Welcome to IOL 2007!

The University of Texas at Dallas

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Objectives

- To discuss how instructional and research design can support rigorous coursework and evaluation
- To describe how best practices in distance education were influenced by and impacted on traditional course delivery methods
- To disseminate qualitative and quantitative results regarding onsite and online implementation of the enhanced course sections

Form Following Function: Moving Online, Improving Onsite

Abstract: Find out how faculty and designers teamed to develop an online course sequence that enhanced its onsite counterpart. We’ll provide specific examples of how instructional and research design elements supported constructivist pedagogy and rigorous evaluation. Items that fostered the new learning environments include syllabus, instructors, lessons, assignments, assessments, and projects.

Keywords: instructional design, research methods, learning environment
What is unique about research in science education? Research in distance education? What are the near and far-term implications of the need for rigorous instructional and research design to support multidimensional evaluation.

The federal call for scientifically based research in education requires a solid foundation in research practice and process, the tools necessary to “distinguish practices supported by rigorous evidence from those that are not” (Coalition for Evidence-Based Policy, 2003). Supporting that need, the goal of the course of interest was to familiarize students with research in science education. Toward that end, students were expected to appropriately search the current body of literature, critically evaluate relevant research documents, and formulate an independent research plan based on a formal review of literature.

On top of that, concern has been expressed that the academic rigor of courses is compromised in order to facilitate distance delivery (Schoenfeld-Tacher, McConnell & Graham, 2001). Even though there is a growing body of research on the similarities and differences between online and onsite education (Russell, 2006), there also is concern as to the rigor of the design and methodology used to generate these reports. The authors, who designed and delivered the courses, attempt to address these concerns in the development process.

• No Significant Difference Phenomenon > http://www.nosignificantdifference.org/

As part of the comprehensive evaluation of the new program’s design and effectiveness, we examined the first course of the online offering, a required introductory science education research course. The purpose of the course is to give graduate students the tools they need to be able to produce scientifically rigorous evaluations of interventions and published research. It includes examination of selected topics in the methodological and philosophical foundations of science education as applied to contemporary issues affecting today’s students.

Our study specifically compared student achievement, student performance, and student perceptions of onsite and online sections of the course.
What factors influenced our decision to offer the UTD MAT-SE program online?

“In both conventional and distance education, distance is an element. One response to distance is to require the student to travel to the educational institution. An alternative is to enable the course to travel to the student” (Kennedy, 2002, p. 410). To extend the options available to students seeking a graduate degree in science education, a new program strand for completely online and asynchronous delivery was developed with the same learning objectives as the traditional campus-based program that has been offered for over 30 years.

Although the university defines a distance learner in terms of where s/he resides, local students enrolled in the online course for various reasons, including personal health and employment obstacles to campus participation. There were online students from geographically-separate areas, in fact two other countries. It is also important to note that ‘traditional’ study at this university incorporates many features of distance education (i.e., web-based assessment, assignment, and communication options) on a regular basis to facilitate teaching and learning. In this context, ‘onsite’ refers to the traditional campus-based coursework and students. The term ‘online’ is used to describe the completely asynchronous coursework delivered to remote learners in a secure web-based portal.

Like the onsite program, the online curriculum is a thirty-six hour program comprised of 15 hours in science education, 15 hours in science content, and 6 hours of approved electives. (See MAT-SE at uttc.org)

The context of this work supported both the UTD program (i.e. SACS requirements) and the UTTC award (i.e. Principles of Good Practice). These are the ‘means’ that enabled the ‘end’ for us: development of a research course sequence.
Why is this program so important to us – and our future?

Over the program’s 30-year history, the information revolution has changed the world of professional education, offering numerous and valuable benefits to both society and education in general. Immediate access to ever-changing facts and figures has made rote memorization of discrete bits of information obsolete. However, “The complexities and significant qualities of educational life can be made vivid through a method used to describe, interpret and evaluate other cultural forms. The method is one of criticism; in education it can be regarded as educational criticism” (Eisner, 1985, p. 379). Exemplary performance at the graduate level requires evidence of this type of ‘educational connoisseurship’.

