Educational Statistics Authentic Learning CAPSULES: Community Action Projects for Students Utilizing Leadership and E-based Statistics

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Abstract

Since educational statistics is a core or general requirement of all students enrolled in graduate education programs, the need for high quality student engagement and appropriate authentic learning experiences is critical for promoting student interest and student success in the course. Based in authentic learning theory and engagement theory graduate educational statistics CAPSULES (Community Action Projects for Students Utilizing Leadership and E-based Statistics) engage graduate students in service-learning projects involving managing, conducting, and delivering authentic data-driven research. The community action projects utilizing leadership and e-based statistics skills are spearheaded by a university-based Community Outreach Research and Authentic Learning (CORAL) Center. The graduate educational statistics CAPSULES program includes: (1) restructuring educational statistics courses to include real-world active learning and authentic assessment; (2) providing opportunities for graduate students to engage in team-driven quantitative research prior to the thesis or dissertation experience with projects generated from community agencies/educational institutions; and (3) connecting graduate students with community action projects as research managers, leaders, and presenters. Highlights of initial formative and summative student outcomes are presented relative to specific examples of student-directed CAPSULES. Student outcomes from the CAPSULES program indicate positive increases in graduate students' attitudes toward statistics and research, and students' leadership and project management skills.

1. Introduction

Graduate students often postpone their educational statistics courses to the end of their degree program because of their mathematics/statistics fears, anxieties surrounding their lack of knowledge base in statistics, and their feelings of uncertainty regarding the use or applications of statistics (Onwuegbuzie, 2004). Students express general feelings of apprehension and uneasiness concerning the use of educational statistics in applied research. Correspondingly, graduate students reveal feelings of anticipated dread relative to their abilities in using research design and statistical procedures effectively. Students attribute their feelings of uneasiness to the lack of opportunities afforded them in their coursework to perform original applied research. Many of the traditional courses in graduate education programs require students to conduct reviews of previous research, to analyze methodologies of previous research studies, to perform statistical analyses using software only accessible in face-to-face laboratory environments, and to generate hypothetical research questions and hypotheses. These activities only simulate original research and statistics efforts rather than provide a rich authentic research environment. Students must experience ownership in an investigation and discover the excitement and confidence associated with finding solutions to real world problems. The need for high quality student engagement and appropriate relevant authentic-learning experiences using educational statistics is critical for promoting student interest and success. Engaging graduate students in genuine-learning experiences involving the use and application of statistics is one option for approaching the teaching and learning of educational statistics.

2. Conceptual Framework

Two theoretical focus areas frame the conceptual base for the study: (1) Authentic Learning Theory and (2) Engagement Theory. Authentic learning theory is a direct reflection of constructivism whereby learning involves engaging students in real-world problems and projects while encouraging students' questions, drawing on their past experiences, and providing "relevance to their lives both inside and outside the classroom" (Carlson, 2002, para 1). Authentic learning embraces three prominent components: (1) a learner-centered classroom; (2) students as active learners; and (3) real-world experiences (Carlson, 2002). Authenticity in learning allows learners to pursue their own projects of interest and emphasizes autonomy, socialization, and relatedness to their lives.

The importance and framework of tasks within authentic-learning environments in higher education has been the focus of authentic learning researchers (Brown, Collins, and Duguid, 1989; Lebow and Wagner, 1994; Young, 1993; and Herrington, 2005). The faculty of education at the University of Wollongong, Australia (Herrington, 2005) offer a summary of the framework for authentic learning tasks for higher education as the following: (1) "an authentic context that reflects the way the knowledge will be used in real life"; (2) "ill-defined activities which have real-world relevance"; (3) "access to expert performances and the modeling of processes"; (4) "provide the opportunity for students to examine the task from different perspectives, using a variety of resources"; (5) "provide the opportunity to collaborate"; (6) "provide the opportunity to reflect"; (7) "providing opportunities for articulation, i.e. , the tasks need to incorporate inherent opportunities to articulate"; (8) "providing a collaborative learning environment where more able partners can assist with scaffolding and coaching"; and (9) "provide opportunities for students to be effective performers with acquired knowledge"(p. 2).

