

2005-2006 Learning Technologies Grants Proposal

Project Information

Developing Multimedia-Based Case Training for Small Animal Orthopedic Surgery

Project Title

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Project Director(s)

Department of Small Animal Medicine and Surgery

Department of Educational Psychology and Instructional Technology

Requesting Department(s)

\$12,730

Amount Requested Year 1

\$9,300

Amount Requested Year 2

Project Directors' Signatures

Proposal Endorsement Signatures

Department Head(s)

Dean

Proposal Abstract

Veterinary medicine is a profession, which demands subtle judgment and dynamic decision-making. Helping future veterinarians understand the complex and dynamic nature of veterinary medicine and effectively exercise their judgment based on analytical and reflective thinking is a critical aspect in veterinary education. In this project, we collaborate to develop and implement multimedia-based case training through which prospective veterinarians are exposed to various small animal orthopedic surgery cases and how experts think and react to the cases. This innovative training will enhance prospective veterinarian's reasoning and dynamic decision-making skills and their awareness of multiple perspectives and diverse ways of problem solving.

Developing Multimedia-Based Case Training for Small Animal Orthopedic Surgery

Section I: Project Description

Nature of the innovation

There is a serious gap between classroom learning and real world problem solving in higher education. In everyday college classrooms, we have often observed that many instructors have been focusing on delivering de-contextualized and oversimplified textbook information with limited time and resources. Consequently, instructors of these classes have observed that students were neither engaged in reflective thinking nor deepening their understanding and problem solving skills for the topics taught. The knowledge acquired in these classes seems to remain in the form of inert knowledge that may not be utilized in real world situations (Whitehead, 1929/1967; Spiro et al., 1992; Choi et al., in press).

Veterinary education is not an exception. In a typical veterinary medicine classroom, many instructors have focused on delivering content knowledge (textbook knowledge), and they have waited to teach clinical knowledge until their students are participating with real patients. Students who have just built de-contextualized textbook information cannot activate the knowledge when they try to solve real world problems (Whitehead, 1929/1967; Spiro et al., 1992), and this causes difficulties in making a smooth transition from their classroom knowledge to clinical knowledge. In order to build active/meaningful knowledge, students have to integrate situational knowledge (knowing contextual information, when to use knowledge, how to identify situational cues, etc), strategic knowledge (knowing how to interpret/assess situational cues, how to reason, etc), and content knowledge (knowing general facts, concepts, principles, theories, etc) all together in their classrooms (Bransford et al., 1990; Alexander 1992; Alexander & Judy, 1988).

Thus, the goal of this innovation is to facilitate students integration of the three types of knowledge in the orthopedic surgery classroom and to scaffold students' dynamic decision-making skills in order to bridge gaps between their classroom learning and clinical experience.

The proposed innovation (Multimedia-Based Case Training) applies Internet and video technology to a case-based learning context. This innovation will help prospective veterinarians (a) vicariously experience real world small animal orthopedic surgery problems, (b) understand the complex and context-specific nature of surgical decision-making, (c) apply basic medical knowledge to practices, (d) flexibly learn online and offline, and (f) develop and communicate the rationale for their decision making.

The innovation will be developed based on the following two main instructional design principles (Choi, 2005). The first principle is *learning experience around critical decision-points*. An orthopedic surgery task consists of a set of decisions being made and the actions following the decisions. Some of the decisions, which we are calling critical decisions, are crucial for the success of the task. Orthopedic surgeons are engaged in serious reasoning processes around these critical decision points in order to understand problem situations and then to generate an appropriate course of action based on existing medical knowledge. In order to teach experts' reasoning and decision-making skills along with the basic medical knowledge related to orthopedic surgery, the critical decision points should be major problem units where the learner's attention is focused and where instructional efforts need to be made.

The second principle is *three types of knowledge integration*. In order to build active/meaningful knowledge, as mentioned earlier, students have to integrate situational knowledge, strategic knowledge, and content knowledge all together in their classrooms. Thus, the interface of the innovation should include three main areas that are designed to enhance the three types of knowledge respectively: surgery case videos where students can watch real surgical problems and experts' problem solving performance (situational knowledge), reasoning videos where students can listen how the experts reason and make decisions in order to resolve surgical problems (strategic knowledge; additional methods for scaffolding students' reasoning and decision making will be provided within the innovation), and a dynamic textbook where students can review relevant textbooks information or search for additional information (content knowledge).

This project will be conducted by an orthopedic surgeon (Dr. Aron) who has 30 years teaching and clinical experience and by an instructional technologist (Dr. Choi) who has been developing various case-based e-learning environments and its design models in different domains over the past 10 years.

Need/Rationale

Orthopedic surgery is one of the most time and resource demanding courses. In the junior orthopedic surgery class, each instructor has a week or less to teach a specific type of surgery. Some instructors lead lecture-type class to cover broad content knowledge while some apply a simulated operating room environment where only one simulated case can be taught. During the senior orthopedic surgery class, a group of about six students will shadow one orthopedic surgeon's performance over a three-week period where student's learning is mainly limited by the types and the number of orthopedic cases coming to the hospital.