The ultimate success of the program itself is evidenced in each graduate’s ability to make judgments based on applications of facts and their ability to incorporate new facts into those applications and judgments when research presents new ideas. In 1970, Thomas Kuhn’s book, *The Structure of Scientific Revolution*, presented a view of scientific research and changes in scientific theory that applied his philosophy to science education and science education research. Scientific revolutions (new paradigms) occur when scientific “achievement [is] sufficiently unprecedented to attract an enduring group of adherents away from competing modes of scientific activity...” and “... sufficiently open-ended to leave all sorts of problems for the redefined group of practitioners to resolve” (p. 10). “... [T]he successive transition from one paradigm to another via revolution is the usual developmental pattern of mature science” (p. 12). “The new paradigm implies a new and more rigid definition of the field” (p. 19). This is what educational researchers experience, as well as scientific researchers. “Led by a new paradigm, scientists adopt new instruments and look in new places” (p. 111).
The theoretical framework that drove the instructional and research designs is founded on the constructivist paradigm and the burgeoning field of learning environments research.

Constructivism may be defined as the ‘co-construction’ of knowledge that develops through student-content, student-student and student-instructor interactions (Summers, Waigandt & Whittaker, 2005). Therefore, designing courses based on constructivist pedagogy may offer the best framework for online learning (Bennett & Green, 2001; Dabbagh, 2000). Viewing constructivism as a referent for science teaching has tremendous potential. Within such a framework, problem solving is used as a learning strategy and cooperative learning is the primary teaching strategy. Research indicates that “as teachers made transitions from objectivist to constructivist oriented thoughts and behaviors their classroom practices changed radically” (Lorsbach & Tobin, 1997, ¶ 17).

“To teach someone any subject adequately, the subject must be embedded in all the elements that give it meaning. People must have a way to relate to the subject in terms of what is personally important” (Caine & Caine, 1994, p. 64). Referring “to the social, physical, psychological, and pedagogical contexts in which learning occurs and which affect student achievement and attitudes” (Fraser, 1998a, p. 3), the field of learning environment research is broad in terms of both substance and methods. Research and evaluation in science education continue to rely heavily on the assessment of academic achievement and other valued learning outcomes. However, such results do not yield a complete picture of the educational process. Therefore, to fully understand the implications of educational reform, it is critical to investigate the determinants and effects of all aspects of the classroom- and school-level learning environments (Nix, 2002).
Good teaching is good teaching.
The PGP that we followed for UTTC course development are every bit as applicable to the onsite courses as they are for the online offerings!

• Partnering with the UTTC: http://www.telecampus.utsystem.edu/index.cfm/4,0,84,74,html

The majority of the presentation will be devoted to showing specific examples of how unique course design elements enhanced both teaching and learning for both online (0T1) and onsite (501) students enrolled in the Fa06/Sp07 research sequence (5305/5308).

These research courses are unlike any other courses our students have taken typically. It’s scary to them for several reasons:

1. These are core courses and they have to make a B or better to be able to graduate.
2. Many of them have never written a formal paper.
3. Most of them have never critically read research of any kind.
4. They have never had to do research that affects human subjects.
Onsite aspects include face-to-face contact in the university setting.

Onsite courses leverage a hybrid design in which students are learning to be researchers as they are doing research. You don’t teach it to them until they need to know it (statistics, reading research, etc.). Emphasizing current issues in science and education, the program goal is to merge educational theory and scientific practice to prepare educators to foster a thorough understanding of concepts and the ability to process knowledge. Graduates at all levels (K-life) in private/public schools, community colleges, universities, business and industry, will be prepared to take the lead in determining the interdisciplinary perspective needed to interpret and manage the diverse requirements of science education, an area of critical importance across Texas and the nation.