Engagement theory stems from the basic principle that collaborative teams work on "ambitious projects that are meaningful to someone outside the classroom" and include three activities referred to as "Relate-Create-Donate" (Kearsley and Shneiderman, 1999). Specifically, Kearsley and Shneiderman (1999) emphasize the learning skills that emerge from engagement theory: (1) communicating, planning, managing, and social skills are integral to working in teams (Relate); (2) defining problems and

conducting original projects (Create) are key skills in problem-based learning; and (3) making a useful contribution (Donate) is inherent in service learning. Lebow and Wagner (1994) emphasize projects-based learning strategies in the context of integrating technology within a constructivist environment. Engagement theory is implied by Schuyten & Ferla (2007) who advocate an "evidence-based society" generated by graduate students who will competently "take part in the production, interpretation, and communication of data pertaining to problems they encounter in their professional life (p. 1)".

The infusion of authentic learning theory and engagement theory establishes a framework of constructs for learning that incorporates the true context of real-world problems with sound student engagement for the purpose of promoting meaningful, creative valid learning. The authentic learning Community Action Projects for Students Utilizing Leadership and E-based Statistics (CAPSULES) program embodies the constructs of authentic learning and engagement theory while supporting genuine service to the community.

3. Authentic Capsules Description

Based in authentic learning theory and engagement theory graduate educational statistics CAPSULES engage graduate students in managing, conducting, and delivering real-world data-driven research community action projects utilizing leadership and e-based statistics. The CAPSULES program is spearheaded by a university-based Community Outreach Research and Authentic Learning (CORAL) Center. The CAPSULES program objectives include the following: (1) restructuring educational statistics courses to include authentic active learning and authentic assessment; (2) providing opportunities for graduate students to engage in team-driven quantitative research prior to the thesis or dissertation experience with projects generated from community agencies/educational institutions; and (3) connecting graduate students with community action projects as research managers, leaders, and presenters. In addition CAPSULES consist of the following programmatic and operational considerations: (a) a strong community service-learning component; (b) a powerful student engagement with real-world learning activities; and (c) a rigorous effort addressing authentic student research and statistics opportunities, accessibility, and assessment tasks. Each of these considerations is presented relative to the program objectives and description.

3.1 Restructure of Educational Statistics Courses

Restructuring educational statistics courses to include authentic active learning and authentic assessment requires graduate faculty to move away from the traditional lecture-exam teaching format to include a rigorous effort devoted to addressing genuine student research and statistics opportunities, accessibility, and assessment tasks. Computer laboratories and/or computer access must play an integral role in the CAPSULES program. Graduate faculty must be comfortable with redefining their role as facilitator in a student-centered classroom rather than a faculty-directed classroom. Students serve as active learners in pursuit of rich community-based projects for research and statistical analysis. Faculty members serve as liaisons between the students and the community agencies, facilitators in the learning of educational statistics, and observers of authentic learning activities. These new roles are key changes in the restructuring process.

Student access to appropriate statistical software is another key ingredient in the course restructuring process. Many students do not have access to expensive statistical software and related programs in their home environments. Some students travel great distances to campus to classes that often meet only once a week face-to-face or online e-learning environments. The restructuring of educational statistics courses needs to include accessibility to university-owned sophisticated statistical software and related programs. The use of e-based environments such as e-Desktop whereby students can access university software

programs from their home computer desktops is one solution for providing software access for educational statistics. Additionally, students must have access to each other as project-based teams through face-to-face and e-based environments such as e-Learning platforms. Faculty members must assist in creating these team-based learning environments. The restructuring of educational statistics courses for implementing CAPSULES also requires faculty to restructure assessment practices. Traditional multiple exams using textbook examples or quantitative textbook exercises performed by pencil paper and/or computer-based analyses are inappropriate methods of assessing student learning in the CAPSULES program. Assessment practices in the CAPSULES environment require faculty members and students to generate creative authentic methods for assessing real-world learning tasks, such as peer and community observations, student reflection papers and journals, leadership and management observation checklists, and service-learning observations. Specific assessment examples are presented in a subsequent section of this presentation.