In the current learning environment, we observed the following four challenges in training our students in orthopedic surgery. First, due to the lack of time and resources, either lecture-style or simulation method in junior orthopedic surgery class has its own limitations. The lecture-style can cover broad content knowledge but it cannot deliver richer situational and strategic knowledge. Alternatively, the simulation method can enhance rich situational and strategic knowledge but not much content knowledge. Second, we observed that students in senior years where they learn through observing real cases experienced difficulties in connecting their basic medical knowledge to clinical problem solving. This is a typical challenge in higher education due to the difference in the nature of problems between classroom problem-solving (well-structured problem solving) and real world problem-solving (ill-structured problem solving). Third, the case that senior students will learn is mainly dependent on the actual cases that the surgeon will take during the period. Due to the limited time, a variety of rich cases cannot be covered during the three-week period. Lastly, it is always a challenge to teach reasoning and decision-making skills beyond the content knowledge in general. The goal of these classes is for the students to diagnose the cases and to plan a course of action while applying basic medical knowledge. However, without explicit scaffolding strategies for reasoning and decision-making, it is not easy for enhancing thinking skills in typical classroom environments.

The proposed innovation (Multimedia-Based Case Training), which will be implemented during and between the current junior and senior orthopedic surgery classes through the Internet as supplementary resources, can help to provide all three types of balanced knowledge, to link gaps between the junior and senior classes, and to enhance students reasoning and decision-making skills through vicarious cases. As such, we can better prepare equipped veterinarians.

Relevance of the project to unit and University priorities

The proposed project corresponds with the University of Georgia's commitment (a land grant university) to the high quality veterinary education and preparation. Veterinary Medicine at UGA has been one of the high demand majors. Providing high quality veterinary medicine training for prospective veterinarians is critical to quality veterinary medical service provided for people in Georgia and other states.

Specific courses benefiting from the project

The instructional resources developed in this project will be directly used for the following orthopedic surgery courses taught by Aron.

- SAMS 5372 Basic Surgical Techniques - 95 junior students per year
- SAMS 5373 Advanced Surgical Techniques - 53 senior students per year
- SAMS 5345 Musculoskeletal Diseases - 66 junior students per year
- SAMS 5430 Orthopedic surgery - senior block of "shadow" (36 seniors per year)

Choi will be also using the innovation developed in this project as an example in his undergraduate and graduate classes, such as EDIT 4160, 4210, 6190, 6200, and 6210, where students learn how to design and develop technology-based educational programs.

Number of students served including undergraduate, graduate/professional or both

A total of about 250 students per year in Veterinary Medicine will be served with the instructional resources. We will share the instructional resources with other instructors who are teaching other clusters of surgery courses. The average number of students who have taken Choi's undergraduate and graduate courses listed above is over 120 per year.

Section II. Budget

Proposed Budget: The First Year

Item	Quantity	Total Cost	Requested from LTG	Provided by Other Sources
Apple Computer, Final Cut, Video camera, and Web site.	1	--		In-Kind Support by OIT, COE
Tablet PC -- 1.86Ghz; 1024 MB; 80G; 14" TFT; DVD+RW; CD-RW.	1	\$2,262	\$2,262	
Tablet PC Software -- Captivate, Nvivo, Studio MX, SPSS	1			In-Kind Support by EPIT
External Hard Disk – 500G	2	\$1,000	\$1,000	
Supplies (CDs, DVDs, Video Tapes)		\$500	\$500	
Design & Production (300 hours) -- 100 hours from EPIT; 50 hours from SAMS; 150 hours from LTG		\$6,000 (300 h)	\$3,000 (150h)	\$2,000 (EPIT) \$1,000(SAMS) (150 h)
Research Lab -- Rm 333 Aderhold		--		In-Kind By EPIT
Faculty Summer Salary (To be released from a summer course)	1	\$6018	\$6018	
Total		\$15,780	\$12,730	\$3,000

Budget Justification Narration: The First Year

Apple Computer, Software, and Website	The Office of Instructional Technology in the College of Education will provide necessary equipment, software, and Website space for digitizing, editing, developing, and implementing online video-based cases for this project.
Tablet PC & software	A tablet PC will be used for developing the Website and testing the usability of the Website (All project directors use Mac computers while actual students use PCs), conducting dynamic interviews and observations during the surgery, classroom and clinical learning settings, and analyzing data for the product and learning outcome evaluation. All necessary software for the PC will be provided by EPIT (Department of Educational Psychology and Instruction Technology).
External Hard Disks	Two external hard disks will be used to manage surgery video clips, interview data, Web site programs and backup files.
Supplies	Digital videotapes, CDs, and DVDs are necessary to save and manage interview data, video clips, and backup files.
Design & Production	Approximately 300 hours of design and development service will be necessary. The service will include videotaping real surgical cases, videotaping expert interviews, editing video clips, developing content, programming database and developing Web site. This is budgeted based on \$20 per hour. The Department Head of Small Animal Medicine and Surgery (Dr. Branson Ritchie) and the Department Head of EPIT (Dr. Randy Kamphaus) have made a commitment to a total of 150 hours in-kind support for this project.
Design & Research Lab	Room 333 in Aderhold hall allocated by EPIT department will be used for conducting this project.
Faculty Summer Salary (To be released from a summer course)	The project directors will be responsible for collecting and analyzing surgical cases, developing course contents, developing the case-based Web resources, developing instructional methods, and implementing and evaluating the effect of the innovation. Choi normally teaches two courses during the summer semester. This will be used to release a Maymester course for him during 2006. The course release time has been approved by the EPIT department head.