• UTD Science/Mathematics Education Program > http://www.utdallas.edu/scimathed/

Cynthia had taught these courses onsite for 20 years. She had recently created hybrid versions (including online lesson outlines when she was out of town, electronic paper review, and gradebook - the basics). So it seemed that putting it completely online would be a snap. Wronggo, NOT. It was hard to imagine that online students might never see me and that she might see them. A lot of the non-verbal communication nuances were not necessarily going to be experienced as in 501.

In addition, just putting up class notes did not communicate the essence of the course. New methods had to be considered to account for the give-and-take interaction that happens face-to-face. Initially the online tools were viewed as options for the students primarily, not as pedagogical techniques that could be leveraged to create that positive learning environment that was enjoyed in the physical classroom. Establishing a personal rapport/respect with students to facilitate individualized feedback was a critical concern.
Online equivalents include materials, class starters, and basic content.

Two sections of the same course were offered in the Fall semester of 2006. Students enrolled for either the onsite class (section 501) or the online class (section 0T1). As the academic standards and expectations for student learning for the electronically offered section were the same as those for the course delivered on campus, these two sections are comparable. The independent variable is the method of delivery: onsite or online. The dependent variables are student achievement, student performance, and student perceptions. To increase the ability to demonstrate cause and effect, extraneous variables were controlled for by design.

The course syllabi were identical in terms of the general course information (i.e., prerequisites, learning outcomes, text, readings, and materials), assignments and academic calendar (i.e., topics and due dates), and course policies (i.e., grading, late work, student conduct, and academic integrity). The same experienced instructor taught both sections within a constructivist framework. The same types of student services were made available for both sections. For example, the library liaison was actively engaged in supporting the work of onsite and online students.

Other aspects of the course offerings were slightly different due to the delivery mode. The onsite section met face-to-face on Thursday evenings from 5:30 – 8:45 pm in a small computer laboratory at the university. The online lessons, made available each Thursday morning, were completely asynchronous and accessible via a secure Internet portal. Research article assignments were reviewed and discussed as a class for the onsite section. The articles, reporting pertinent research in science education, were retrieved digitally, read for content and style, and evaluated with respect to educational research value. The online students completed those same assignments as electronic quizzes (scored as complete or incomplete) in order to provide in-depth and immediate feedback in lieu of class discussion.
Unique online features include animated RAs - and UTTC.

At this point, we'd be remiss if we didn't introduce you to two other folks involved in this course, our research assistants: Tosca and Ralph. When they come to class, be sure to look to them for sage advice. Don't let them fool you though; occasionally, they'll need your advice... and test your judgment!

These pseudo-avatars provide a means for us to call-out key information that would be spontaneously interjected in real-time. For example, in Cynthia’s 20+ years of experience with these courses, she can pretty much predict where students will introduce misconceptions or potentially develop misinterpretations. Ralph and Tosca are in a position to play good cop-bad cop by addressing these issues in a colorful and non-confrontational way. They swap roles to also provide encouragement and support at critical junctures that are often overwhelming or underrated.

We would not have undertaken this project without the expertise and experience of the UT TeleCampus. In addition to providing top-notch student services and technical support, their course production and faculty training resources are a necessary consideration for distance educators. Those essential elements allow us to teach our courses with the same student-centeredness and immediacy of the program’s tradition.

• About UTTC > http://www.telecampus.utsystem.edu/index.cfm/4,0,85,html
Onsite enhancements include scheduling, scoring, and work forms.

Breaking the content into concrete and manageable bits was a challenge! Because we wanted to minimize the technology interface, we linked course functions to a menu that is common across program courses. Because the research courses are so process-oriented, we devised a schedule that stepped the students through their action research projects per the 15-week semesters. This had been implied in the onsite courses, but it was made overt in the online offering. Remember that we’re teaching JIT, so time and keeping up is of the essence. We wanted to make sure our online students were well-positioned to succeed without the casual exchanges that happen among peers in the halls and other classes. The busy onsite students appreciated the checklist format once they realized the magnitude of the workload. The time spent clarifying tasks and due dates was reallocated to higher-level conversations about the projects. For easy reference, each semester’s course schedule is matched directly to the navigation buttons in the course menu. It summarizes key items to be completed and indicates the availability timeframe for each unit. Specific details are provided in each respective area of the course.