3.2 Student Engagement in Applied Research Prior to the Thesis or Dissertation

Providing opportunities for graduate students to engage in team-driven quantitative research efforts prior to the thesis or dissertation experience with projects generated from community agencies/educational institutions is a primary objective of the CAPSULES program. The Community Outreach Research and Authentic Learning (CORAL) Center is the central service learning station for assisting educational statistics faculty and students in connecting with community agencies and organizations. The CORAL Center serves as the university's service center for matching agencies and organizations with educational statistics faculty to promote community outreach and to provide the legal, ethical, Internal Review Board (IRB) approvals, and practical assistance needed to efficiently conduct the CAPSULES program. In addition, the CORAL Center serves as an educational statistics computer laboratory with graduate assistants and research associates for faculty and students to utilize in their efforts to conduct quality CAPSULES.

Graduate student teams are matched with specific agencies, organizations, or institutions to engage in research projects as the impetus for their learning of educational statistics. Since most graduate students are preparing for masters theses or doctoral dissertations, the need for students to experience applied research projects prior to their own original research projects is a priority consideration for powerful student engagement in authentic learning activities. Student teams are required to conduct meetings face-to-face with their assigned or selected respective community agencies. Teams deliver a written proposal to the educational statistics faculty member of the proposed research project generated from the data and discussions that the student teams and host agencies have developed. Student teams must include in their research proposal the Research Problem, Research Questions, Hypotheses, Methodology, Timeline, Analyses of Data Procedures, and Interpretation/Presentation of Findings Plan. Since CAPSULES are conducted as service learning projects, there are no budget documents generated by the student teams. Also, since only data from existing data retrieval sources within the community agencies are used for the authentic CAPSULES (to preserve time constraints, fidelity of data retrieval methods, and authenticity considerations of the program), project proposals are limited to existing conditions within the specific community agencies involved in the program. However, findings generated by the graduate student teams from their specific research projects often result in recommendations for future studies, suggestions for new methods for conducting data retrieval within an agency or organization, and innovative ideas for agencies concerning operational or programmatic considerations. Graduate student teams are required to develop and deliver their research study results in written reports and power-point presentations to the community agency staff, the CORAL Center director, and their educational statistics class faculty facilitator. The educational statistics faculty member accompanies graduate students to their respective community agencies to observe these presentations and discussions as a key component of authentic assessment of student learning. In addition, the student team members and the community agency are included as contributors in the assessment of the students' authentic learning.

3.3 Graduate Students as Research Managers/Leaders within the Community

Connecting graduate students with community action projects as research managers, leaders, and presenters is instrumental to the CAPSULES program. The CAPSULES approach requires graduate students to become research managers rather than research reviewers. The strong service-learning component of the CAPSULES program necessitates that students be devoted to service to the community, self-directed, and efficient managers of time. The CAPSULES program obligates graduate students to approach tasks as powerful team leaders and followers as appropriate for high quality project collaboration. The CAPSULES program requires leaders who are sound communicators, and energetic presenters. Many of the students enrolled in graduate educational statistics courses are preparing for leadership roles in education such as principals, curriculum directors, program evaluators, and superintendents. The CAPSULES experiences involving project management skills keenly align with those career goals. Graduate students who participate in the CAPSULES program are charged with the responsibility of dissemination of research findings. Designing, directing, delivering, and disseminating are activities of the CAPSULES approach aimed at developing research leaders and managers.

4. Sample Capsules

Two sample student projects from the educational statistics CAPSULES program are summarized relative to their authenticity of learning alignment considerations. Each description represents CAPSULES aimed at specific special needs population focus areas.

4.1 Independent Living for Blind Adolescents and Adults

A graduate student team enrolled in their second graduate level course in educational statistics was matched with a community agency concerned with providing appropriate services to promote independence skills for blind adolescents and adults. Students, accompanied by the educational statistics faculty member, met with the agency director and staff, toured the facility, and discussed the agency mission, history, services, and clients. The agency director then allowed students to preview the types of data and information retrieved by the agency staff as an ongoing part of their operation. Students asked specific questions of the director and lead staff to determine the kinds of information that an applied research study could ascertain for assisting the agency. This initial two-hour meeting established the setting, problem formulation, and research study development phase for the graduate student team.

The student team then scheduled a second meeting with the director/staff of the agency for the data retrieval phase of the project. Students signed confidentiality agreements via the university Community Outreach Research and Authentic Learning (CORAL) Center services prior to meeting the second time with the community agency. The second meeting time consisted of a three-hour data retrieval and variable definitions discussion between the student team and the agency data-records staff. The student team met within the educational statistics class time-period, through email, between class periods, in the CORAL Center computer lab area, online within e-Learning discussion threads and using e-Desktop access to statistical software simultaneously through phone-conferencing. The student team selected a project leader, who directed the team through the multiphase process of the review of related literature, the generation of the problem and hypotheses for investigation, the organization and analysis of the data using appropriate descriptive and inferential statistical procedures, and assisted in the interpretation of findings, the completion of the final report and the development of the power point for the final presentation of the results to the agency.

Throughout this 12-week process, the educational statistics faculty member served as the facilitator and project monitor for the team. Perhaps the most difficult challenge for the team during this multiphase

process was the compilation and organization of the data. The agency data files consisted of 37 types of Microsoft Excel files with multiple and duplicated variables assigned varying types of collection schemes. Files ranged from tic marks for attendance to copious notes from case workers. The team faced the arduous task of determining coding, recoding, organizing, and merging data. This challenge required more time and team member communications than the subsequent data analysis phase.

During the final two weeks of the educational statistics course, the student team scheduled and delivered the results of their research project to the community agency director and staff via a power point presentation and written report. An example of a specific result and recommendation provided by the student team that performed authentic research for the independence for blind adolescents and adults agency is evidenced in the following finding: "Results indicated that blind adolescents (ages 16 to 18) progressed through the computer skills modules used by the agency with greater average speed, higher average cognition, and more in-depth communication of process than any other age grouping within the agency" (Team Report, 2007). Therefore, the student research team recommended that this age grouping (ages 16 to 18) be considered as possible computer mentors for younger and older clients within the center. Additional analyses and recommendations by the student team for the Independent Living for the Blind agency included a descriptive profile of their client base and a set of frequency tables with accompanying bar graphs depicting the services provided by the agency over a three-year period to respond to the agency service goals. Inferential statistical analyses (independent t tests, analysis of variance, and analysis of covariance) were utilized by the team to examine differences in the average impact of services relative to specific demographic characteristics (gender, ethnicity, age, socioeconomic background, and degree of blindness). In addition to the implications suggested by the specific statistical findings, the team recommended a more efficient data retrieval system for the agency. The new data system provides for safeguards to avoid data duplication issues and blends various data files efficiently into one database system.

4.2 Multi-sensory Educational Environments with Special Populations

Several veteran special education professionals enrolled in doctoral education programs formed a student research team within their third level (multivariate) educational statistics course and were matched with a public K-12 school for severely mentally and physically challenged students as their CAPSULES program of study. The school had recently been awarded a new multi-sensory environment center designed to provide many types of services for the school’s population of severely mentally and physically challenged students ages 2 to 22. The student research team met with the school principal and key staff to devise a plan for acquiring data from students regarding the use of the new center.

The graduate student research team was charged with the following tasks: (a) developing an observational instrument for the special population of school students; (b) implementing an observational research study for acquiring data pertinent to the new center usage; (c) pilot testing the observational instrument; (d) performing a construct-validation study of the observational instrument; and (e) conducting reliability analysis and inter-rater observational reliability analysis of the instrument. The student research team met periodically with the K-12 school staff, designed a plan of action, implemented the pilot study of the observation instrument, and conducted the construct validation study of the instrument. The team interacted two to three times per week through e-based and face to face meetings.

One of the challenges the team encountered during the pilot testing of the observational instrument involved a visibility and data recording issue. The team used small observation rooms (formerly school storage closets with observation windows) to observe students in their regular classrooms and within the new multisensory center. The observation room windows had to be covered with dark film and lights and sounds were not allowed in the observation rooms during the observation periods so that the special needs students would not sense the presence of the graduate research observers in the room. The research

team quickly discovered the need for tiny lights attached to clipboards for use in marking observed behaviors. Additionally, the team needed a mechanism for marking observations every two minutes as dictated by the observational instrument requirements. The team acquired headphones with a taped tonal prompt that indicated each two-minute interval. The four-member team practiced in dark locations within the school building to perfect their skills in using the headphones and lighted clipboards as data collection tools.

During the final two weeks of the educational statistics course the student research team delivered a written report and power point presentation of their research efforts to the K-12 school personnel and to the university faculty facilitator. Additionally, the team worked together to submit a paper for presentation to a national educational conference. An example of a specific result and recommendation of this graduate student research team derived from the observational data retrieved by the team is as follows: "Experiences with multi-sensory environments demonstrate increases in the average sustained focus levels of some special student populations" (Team Report, 2006). The research team recommended that other variables such as joint attention and adaptive behaviors be examined statistically through the data retrieved using the observational instrument developed by the team. An outcome of the study relevant to the doctoral students and the university is the decision of one of the doctoral student team members to use the observational instrument developed by the team in a subsequent dissertation study involving special needs students within a different setting.

5. Authentic Assessment

Formative and summative, cognitive and affective, comprise the authentic assessment practices utilized in the CAPSULES program. Hydorn (2007) suggests several areas for assessment that are aligned with service-learning in statistics courses, including the following: (a) academic learning; (b) democratic citizenship learning; (c) diversity learning; (d) political learning; (e) leadership learning; (f) inter- and intra-personal learning; and (g) social learning. The CAPSULES program incorporates two formal quantitative self-assessment instruments, including: statistics self-efficacy (Finney & Schraw, 2003) and leadership learning (http://www.Leadership-tools.com). Colvin and Vos (1997) present six principles for developing an assessment model: (1) Assessment should reflect "important statistics education content"; (2) Assessment should "enhance the learning of statistics"; (3) Assessment should reflect the "development levels of the learners"; (4) Assessment should "include criteria for performance"; (5) Assessment should involve "multiple sources of information"; and (6) Assessment practices should be "open for public scrutiny" (pp 6-7). Schuyten and Ferla (2007) support group project-based authentic assessment in educational statistics learning. The use of interactive presentations based on research performed by graduate students was also documented as an effective means for providing authentic assessment (Ayotte, et. al., 2006). Journal reflection entries maintained by the team members, threaded discussions from the e-Learning postings, email messages, and documented team meeting discussions were accumulated and used for genuine formative assessments of student learning. Pre- and post-assessments related to leadership skills, team-building skills, and statistics self-efficacy levels were retrieved by the educational statistics faculty facilitator for assessing authentic affective learning. Student peers, the faculty facilitator, and community leaders participated in a quantitative and qualitative assessment of the student team final report and presentation using an authentic assessment form generated by the student team. The student team proposals, formative authentic assessment data, pre- and post-authentic affective assessments, summative final reports, and power-point presentations serve as the basis for the assessment of real-world learning from the CAPSULES team and individual efforts. Authentic assessments of graduate students as research managers and leaders within the community are accomplished by student and faculty reflections using a leadership checklist of skills identified with managers. Students report their management leadership skill levels prior to beginning the educational statistics CAPSULES program and again upon completion of the program to determine levels of change in leadership skills as perceived by students and observed by faculty members.

6. Alignment of Capsules with Authenticity

Lombardi and Oblinger (2007) extend earlier descriptions of authentic learning frameworks (Herrington, 2005) by advocating ten design elements for authentic learning environments for 21st century education: (1) "real-world relevance" whereby realistic tasks from professional practitioners are utilized for students to problem solve and to actively examine through investigation and decision-making; (2) "ill-defined problems", that is, authentic activities must be determined by the student rather than a preset algorithm for solving the problem; (3) "sustained investigation" requires students to devote a "significant investment of time and intellectual resources" to the investigation of the problem; (4) "multiple sources and perspectives" requires students to utilize multiple sources, perspectives and to "distinguish relevant from irrelevant information"; (5) "collaboration" implies that students will seek assistance from their peers and others as appropriate for the problem under investigation; (6) "reflection or meta-cognition allows learners to reflect on their learning both individually and as a team"; (7) the "interdisciplinary perspective" encourages "students to adopt diverse roles and to think in interdisciplinary terms"; (8) "integrated assessment" implies that assessment is "woven seamlessly into the major task" rather than solely as a summative measure; (9) "polished products" are the "creation of a whole end product that is valuable in its own right"; and (10) "multiple interpretations and outcomes rather than a single correct answer." Each of these 21st century design elements are evidenced in the authentic learning CAPSULES program: (1) Students focus on real-world community action projects; (2) Students plan and drive the problem solving research activities; (3) Students invest appropriate time and resources in the investigation of the research problem; (4) Students must examine existing data from community agencies to discern relevant and irrelevant information; (5) Students work in research teams and meet periodically with community agencies; (6) Students reflect on their learning both individually and in teams; (7) Students embrace interdisciplinary topics from diverse community organizations and agencies; (8) Students assess the specific steps within the research process and are assessed throughout the research process by means of formative reflective authentic assessment efforts; (9) Students deliver formal research proposals, final research reports, and formal power point presentations; (10) Students produce multiple findings and recommendations for community agencies.

7. Findings and Implications for Educational Statistics

The analysis of qualitative and quantitative evaluation data from the CAPSULES program involved examining changes from pre- and post-assessments with accompanying comments from students who participated in the CAPSULES program. The CAPSULES program provides eight findings for the teaching and learning of graduate educational statistics: (1) Students who have experienced the CAPSULES approach to learning graduate educational statistics reported increases in average leadership skills and statistics self-efficacy; (2) Students who experienced the CAPSULES approach to learning graduate educational statistics reported increased positive attitudes toward using computers and statistical software after completing the course; (3) Students who experienced the CAPSULES approach to learning graduate educational statistics reported positive increases in average attitudes regarding the use of authentic assessments/grading procedures; (4) Students who experienced the CAPSULES approach to learning graduate educational statistics reported high overall mean ratings on the course evaluation form; (5) Students who experienced the CAPSULES approach to learning graduate educational statistics reported high mean ratings regarding the usefulness of the course in preparing for the thesis or dissertation; (6) Students who have experienced the CAPSULES approach to learning graduate educational statistics rate the usefulness and relevancy of the course high; (7) Students who have experienced the CAPSULES approach to learning graduate educational statistics indicate high mean ratings regarding real-world applications of research and statistics; and (8) Students who have experienced the CAPSULES approach to learning graduate educational statistics report high mean ratings regarding student engagement and team collaboration efforts.

Implications of these findings for the teaching and learning of graduate educational statistics provides several key programmatic and operational considerations for encouraging graduate students toward a positive experience in educational statistics: (a) Including authentic learning components of real-world applications; team projects; student-centered and student-directed activities; problem-solving applications with multiple approaches and multiple answers; continuous-assessment procedures; hands-on data analysis, interpretation, and decision-making experiences; and creative summative-whole products are demonstrated successful strategies for the teaching and learning of graduate educational statistics; (b) Developing community partnerships as exemplified by the CAPSULES program with agencies, institutions, and organizations for the purpose of providing real-world settings for applied research and statistics create a natural service-learning and community service environment for educational statistics programs; and (c) Empowering students with authentic learning skills of collaboration, reflection, self-direction, exploration, investigation, production, interpretation, integration, evaluation, socialization, adaptation, and real-world problem solving aligns with the skills advocated for 21st century learning (Lombardi and Oblinger, 2007).

