2007 Scholarship of Teaching Grants (STG) Application

Grant Application

Title of STG proposal: A Free-text based Audience Response System to Enhance Team Learning and Group Decision Making

Project Director

Name:	Robert Badgett
Title:	Professor of Medicine
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Collaborators

Name:	Glen Medellin
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Executive Summary

Discuss the educational problem and how your project will address the issue. Please reference the numbers and types of students the project will assist as well as the techniques used to evaluate the project. Be aware that the Executive Summary will be provided to *all* members of the Academic Center for Excellence in Teaching (ACET) Advisory Committee and will be used in the review process. *Please limit your summary to 200 words.*

Technology is becoming increasingly important in clinical teaching and learning. One of us, BB, has developed a free-text, internet-based ARS (UT-ARS) and has piloted its usage in Team Learning (TL) and in Delphi processes. We propose to study implementation of this novel ARS technology.

Team Learning, a proven method to increase student engagement, specifies simultaneous reporting of group answers. To facilitate classroom management, Audience Response Systems (ARS) could be implemented, but existing ARS require forced choice answers and so limit the complexity of group tasks. GM will teach Pediatrics to 200 medical students in sessions randomized to traditional TL vs. UT-ARS in the classroom with laptops. The outcomes will be learner engagement as measured by the validated STROBE and CES tools.

A second use of the UT-ARS is to manage the process of group decision making such as Delphi. Uniquely, the UT-ARS allows group decision making to occur synchronously, across distances. BB will assemble a group of experts to use the Delphi method to identify potential uses of the UT-ARS in group decision making. The experts would use the UT-ARS to manage their own Delphi process.

Total amount of funding requested: $9,886.14

Budget Request

Item *(itemize each below)*	**Funds Requested**
Consumable supplies: Photocopies of STROBE (6 pages each) #16 instruments @$0.3 each Photocopies of Classroom Engagement Survey (CES) (1 page each) #200 questionnaires @$0.05 each Scantrons for CES #200 pages @$0.20 each	$54.80
Equipment: 5 laptops. Dell Latitude 131L. @$1,033.27 each Cart with locking and recharging features. CT-LS30 Cart @$654.99	$5,821.34
Hourly rate services (e.g. software programming): Programmer (Steve Bitant) for ARS 30 hrs @$60/hr Statistician (John Schoolfield) 16 hrs @$45/hr General consultant and member of both developmental groups below (Dr Manwell-Jackson) 6 hrs @$60/hr Heuristic expert (James Barrett) 2hrs @$40/hr Heuristic expert (Dr. Todd Johnson of UT Houston) 2hrs @ $250/hr Delphi group member (Dr. John Littlefield) 3hrs @$60/hr	$4,010.00

Delphi group member (Dr. Laurel Copeland) 3hrs @$60/hr Delphi group member (Dr. Nedal Arar) 3hrs @$60/hr	
Other expenses:	$0.00
TOTAL *(calculated)*	**$9,886.14**

Travel and equipment: Budget requests to support travel for presentations at meetings related to an STG project must be justified in the application. If the grant is funded, travel expenses may not exceed 10% of the total award. If the project budget includes funds for purchasing equipment, the applicant must document that such equipment is not available or accessible at UTHSCSA.

Proposal Review Criteria

Your application is expected to answer each of the six questions below. Please complete each section.

1. Definition of the problem

Define the instructional problem addressed by the project. Indicate how the proposal relates to students' needs, is innovative, and takes advantage of interdisciplinary collaboration. Discuss research literature related to the problem.

The UT-ARS was prototyped in 2006 as BB simultaneously taught evidence-based medicine face to face to a class in San Antonio and via two-way teleconference to students on the Harlingen campus. Each student or team of students goes to an entry page for the ARS and submits their responses to questions or tasks posed by the teacher. The instructor has access to a protected entry page for the ARS and can monitor how many teams have submitted answers. Once all of the answers are received, the instructor reveals them all on the instructor's computer that is projected in the classroom.