Ten textbook reading quizzes were administered electronically on a weekly basis. Students were allowed 30 minutes to complete each quiz in a single attempt. Specific readings were assigned to provide fundamental information on research types, methods, and ethics, and writing genre. A variety of question formats (i.e. multiple choice, true/false, matching, ordering, and fill-in-the-blank) were used to assess student knowledge and application of that knowledge, as well as the ability to evaluate specific case studies. Scores are reported as percentages because of the variable number of items per quiz and response options per item. Questions were based on those suggested for use within the text (Gay, Mills & Airasian, 2006). Developed for the online section, these quizzes were easily incorporated into the hybrid onsite section. With immediate scoring, the content ‘holes’ were identified for all students right then and there – when they were in a learning mode.

To facilitate major assignment submission, we created several work forms. These are simply protected Microsoft Word documents with spaces for students to type in text or select pre-defined responses. As part of our modeling of research practice, they allowed the students to understand exactly what was wanted and in what format. Previously, this material was assigned, but the students really didn’t know exactly the format and specifics that were expected. The form also allowed students to more easily incorporate the information into their papers without the requirements of re-typing and losing the actual references.
Key online and onsite value-adds include RMD Tool production and library integration.

We generated a lot of custom resources. The funding that UTTC provided for this course development enabled us to contract production of a far-improved research method design tool. This complex flash module spans the research course sequence, supporting science education researchers beyond SCE 8398: Thesis.

• Research Method Design Tool > http://www.utdallas.edu/~rnix/RMD_Tool/index.html

Examination of our teaching practice and course design eliminated the urgency for information literacy. Just because you built it, you can’t expect them to come. A significant portion of our course development evolved working closely with the UTD departmental liaison and UTTC digital librarian to integrate information resources into these courses. The library integration also spilled over into 501—our liaison worked with the onsite and the online students heavily.

• Meeting in the Middle presentation, Nix & Barksdale, IOL 2007
Directly compared online with onsite sections in Fa06

Given the homogeneity of the sample in terms of student background and personality traits, the results indicate that both the online and onsite students achieved, performed, and perceived the coursework in similar ways, showing no statistical differences on any of the final measures.

• Full paper submitted to Electronic Journal of Science Education in April 2007 > http://ejse.southwestern.edu/
• No Significant Difference Phenomenon > http://www.nosignificantdifference.org/
Quantitative results can be illuminated further with qualitative anecdotes of performance and satisfaction for students, faculty, staff, administration, and the community.

Don’t be afraid to be creative… if we can use the quiz function to create a powerful assignment, you can too! The designer had to educate instructor on what was possible. Research and ask questions! Nix showed examples of how she did things in her class - but not all designers are instructors and vice versa. So looking at what others have done (best practices) is a huge step. That's the beauty/POWER of events like IOL. Let UTTC - as well as your DE office - help expand your vision. When Ledbetter wanted to use every whiz-bang gizmo in the book, Nix wouldn't let her because it would detract from what she was trying to teach.

- United States Distance Learning Association > http://www.usdla.org

Some things were not possible for various reasons - teaching experience, technological readiness, bang for the effort tradeoff on all sides (student, faculty, design) had to be worth it. Ledbetter knew what she meant when she said something... Nix looked at her and said what the %?#& do you mean? That's a very important part of the process. There was a lot of experimentation between us. It was important that we experienced the technology as an end user before we required it of our students (i.e. library services, interface elements, etc.). Yes, it was frustrating for both of us… but, as the instructors/designers we needed to know where the students were coming from - and how to weight the tradeoff in the overall cost/benefit analysis of the entire course. The form had to match the function – and vice versa.
Thank you! We welcome your comments/suggestions/questions – anytime, anywhere!

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References cited:


