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Lee Stadtlander
Walden University, leann.stadtlander@waldenu.edu

Martha Giles
Walden University, martha.giles@mail.waldenu.edu

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Lee Stadtlander
Walden University

Martha Giles
Walden University

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Graduate Student Researchers' Knowledge/Efficacy: Results from a Virtual Lab

Lee M. Stadtlander
Coordinator, Health Psychology Program
Walden University

Martha J. Giles
Psychology Faculty
Walden University

Amy E. Sickel
Coordinator, Educational, General, and Social Psychology Doctoral Programs
Walden University

Background

One of the main indicators of a university's reputation is faculty publication rate (Sweitzer & Volkwein, 2009). In the social sciences, publications typically result from laboratory based research projects. However, in an online teaching environment, it has been difficult for faculty to do research and publish without the laboratory facilities and student research assistants that are available in a traditional land based school. Similarly, a key element of graduate training is the in-depth intellectual mentoring, particularly in research training. Research mentoring benefits students through the development of professional skills, increased confidence and self-efficacy (Love, Bahner, Jones & Nilsson, 2007), dissertation success, reported satisfaction of the doctoral program in which the student was enrolled (Clark, Harden & Johnson, 2000), and improved career potential (Demaray, Carlson, & Hodgson, 2003).

In contrast to undergraduate education, where learning occurs primarily in the classroom, the production of scholars at the graduate level occurs primarily through the process of mentoring (Forehand, 2008). There has been concern as to the ability of faculty to mentor students in an online environment (Belar, 2006) for the same reasons online faculty have difficulty in conducting research: a lack of laboratories and student opportunities to assist in research.

There is a very small literature on virtual or online research laboratories in graduate education, with existing research typically discussing the use of shared remote equipment. For example, González-Castaño et al. (2001) designed an internet access laboratory that provided remote access to equipment used in a Computer Architecture laboratory. However, there were no descriptions of methodological based virtual research labs in the literature until Stadtlander and Giles' (2010) article.

Stadtlander and Giles (2010) showed the feasibility of an online qualitative research laboratory classroom in which nationally diverse data were collected in a one-quarter (3 month) period. The authors were interested in students' attitudes toward working in an online lab, and gathered qualitative data showing that students enjoyed the experience. However, they were not confident that the students gained research skills or improved their confidence (self-efficacy) in the research process as has been reported in land based research labs (Love et al., 2007). The current study addressed this issue.

This Study

There are challenges specific to teaching an online lab. For example, training students with methodology is difficult; monitoring their protocol compliance requires extensive communication and considerable trial and error. Each student's skills must be evaluated and remediated online. Similar to land based labs,

personality issues can arise between students and between student and faculty, which must be carefully and judiciously handled with the added complication of the online environment.

In the current study, doctoral students were recruited to conduct a mixed method study, analyze the data, and write an article on the project in a one-credit lab on eCollege. Students were asked to commit to working on the project for three quarters (9 months) and agreed to each conduct four one-hour interviews and administer quantitative surveys. Each student completed two measures at the beginning of each quarter and at the end of the project so that we could evaluate learning, research skills, and self-efficacy over the entire three quarter period. Students were also asked to submit a brief reflection journal each week, discussing their impressions and opinions on the experience.

The mixed methods project that the students worked on is a continuation of Stadtlander and Giles' (2008) qualitative study on the elderly. Few studies have examined how people over 85 years (oldest old) interact with their physicians. There is evidence that suggests that the oldest old have fewer physician visits than younger individuals (Linden et al., 1997; Nie et al., 2008). Surveys have provided conflicting results (e.g., Kong et al., 2007; Lee & Kasper, 1998), suggesting that fewer visits may be a result of less mobility or dissatisfaction with their care. The students conducted a one-hour qualitative interview in which the individual was prompted to examine their thoughts and opinions on their health care and physicians. The quantitative portion included a number of survey instruments to examine participants' current health, health care history and health efficacy.

Method

The present study involved the design of an online research lab in which Walden University doctoral psychology students participated. The intent of the lab was twofold: 1) to measure change in the 10 student participants' research skills and self-efficacy through a quantitative methodology, and 2) for students to conduct the mixed methods study detailed previously. Applicants were recruited through Walden student list servs, and were asked to complete an application. Qualified students were chosen based upon an interest in gerontology and geographical location to ensure a nationally representative sample for the primary study.

A possible confound was that students may increase their research skills and self-efficacy through their education without the lab opportunity, therefore, a control group was used. Ten additional students were chosen from the qualified applicants (matched with lab students to be at similar milestone, e.g., writing dissertation) to be controls for the study. All 20 students (10 lab students and 10 controls) took the measures of research skills/ self-efficacy at the same four times.

Measures: The *Research Outcomes Scale* was used (Bieschke& Bishop, 1994). This is a 20 item instrument that measures self-efficacy in research related tasks. A *Research Knowledge/Skills* test was developed by the authors consisting of 34 research skills necessary in the study. Participants rated their capability to do each skill

Ethical issues: IRB approval was received for both the students' elderly project and for the lab study. Students signed consents before they committed to participate in the study, as did individuals in the elderly study. Transcriptionist and student researchers signed confidentiality agreements.

Results

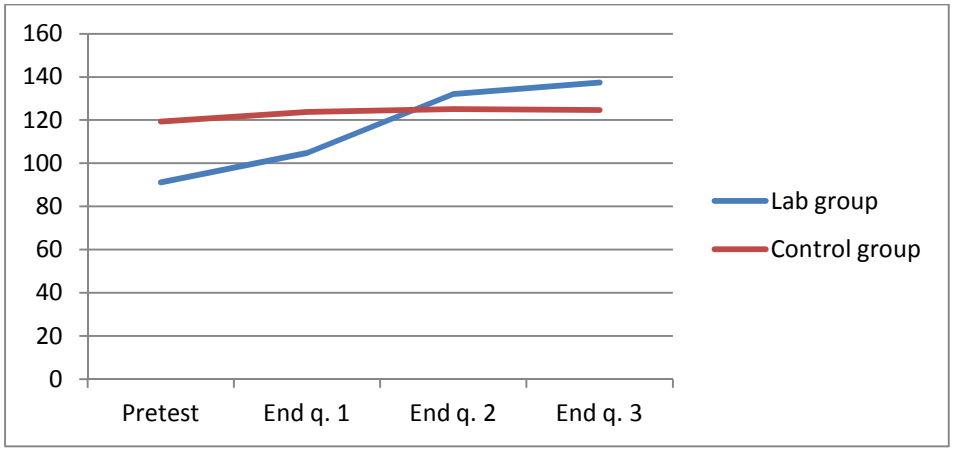
For the research knowledge test, a repeated measures ANOVA was conducted for the total score across all 4 time periods. As shown in Table 1, there was a significant effect of time ($F(1, 14) = 20.06$, $p < .001$), thus the means for each of the 4 time periods were significantly different. There was not an effect of

condition (p> .05) As shown in Figure 1, there was an interaction effect ($F(1, 14) = 13.25$, $p < .01$), whereby the lab group showed a greater knowledge gain over the 4 periods as compared to the control group.

Table 1. Research Knowledge Test Scores for Lab and Control Students

	Pretest	End Quarter 1	End Quarter 2	End Quarter 3	Means
Lab Group	91.25	104.88	132.13	137.38	116.4
Control Group	119.38	123.75	125.13	124.63	123.22
Means	105.3	114.32	128.63	131.0	

Figure 1. Research Knowledge Test Scores Interaction Effect for Lab and Control Students



For the research efficacy (confidence) test, a repeated measures ANOVA was conducted for the total score across all 4 time periods. As shown in Table 2, there was a significant effect of time ($F(1, 14) = 10.2$, $p < .01$), thus the means for each of the 4 time periods were significantly different. There was also an effect of condition ($F(1, 14) = 6.3$, $p< .05$) in which the mean for the lab students was higher than the control group. There was no interaction effect ($p > .10$).

