - a. Document if VR technology content was incorporated into Health Science state standards.

Objective 6:

- a) By July 2018, work on the database will begin, and VR tech tools will be continuously added through the course of the grant.

- b) By July 31, 2019, the database will be available to ESUs, high school academies, community college educators, and high school teachers so they can search and utilize the tools based on the course objectives.
 - a. Document creation of the database
 - b. Document marketing via NDE listserve, ESU communications with high schools, and conferences.

DISSEMINATION OF KNOWLEDGE:

1. **How the model is replicable and/or sustainable.** The sustainability piece of this project will be built into the regularly scheduled opportunities that already exist to communicate to stakeholders about the existence and benefit of the VR simulations. This includes the annual HOSA conference, career days for high school students, student campus visits, regular communication from NDE to high schools, and professional development opportunities announced by the ESUs.
2. **How responsible parties will report results.**
 - a. Share with project partners – During the last quarter of the project, the project director will provide a summary report to participating community college/high school administrators and other partners for dissemination to appropriate personnel within their institutions. When the project is complete, e-mail and/or standard mail messages will be sent to project partners to alert them to the project outcomes and the availability of the resources created by the project.
 - b. Executive summary for publication in the PFI newsletter and/or state/national education association publications.
 - c. Send two or three staff to present findings at League of Innovation conference and/or Nebraska Career Education conference (summer 2019) and/or International Medical Simulation in Health Care (January 2020).
 - d. Report to the PFI Leadership Council – The Project Coordinator will present the final project outcomes, evaluation, and products to the PFI Leadership Council when their schedule allows.

BUDGET PLAN

Budget Narrative: See attached table

¹ Roy, M.J., Sticha, D.L., Kraus, P.L., and Olsen, D.E. (2006). Simulation and Virtual Reality in Medical Education and Therapy: A Protocol. *CyberPsychology & Behavior* Vol. 9, No. 2:245-247.

² Fowler, Chris (2015). Virtual Reality and Learning: Where is the Pedagogy? *British Journal of Educational Technology* Vol. 46, No. 2:412-422.

³ Duncan, I., Miller, A., and Jiang, S. (2012). A Taxonomy of Virtual World Usage in Education. *British Journal of Educational Technology* Vol. 43, No. 6:949-964.

⁴ Thomas, R.G., et al. (2010). Augmented Reality for Anatomical Education. *Journal of Visual Communication in Medicine* Vol. 33, No. 1:6-15.

PFI 2018-2019 VIRTUAL REALITY GRANT PROPOSAL

Budget	Personnel: Stipends/Pre sender Fees/Substit ute Fees	Supplies	Travel: Lodging, Mileage, Meals	Conference Expenses	In-Kind	Total	Goal/Obj ective/Activ ity
Developer for the creation of the 6 VR simulations. Including web development of EOR site for simulations and database.	\$ 30,000.00					\$ 30,000.00	Goal 1
Project Marketing: Creation and printing of digital and paper flyers to be distributed to high school academies, community college educators, and ESUs.		\$ 1,000.00				\$ 1,000.00	Goal 2, 3, 6, 7
Virtual Reality Equipment for all six community colleges. Selection of VR delivery will dictate equipment selection. \$10,000 equipment allowance X 6 community colleges.		\$ 60,000.00				\$ 60,000.00	Goal 1, 2, 3, 4, 6, 7
Presentation of Project: Conference Registrations: \$2000, Travel: \$1500, Lodging: \$1500. Mileage: \$300			\$ 5,300.00			\$ 5,300.00	Goal 1-7
GRAND TOTAL						\$96,300	