The UT-ARS provides a common technological solution to two disparate problems. First in regard to Team Learning, current ARS technology limits teams to reporting answers in a forced choice format. Team-based Learning is an educational strategy that is receiving increased interest in medical education because it can increase student engagement (1). It emphasizes independent study, assessment of individual and group knowledge, and in class group assignments. To foster peer teaching, students work in teams to complete the assignments, and answers are revealed simultaneously to foster group and whole-class discussions. One difficulty in developing team assignments is teams having to report their answers in a forced choice format. Forced choice is currently necessary in order for teams to present their answers simultaneously, but forced choice limits the complexity of the tasks that can be assigned to the teams(2). With forced choice responses, teachers can ask teams to pick answers from a list, but not to synthesize answers from scratch. A unique feature of the UT-ARS is that it allows for the identification of groups entering responses. In traditional ARS, the respondents are usually anonymized to decrease stress of committing to an answer. In TL, group accountability is an important feature since this will foster peer interaction.

An example of a team assignment would be asking groups to write a prescription. This is a complex task requiring calculating dosage, finding dosage strengths and fulfilling all of the requirements of a prescription. From personal experience, students are often able to select a best answer from multiple choice questions, but are unable to write an accurate prescription in practice. Currently in the class of GM, the method to reveal the answer is to write the answers on the white-board, which is cumbersome. With the UT-ARS, each group could write a prescription and posts it online, allowing the instructor to reveal all answers at the same time. This stimulates students to discuss the different answers.

An example that would take further advantage of technology would be teaching Evidence-based Medicine (EBM). The teacher could ask teams to "find a study to support a clinical position and paste the citation into the UT-ARS". Using

the group laptops, the students could access on-line information and then post answers using UT-ARS. This would require high levels of thought as students would have to decide on resources, search techniques and identify best articles.

A recent review of ARS shows the sparse data validating this teaching tool. There is even less data about the use of ARS in groups. Fies and Marshall say that current gaps include “tightly controlled comparisons in which the only difference is the use, or lack of use, of an ARS,” and “the current literature base contains conflicting reports of the efficacy of using CRSs in individual mode versus group mode. Given the emphasis on collaborative work in the National Science Education Standards and elsewhere, the effects of group mode use merit further study.”
Second in regard to group decision making, current methods require the group to meet in person (3,4). In 1968 a Rand publication speculated:
"In the course of a few years, it should be possible to equip each expert with a console through which he could feed his responses into a computer. The computer would process them, compute some measures of the group response, possibly add relevant information from an existing data bank and feed the results back to each respondent".

However, recent Rand publications still use a modified version of the Delphi in which the final round of rankings is done in person (5-7).
Although we believe the ARS will enhance team learning and group decision making, introduction of the ARS may create new barriers. First, computers in the classroom may distract learners (8,9). This distraction may be exacerbated by TL as TL specifies optimal group size of 5-7 randomly assigned learners (10). We suspect this: many learners may either have difficulty sharing one computer, or the group process will fragment if they share more than one computer. Second, use of the ARS could be limited by lack of availability of computer lab space. To avoid these problems, we propose implementation with varying group sizes and with wireless mobile computers – both laptops and PDAs. Using laptops not only allow reporting answers with the ARS, but the laptops can also be used as tools to solve group tasks such as learning information retrieval or usage of electronic medical records.

References
(1) Kelly PA, Haidet P, Schneider V, Searle N, Seidel CL, Richards BF. A comparison of in-class learner engagement across lecture, problem-based learning, and team learning using the STROBE classroom observation tool. Teach.Learn.Med. 2005 Spring;17(2):112-118.
(2) Levine RE, O'Boyle M, Haidet P, Lynn DJ, Stone MM, Wolf DV, et al. Transforming a clinical clerkship with team learning. Teach.Learn.Med. 2004 Summer;16(3):270-275.
(3) Jones J, Hunter D. Consensus methods for medical and health services research. BMJ 1995 Aug 5;311(7001):376-380.
(4) Fink A, Kosecoff J, Chassin M, Brook RH. Consensus methods: characteristics and guidelines for use. Am.J.Public Health 1984 Sep;74(9):979-983.
(5) McGory ML, Shekelle PG, Ko CY. Development of quality indicators for patients undergoing colorectal cancer surgery. J.Natl.Cancer Inst. 2006 Nov 15;98(22):1623-1633.
(6) Shiffman RN, Shekelle P, Overhage JM, Slutsky J, Grimshaw J, Deshpande AM. Standardized reporting of clinical practice guidelines: a proposal from the Conference on Guideline Standardization. Ann.Intern.Med. 2003 Sep 16;139 (6):493-498.
(7) Shekelle PG, Kahan JP, Bernstein SJ, Leape LL, Kamberg CJ, Park RE. The reproducibility of a method to identify the overuse and underuse of medical procedures. N.Engl.J.Med. 1998 Jun 25;338(26):1888-1895.
(8) Guernsey L. When Gadgets Get in the Way. New York Times 2004 August 19, 2004.
(9) Schwartz J. Professors Vie With Web for Class's Attention. New York Times 2003 January 2, 2003.
(10) Michaelsen L, Richards B. Drawing conclusions from the team-learning literature in health-sciences education: a commentary. Teach.Learn.Med. 2005 Winter;17(1):85-88.

2. Design of the project
Describe what is planned, how it will be done, and who will do the work. Specify time lines for the proposed project.

We have already implemented an initial version of the ARS that BB and GM have used in teaching for proof of concept. We will use three of our consultants, James Barrett, Dr. Todd Johnston of UTHSCH, and Dr. Mary Manwell-Jackson who have experience in both web design and educational technology, to help us refine the ARS using established heuristics(1). With the help of the consultants, we will address the instructor's interface with the ARS as well as the learner's interfaces. The user's interfaces are the existing web pages sized for desktop and laptop as well as the smaller page that is sized for PDAs and for internet browser toolbars. The web pages will be designed to display answers generated by teams in team learning, or by individuals in group decision making.

In order to overcome the obstacle of limited computer lab accessibility, we will use laptops in a traditional classroom setting. Using TL, 5 computers should be adequate for class sizes of up to 30. This is a much less expensive model than using a computer lab with 30 computers. In order to minimize technical issues during the study phase, the laptops should be the same model with identical software configurations. We will provide one laptop to each group for classroom use. When not in use, these laptops will be stored in a lockable cart that allows recharge of the batteries. The laptop will be housed in the AIS department to allow collaborative usage when they are not being used for this project.

In order to evaluate the impact of computers on team learning dynamics, classes using traditional TL will be compared to classes using the laptops with Internet access and the UT-ARS. GM already uses TL to teach the pediatric clerkship. All 200 medical students per year rotate through pediatrics in 6 week blocks. Each block includes five 3-hour teaching sessions conducted by GM. For this study, teaching sessions will be randomized to either computer-based or traditional TL. For each block, two sessions will be evaluated using validated tools. This will allow a total of 8 sessions to be evaluated per arm, with all 200 students participating in both arms.

To assess the impact of computers and the UT-ARS on TL, the STROBE Classroom to will be used(2)This is an observational tool that describes the level of student and teacher engagement that has been validated in lecture and TL settings. It will be an objective measure of student distraction and other barriers imposed by computers in the classroom. A trained observer will capture data in six 5-minute cycles during the middle hour of 2 sessions per group. This will provide 240 minutes of observation per study arm. The second measure will be the Classroom Engagement Survey (CES) which measures learner participation and learner enjoyment of the teaching sessions. This is an 8-question student survey which has psychometric data reported from use in the Team Learning Collaborative. It will be administered after 2 sessions per block providing responses from all 200 students in each arm. Finally qualitative data will be gleaned from the end of course evaluations. Students will be asked to comment on TL and their impression of computers in the sessions. Overall satisfaction with team learning will be compared to historical controls.
Lastly, as we have less experience in using the ARS for group decision-making, we will use our consultants Dr. Laurel Copeland, Dr. Nedal Arar, Dr. John Littlefield, and Dr. Mary Manwell-Jackson to use the ARS in an actual group process. The panel has experience in various research methodologies and educational technology. The task of this initial group process will be to identify potential uses of the ARS for group-decision making. The goals of this exercise are to both prioritize potential uses and to gather initial feedback on the ARS in this group decision-making.

References:
(1) Nielsen J. Designing Web Usability: The Practice of Simplicity. Indianapolis, IN: New Riders Press; 1999.
(2) O'Malley KJ, Moran BJ, Haidet P, Seidel CL, Schneider V, Morgan RO, et al. Validation of an observation instrument for measuring student engagement in health professions settings. Eval.Health Prof. 2003 Mar;26(1):86-103.

3. Potential impact

Discuss the effects the proposed changes will have on student learning including the number of students who are likely to be affected.

This project has the potential for significant impact. It will allow the expansion of TL into areas such as EBM without the use of expensive computer labs. The creation of a laptop cart managed by AIS would give the ability to bring technology into the classroom using only a few computers. It would allow for innovation in teaching medium size classes in all disciplines and would also allow better utilization of the existing computer labs for tasks where each

student needs an assigned computer. Another potential usage would be TL using distance learning. This could be particularly useful with groups at the RAHC. The UT-ARS will allow the off-site groups to reveal their answers and to see the answers of the other groups in a more active way.

As we do not know of similar products available, we will investigate intellectual property protection and commercialization of the UT-ARS for both roles. We have submitted Invention Report Form To the UTHSCSA Office of Technology Ventures.

4. Plan for continuation

Priority will be given to activities that will be continued beyond the initial funding period. Grants can be used as seed money to demonstrate the potential impact of the project and attract additional funding.

Further studies would be to look at optimal team size. This study would utilize the recommended team size of 5-7 students per team for TL. Of interest would be comparing teams of 2-3 students to teams of 5-7 students. Computers might change the dynamics of the team such that fewer students are optimal. Also studies of varying the degree of anonymity given the teams or students may guide best use of an ARS(1).

If TL with UT-ARS is found to be useful at maintaining a high level of engagement of students and instructors, the software could be accessed by a student's computer. Furthermore, a PDA interface exists, but is limited by the ability to enter text easily, screen size, and needing wireless access. It would be an option when either the Turning Point ARS devices are not available or when short answer entries are needed.
As noted, we will investigate commercialization of the ARS by entities involved in computer-based education, distance learning, or group decision-making.

References:
(1) Fies C, Marshall J. Classroom Response Systems: A Review of the Literature. Journal of Science Education and Technology 2006 03/20;15(1):101-109.

5. Plan for evaluation

Include a formative evaluation that provides information during the development of the project and a summative evaluation of the project outcomes.

The role of the ARS in TL will be evaluated by a comparative study of sessions conducted by GM. GM teaches clinical pediatrics to groups of 25 students in five sessions over 6 weeks for a total of 200 students per year. He will randomly select one session per 6 week period to continue revealing group answers on a white board versus one session per 6 week period that will use the UT-ARS. We will measure learner engagement with the validated STROBE tool(1) and Classroom Engagement Survey (CES) (2). We project we will have adequate sample size if we have 150-200 minutes of observation per group(3).

The role of the ARS in facilitating group-decision making for will be evaluated by the group of consultants (Dr. Laurel Copeland, Dr. Nedal Arar, Dr. John Littlefield, and Dr. Mary Manwell-Jackson) who will use the ARS for a group process whose goal is to identify potential uses of the ARS and to provide feedback from an initial use of the ARS in a group process.

References:
(1) O'Malley KJ, Moran BJ, Haidet P, Seidel CL, Schneider V, Morgan RO, et al. Validation of an observation instrument for measuring student engagement in health professions settings. Eval.Health Prof. 2003 Mar;26(1):86-103.
(2) Haidet P, Hunt D, Coverdale J. Learning by doing: teaching critical appraisal of randomized trials by performing an in-class randomized trial. Acad.Med. 2002 Nov;77(11):1161.
(3) Kelly PA, Haidet P, Schneider V, Searle N, Seidel CL, Richards BF. A comparison of in-class learner engagement across lecture, problem-based learning, and team learning using the STROBE classroom observation tool.

Teach.Learn.Med. 2005 Spring;17(2):112-118.