Table 2. Research Efficacy Test Scores for Lab and Control Students

	Pretest	End Quarter 1	End Quarter 2	End Quarter 3	Means
Lab Group	71.3	73.6	76.38	76.88	73.78
Control Group	69.1	69.4	68.63	70.25	68.47
Means	68.38	70.06	72.5	73.56	

Discussion

Being in the lab significantly improved the students' knowledge about research and their confidence in the research process over students matched to be at the same points in their program, but did not take the lab. Lab students improved as the project progressed (particularly when they were analyzing the data in the 2nd quarter - 3rd testing time).

Students showed individual growth and self-learning. Many reported appreciating the shared experience of working and learning in a group with a common goal. It was a common experience to report that while they had studied and applied concepts and skills in a classroom setting, the application of those skills in a

research setting was more complex. For example, everyone had taken statistics courses, but the application with a real data set was more difficult than expected for the students.

Logistical Issues

We discovered in our previous lab study that there are a number of new teaching and research skills that must be learned by faculty members when supervising online labs. For example, there is currently no way for a new lab supervisor to know and learn the skills that will be required until they are in the midst of teaching the lab. In an effort toward future development of training modules for faculty, as well as for student interest, instructors maintained an online blog of their experiences: http://transparentpsylab.blogspot.com/.

We used a stripped course shell for the lab, which required that the instructor(s) develop their own syllabus and set up the course and grade book. We have found that having multiple instructors is essential, particularly when recordings must be reviewed for a qualitative / mixed method project. Administration support for faculty is needed through course buyout, workload adjustments, and tech support. We have found that supportive technology is useful, such as the use of GoToMeeting software, making a blog, and using yousendit.com for large data and recording files.

It is important to be clear to students on expectations, ownership of data and potential author status on papers (we included this information in the student application). Instructors should be mentors to the lab students by having regular lab conference calls, assessing students' skills and providing needed training. It is also important for instructors to be flexible in both their own and students' expectations and be mindful of group dynamics: strong student personalities may have a negative impact on the research and class interactions.

We have demonstrated that faculty mentoring in an online lab environment effectively improves student research knowledge and increases student research efficacy, while providing faculty the opportunity to collect national data in a short period of time. This enhances social change as students have become better, as well as, more confident researchers. In turn, this can lead to a positive impact on the quality of future research conducted by them thus strengthening the overall fabric of academic literature.

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AUTHOR SUMMARY

Lee M. Stadtlander is both an experimental psychologist (Ohio State University) and a clinical health psychologist (Fielding University) with interests crossing both fields. She was a professor at Montana State University for 11 years and has been a faculty member at Walden University since 2005; she became the Health Psychology Program Coordinator for Walden in 2009.

Address: 25 Morgan Creek Lane
Bozeman, MT 59718
Email: leann.stadtlander@waldenu.edu
Phone: 406-581-9653
Fax: 855-505-4173

Martha J. Giles is a licensed psychologist (MA) in Minnesota and holds a PhD in Academic Psychology from Walden University. She has been full time faculty at Walden University since 2004 in the School of Psychology. She consults for several Not for Profit agencies, both in the US and Tanzania.

Address: 17682 Kettering Trail
Lakeville, MN 55044
Email: martha.giles@waldenu.edu
Phone: 952-898-3418

Amy E. Sickel is a social psychologist (George Washington University) with research interests crossing social and health domains. She has been with Walden University since 2005 (part time) and became full-time as the Coordinator for the Educational, General, and Social Psychology specializations in 2008.

Address: 1231 Derbyshire Road
Potomac, MD 20854
Email: amy.sickel@waldenu.edu
Phone: 410.818.6214
Fax: 301.251.0376