8. Future Capsules Perspectives

Future implications and perspectives of using authentic learning CAPSULES in the teaching and learning of educational statistics may be substantially influenced by the rapid technological changes that have become an integral part of higher education. As more students elect online or distance learning courses and instructional environments move away from traditional face-to-face classes, the need intensifies for students to effectively and efficiently direct their own learning, to pursue real-world opportunities and challenges, to reflect and assess their own learning, to confidently use computers and software for problem-solving and conducting research, and to partner with the community in service and learning. Future implications and perspectives of authentic learning CAPSULES may involve graduate students developing their own connections and partnerships with the community for the purpose of conducting real-world applied research studies in preparation for their own theses and dissertations. Future advanced technology influences will also require students to drive their own learning of statistical operations within genuine e-based environments. Faculty members serving as e-based facilitators will assume the functions of monitoring and facilitating virtual communities as posited by Maharg (2002). The findings also have implications for student learning and diversity. Miliszewska & Horwood (2004) extend the technological and distance education issues to include cultural contexts. Positive cultural influences are indicators of sound engagement theory and authentic learning theory experiences. Perhaps these technology-influenced changes in teaching and learning will provide students with the essential authentic learning skills for appropriately connecting to global communities and for effectively competing in e-based environments for optimum authentic research.

References

Ayotte, A. et al. (2006). Authentic interactive presentations in a graduate education research class. *Journal of Authentic Learning.* 3(1), 27-47.

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher,* 18(1), 32-41.

Carlson, A. (2002), *Authentic Learning: What Does It Really Mean?* Retrieved from Western Washington University Innovative Teaching Showcase September 5, 2006 from http://pandora.cii.wwwu.edu/showcase2001/authentic_learning.htm

Colvin, S. and Vos, K. (1997). Authentic assessment models for statistics education. In I Gal & J. B. Garfield (Eds.), *The assessment challenge in statistics education* (pp. 27-36). Washington, D. C. , MD: IOS Press on behalf of the International Statistical Institute.

Faculty of Education. (2005). *Authentic task design: Framework*. Retrieved March 19, 2008, from the University of Wollongong, Australia, website: http://www.authentictasks.uow.edu.au/framework.html

Finney, S. J. & Schraw, G. (2003). Statistics self-efficacy scale. *Contemporary Educational Psychology*, 28, 161-186.

Herrington, J. (2005). *Authentic e-learning in higher education: Design principles for authentic learning environments and tasks.* Retrieved March 10, 2008, from the University of Wollongong Web site: http://edserver2.uow.edu.au/~janh/Elearn/Site/Authentic%.

Hydorn, D. B. (2007). Community service-learning in statistics: Course design and assessment. *Journal of Statistics Education*, 15(2), Retrieved March 1, 2008, from http://www.amstat.org/publications/jse/v15n2/hydorn.html

Kearsley, G. & Shneiderman, B. (1999). *Engagement Theory: A Framework for Technology-based Teaching and Learning.* Retrieved September 5, 2006 from http://home.sprynet.com~gkearsley/engage.htm

Lebow, D., & Wagner, W. (1994). Authentic activity as a model for appropriate learning activity: Implications for emerging instructional technologies. *Canadian Journal of Educational Communication*, 23(3), 231-244.

Lombardi, M. & Oblinger, D. (2007). *Authentic Learning for the 21st century: An Overview.* Retrieved June 20, 2007 from http://www.educause.edu/ir/library/pdf/ELI3009.pdf

Maharg, P. (2002, July). *Authentic learning: Transactions in virtual communities.* Paper presented at the Sub Tech Conference. Retrieved February 18, 2008, from http://zeugma.typepad.com/Publications/SubTech%20Conference%

Miliszewska, I. & Horwood, J. (2004). Engagement theory: A framework for supporting cultural differences in transnational education. Retrieved March 20, 2008, from http://www.herdsa.org.au/conferences2004/Contributions/RPapers/PO16-jt.pdf

Onwuegbuzie, A. (2004, February). Academic procrastination and statistics anxiety. *Assessment & Evaluation in Higher Education*, 29(1), 3-19.

Schuyten, G. & Ferla, J. (2007). Can authentic assessment help in delivering competent consumers of statistics for non-academic professions? *International Association for Statistical Education/International Statistical Institute.*

Team Report. (2006). *Research Report for Escambia Westgate School.* Unpublished manuscript, University of West Florida, Pensacola, Florida.

Team Report. (2007). *Research report for Independent Living for the Blind*. Unpublished manuscript, University of West Florida, Pensacola, Florida.

Young, M. F. (1993). Instructional design for situated learning. *Educational Technology Research and Development*, 41(1), 43-58.

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