Project Timeline: The First Year

Date	Objective	Person(s) Responsible
Oct. – Dec. 05	<ul style="list-style-type: none"> • Previous curriculum analysis • Previous class observation • Case collection and analysis 	Aron & Choi Choi Aron & Choi
Jan. – March 05	<ul style="list-style-type: none"> • Case collection and selection • Curriculum revision 	Aron & Choi Aron & Choi
March – May 06	<ul style="list-style-type: none"> • Video case development • Web-based instruction prototype 	Aron & Choi Choi & Aron
June - July 06	<ul style="list-style-type: none"> • Web-based instruction development • Evaluation Instrument Development • Usability test 	Choi & Aron Choi & Aron Choi & Aron

Proposed Budget: The Second Year

Item	Quantity	Total Cost	Requested from LTG	Provided by Other Sources
Supplies (CDs, DVDs, Tapes)		\$300	\$300	
Design & Production (150 hours) • Adding new cases & revising site		\$3,000	\$3,000	
Faculty Release Time	1	\$6018	\$6018	
Total		\$9,300	\$9,300	0

Budget Justification Narration: The Second Year

Equipment/Software	The same as the first year.
Design & Production Service	Approximately 150 hours of design and production service will be necessary for revising the Web site based on the implementation results. Also, we will develop additional cases.
Supplies	Digital videotapes, CDs, and DVDs are necessary to save and manage interview data, video clips, and backup files.
Faculty Release Time	The project directors will be responsible for implementing and evaluating the effect of the innovation, adding new cases, and revising the Web site and instructional methods based on results. This will be used to release one course for Choi during spring 2007. The course release time has been approved by the EPIT department head.

Project Timeline: The Second Year

Date	Objective	Person(s) Responsible
Aug – Dec. 06	<ul style="list-style-type: none"> Initial implementation Learning outcome analysis/evaluation 	Aron & Choi Choi & Aron
Jan. – June 07	<ul style="list-style-type: none"> Learning outcome analysis/evaluation Revision of the initial Web-based learning environment based on the implementation results Additional case development 	Choi & Aron Choi & Aron Choi & Aron

Section III. Learning Outcomes

Learning Outcomes

The instructional innovation aims to produce the following learning outcomes:

First, improvement of dynamic decision-making abilities: (a) interpreting various situational cues, (b) assessing problem situations, c) generating possible solutions and choosing a solution, (d) generating a course of action, and (e) evaluating the results.

Second, changes in various aspects of epistemological beliefs--ways of knowing: (a) absolute knowing (Knowledge is certain or absolute), (b) transitional knowing (Knowledge is

partially certain or absolute), (c) independent knowing (Knowledge is uncertain, everyone has his/her own belief), and (d) contextual knowing (Knowledge is judged on evidence in context). It is known that the student's epistemological belief is a strong predictor of the success of the real world problem solving ability (Shin et al., 2003).

Method for evaluation

Multiple measures will be applied to evaluate the learning outcomes and the effectiveness of the innovation. The goals and methods of evaluations are tabulated below.

Evaluation	Goal	Instrument/Method
Usability Test	<ul style="list-style-type: none"> The usability of the innovation 	<ul style="list-style-type: none"> Questionnaire Focus group interview Usability observation
Reaction Test	<ul style="list-style-type: none"> Students' perception of the innovation 	<ul style="list-style-type: none"> Questionnaire Interview
Learning Outcome Test	<ul style="list-style-type: none"> Problem solving skills Epistemological beliefs 	<ul style="list-style-type: none"> Open-ended essay problem/Pre- & post-test Interview on the problem solving process Epistemological beliefs inventory/Pre- & post-test

Potential applications in other academic areas

We will develop web-based instructional strategies and resources in order to promote students' situational, strategic, and content knowledge, which will be crucial for real world problem solving and dynamic decision-making. The tools and strategies developed in this project can be applicable to many academic fields producing practitioners, who make deliberate and reflective action in messy, complex contexts. An incomplete list of such fields dealing with dynamic decision-making tasks includes medical science, environmental science, engineering, agricultural science, law, business, and teacher education.

Section IV. Support Plan

The website will be used continuously in a variety of orthopedic surgery courses taught by Aron. Both the project directors will voluntarily maintain and update the website. The required system (Internet server space) will be continuously supported by the College of Education. External funding will be sought by the project directors between 2006 and 2007 in order to expand and make the Web resources available not only for current students in veterinary medicine at UGA, but also for practitioners in this field. We envision making this Website a place for a virtual case library and virtual conferences on surgical cases of teaching among prospective and practicing veterinarians in local, national, and international contexts. Potential funding sources include the U.S. Department of Agriculture (Higher Education Challenge Grant) and the National Science Foundation.