6. Plan of Information Dissemination

Include the conference, journal or other peer reviewed source in which the results from the study will be shared with other professionals. **Please note:** Plans for IRB approval will have to be discussed with all members of the project. The intent of the IRB is to foster high ethical standards in the conduct of research and to assure that uniform criteria are applied to protect the human subjects who take part in research. Although IRB approval is NOT necessary when submitting the proposal, IRB approval will be necessary before dissemination of results to peer reviewed outlets.

We will submit abstracts to our professional groups including the Association for Program Directors in Internal Medicine, Society of General Internal Medicine, AAMC group on Group on Information Resources, Council on Medical Student Education in Pediatrics, Pediatric Academic Societies. We will submit to appropriate journals. We will also submit to clearinghouses such as MededPORTAL.

7. Budget/Cost Sharing

Include a justification of the budget so that it is clear why each item requested is essential.

Personnel:
1. Programmer for ARS (Steve Bitant) 30 hrs @$60/hr. The programmer will implement upgrades already identified by the investigators during piloting. These initial upgrades include correcting usability issues such as reducing the footprint of ARS window on the instructor's overhead display so that underlying didactic content is not obscured. He will finish the programming of the Delphi functionality. Lastly, he will implement upgrades prioritized by the two developmental groups below.
2. Statistician (John Schoolfield) 16 hrs @$45/hr. Mr. Schoolfield will analyze the STROBE and CES outcomes for the randomized, controlled trial.
3. General consultant and member of both development groups (Dr Manwell-Jackson) 6 hrs @$60/hr. Dr. Manwell-Jackson is expert in Educational Research and Development. She has extensive experience in web development. In this grant, she is a member of both developmental groups below, is a general consultant and has advised the development of this proposal.

Heuristic Group for ARS interfaces:
1. Heuristic expert (James Barrett) 2hrs @ $40/hr. Mr. Barrett is the UTHSCSA web master and has extensive experience in web design.
2. Heuristic expert (Dr. Todd Johnson) 2hrs @ $250/hr. Dr. Johnson is Associate Dean for Academic Affairs at the School of Health Information Sciences at Houston. Dr. Johnson is expert in cognitive science and human interface design. His experience in user-centered software design is not available from experts at UTHSCSA.

Delphi Group to identify uses of the Delphi functionality and make initial usability comments:
1. Delphi group member (Dr. John Littlefield) 3hrs @$60/hr. Dr. Littlefield is Director of Academic Informatics Services and Educational Research & Development. He is expert in educational technology and research.
2. Delphi group member (Dr. Nedal Arar) 3hrs @$60/hr. Dr. Arar is medical anthropologist and investigator at the VERDICT with extensive experience in qualitative research.
3. Delphi group member (Dr. Laurel Copeland) 3hrs @$60/hr. Dr. Copeland is a Research Health Scientist and VERDICT Investigator with experience in qualitative research.

Consumables
Photocopies of STROBE (6 pages each) 0.3 16
Photocopies of CES (1 page each) 0.05 200
Scantrons for collection of CES scores 0.2 200

Equipment:
5 Latitude 131L laptops @ $1,033.27
Cart with locking and recharging features CT-LS30 Cart @$654.99 1

Cost sharing:
1. The Department of Medicine will provide the web server for the ARS.
2. AIS will maintain the laptops and their cart. These will be shared with other UTHSCSA instructors.
3. The Department of Pediatrics will provide personnel for administration of the STROBE and CES evaluation instruments.

Project Director Biosketch

Submit a NIH biographical sketch of the Project Director below.

Professor/Clinical
eRA COMMONS USER NAME: BADGETT
EDUCATION/TRAINING
INSTITUTION AND LOCATION DEGREE YEAR(s) FIELD OF STUDY
University of Colorado - Denver, CO. Fellowship, 1989-1990. Internal Medicine
Moses Cone Memorial Hospital - Greensboro, NC. 1988-1989. Internal Medicine Chief Residency
Moses Cone Memorial Hospital - Greensboro, NC., USA. 1984-1988. Internal Medicine Residency
Moses Cone Memorial Hospital - Greensboro, NC. 1984-1985. Internal Medicine Internship
University of North Carolina - Chapel Hill, NC. MD 1984 Medicine
University of North Carolina - Chapel Hill, NC. BA 1980 Psychology

A. Positions and Honors.
Positions and Employment
2005 to Present Clinical Professor, University of Texas Health Science Center, San Antonio, TX
2001 to Present Associate Editor for Electronic Publication, Annals of Internal Medicine, Philadelphia, PA
1997 to 2005 Associate Professor, Medicine, Medical School, University of Texas Health Science Center, San Antonio, TX
1991 to 1997 Assistant Professor, Medicine, Medical School, University of Texas Health Science Center, San Antonio, TX
1990 to 1991 Internist, Clinical, People‘s Clinic, Boulder, CO
1989 to 1991 Instructor, Medicine, Medical School, University of Colorado Health Sciences Center, Denver, CO
1988 to 1989 Instructor, Medicine, Medical School, University of North Carolina. Chapel Hill, Chapel Hill, NC
1985 to 1986 Emergency Room Physician, Clinical, Betsy Johnson Memorial Hospital, Dunn, NC

Honors
01/1997 Fellow, American College of Physicians
01/1979 BA with honors
01/1979 Phi Beta Kappa
01/1978 Phi Eta Sigma (psychology undergraduate society)

B. Selected peer-reviewed publications (in chronological order). Do not include publications submitted or in preparation.
Boppana RV, Chalasani S, Badgett RG, Pugh JA. Parallel Architectures for MEDLINE Search Encyclopaedia of Healthcare Information Systems 2007
Badgett RG, Chalasani S, Boppana RV, Pugh JA. Medical Search Engines: Survey and Issues Encyclopaedia of

Healthcare Information Systems 2007
Fenton SH, Badgett RG. A Comparison of Two Online Resources in Information Content Availability Related to Primary Care Questions Journal of the Medical Library Association 2007
Badgett R, Badgett RG. Distinguishing organic and functional dyspepsia by history. JAMA 2006 Sep;296(11):1352-1353.
Wen L, Badgett R, Cornell J, Badgett RG. Number needed to treat: A descriptor for weighing therapeutic options. Am J Health Syst Pharm 2005 Oct;62(19):2031-2036.
Badgett RG, Pugh MJ. Diffusion of Innovations in Service Organizations Milbank Quarterly 2005 Mar;83(1):pend
Badgett RG, Mulrow CD. Using Information Technology To Transfer Knowledge: A Medical Institution Steps Up to the Plate. Ann Int Med 2005 Feb;143:220-2201.
Badgett RG. Dose effects of steroids on survival in sepsis. Ann Intern Med 2004 Dec;141(11):891-892.
Straus SE, Green M, Bell DS, Badgett RG, Davis D, Gerrity M, Ortiz E, Shaneyfelt TM, Whelan C, Mangrulkar R. Evaluation of Evidence-Based Health Care Educational Interventions: Conceptual Framework Brit Med J 2004 Oct;329 (7473):1029-1032.
Badgett RG. The medical professional‘s guide to handheld computing. Ann Intern Med 2004 Feb;140(3):236-236.
Badgett RG. Primary care medicine recommendations for PDA [CD-ROM]. Ann Intern Med 2002 Oct;137(8):706-706.
Badgett RG, Mulrow CD. Welcome, PIER, a new Physicians' Information and Education Resource. Ann Intern Med 2002 Apr;136(7):553-554.

C. Research Projects:
TRX01-091 08/01/2003 -- 12/01/2008
Veterans Affairs Health Services Research and Development
Systematic Review of Organizational Interventions
The purpose of the project is to review the literature in order to identify most effective intervention for 8 chronic illnesses such as diabetes, cancer.
Role:Co-Investigator

VA TRX 01-091 07/01/2003 -- 06/01/2008
VA HSR&D
Systematic Review and Tracking Databases for CPG Implementation Research
A systematic review and tracking database of research on organizational strategies to implement clinical practice guidelines for chronic illnesses
Role:Co-Investigator

N/A 01/01/1998 -- 12/01/1998
AHCPR
Developing a search strategy to identify rare but serious adverse effects of pharmaceuticals
Developed a search strategy to identify rare but serious adverse effects of pharmaceuticals.
Role:Principal Investigator

Approval certification

rgb - By initialing this field, I affirm that my Department Chair has approved this project.