Lessons Learned in a Virtual Team: An Integrative Model for Graduate Student Research Skill Development

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Value-added learning dimensions resulting from the use of an integrative model for graduate student research skill development are shared by two student researchers, who used virtual teaming in a 10-week online statistics summer course. The researchers collected original data and conducted quantitative and qualitative research. The problems associated with distance education are analyzed. Serendipitous outcomes of this experience and implications from the perspectives of the graduate student researchers and their academic program advisor are discussed.

Keywords: Virtual Teaming, Distance Education, Research Skill Development

This paper presents an investigation into and integration of recent literature on virtual teams, graduate student research, and distance education. To explore empirically the challenges associated with virtual teaming in a graduate-level distance education course, the researchers report on a project completed during a graduate-level statistics course in which the virtual team members: (a) were separated by location, (b) were challenged by a common collaborative project, and (c) used both asynchronous and synchronous communication media.

The statistics course was conducted during a 10-week summer session. This course was the first distance education course attempted by the instructor and the first distance course completed by the researchers. The instructor had taught the course before, but only in the traditional face-to-face format.

The course had synchronous and asynchronous learning activities. The synchronous learning activities were a series of lectures and presentations by the instructor and synchronous analyses and discussions conducted in electronic classrooms through the use of Centra technology. The asynchronous learning activities included small-group homework assignments and the option to form a collaborative team for the large research project.

Each class session typically consisted of a lecture by the instructor coupled with discussion between the students and the instructor. For example, the instructor used presentation visuals simultaneously transmitted to all students to complement the audio presence. During discussion, the instructor and students interacted orally and in writing using Centra technology.

Problem Statement

Given the apprehension commonly associated with statistics and with distance education in general, the problem statement was:

How might the use of virtual teaming in online graduate statistics facilitate an integrative research experience?

The purpose of this research was to determine how virtual teaming in online graduate statistics facilitated an integrative research experience.

Terminology

The following terms were operationally defined for use with this study:

Collaborative learning: The grouping and pairing of students for the purpose of achieving an academic goal.

Distance/online education: The delivery of educational opportunities via computer technologies to remote locations both on- and off-campus.

Research skills: The ability to investigate carefully and systematically some field of knowledge, undertaken to discover or establish facts or principles.

Statistics: The calculation, description, manipulation, and interpretation of facts or data.
Value-added learning dimension: Learning that goes beyond the standard requirements and allows for greater skill development, which contributes to a competitive learning advantage.
Virtual team: A collaboration of students who are an intact social unit embedded in one or more social systems in which the members of the team are geographically separated and must rely on technology-based communications to accomplish their tasks (Gibson & Cohen, 2003), little or no face-to-face interaction occurs.

Theoretical Framework/Literature Review

The review of literature is presented so that the reader may gain insight into the main topics and variables considered in this study. It provides a summary of distance education's history, documents the problems associated with this type of education, and explores, through the use of virtual teams, ways to help students develop the skills and competencies needed to be successful in distance education.

Most research on virtual teaming has focused on the development of team effectiveness. Little attention has been given to the development of the individual team members or the human capital they bring to the team. Human capital simply refers to the value that people bring to their work in the form of knowledge and skills (Lipnack & Stamps, 2000) as well as their economic and spiritual value (Fitz-enz, 2000). Virtual teams, such as the one used for this project, increase human capital through acquiring or developing new competencies (Lipnack & Stamps, 2000). From a human capital development perspective, when individuals are given integrative opportunities to perform, they generally exceed expectations.

Technology-savvy graduate students search for a new kind of college experience and expect educational systems to provide learning that is not time- or place-bound because the students, themselves, are bound by their homes, families, and jobs. Due to responsibilities in their lives, these adults cannot relocate to the site of an educational institution, and work responsibilities, particularly for those who work odd schedules or travel frequently, preclude regular class attendance. According to Manzo (1997) more and more adults seek opportunities to advance their education at home. However, many of them do not live within commuting distance of a college or university. Gibson and Graff (1992) found that 77% of the students lived over 51 miles from a college campus, with the majority living between 101 and 200 miles from a college campus. All over the world, colleges and universities are meeting the needs of such students by offering educational degree programs that allowed them to work at home or at work. This type of education has been dubbed distance education.

The longstanding literature on distance education has documented problems associated with its practice. One problem, which has received considerable attention in the literature, is the low quality of learning attainment (Abrami & Bures, 1996). A variety of causes has been attributed to this problem: (a) feelings of isolation (Bullen, 1998), (b) lack of two- and three-way communication (Dede, 1996), and (c) difficulties associated with self-regulation of learning (Zimmerman, 2002). While these causes have been investigated as isolated incidents, it is likely that all of them have led to the problems observed in traditional distance education practice.

Recent research points to collaborative online learning as a method of achieving success and minimizing many causes of distance education problems. Dede (1996) claimed that collaborative online learning aids in the acquisition of complex and higher-level concepts and skills that have been a weakness of traditional non-interactive distance education. Slaven (1990) recommended using collaborative learning to direct student-to-student interactions and minimize both off-task and passive behavior while providing a community environment online. Collaborative learning should include sharing of learning tasks; combining expertise, knowledge, and skills to improve the quality of the learning process; and building or consolidating a learning community. Virtual teams represent a prime means of achieving collaborative learning in distance education environments.

In virtual teams, students structure learning by establishing goals and objectives for activities, organizing and assigning tasks and roles, creating timelines, and attaining group consensus. They use groupware--electronic systems that integrate software and hardware--to enable communication and collaborative work (Khoshafian & Buckwitz, 1995). Some environments use synchronous groupware (those that enable team members to interact at the same time) while other environments use asynchronous groupware (those that facilitate delayed interaction) (Coleman, 1997).

Effectively designed, implemented, and managed virtual teams facilitate better outcomes than an individual could achieve alone. Using the framework developed by Schwarz (1994), it is easy to recognize the important role that team structure (that is, the clarity of group goals, tasks, and roles of team members) plays in determining team effectiveness. Team structure refers to the extent to which team members understand and are committed to team goals, as well as the extent to which their roles on the team are clearly defined (Schwartz, 1994). Clarity and commitment to group goals and clearly defined roles not only enhance satisfaction within the team, they underline

the importance of team structure for effective student team functioning (Vancouver, Millsap, & Peters, 1994; Stevens & Campion, 1994).

Certain elements, such as trust and respect, are important in the establishment of healthy learner-learner relationships (Kanuka, Collett, & Caswell, 2002). In a virtual community, trust and respect are crucial and can be challenged by the lack of face-to-face interaction. Communication processes are the key underlying mechanisms for establishing trust (Gibson & Cohen, 2003). Through communication, virtual teams create cooperative relationships, receive insightful information about the personalities of team members, and develop common values.

Most distance education systems geographically isolate learners from the teacher and from their fellow students (Rangecroft, 1998). Keegan (1986) purported that the separation of student and teacher imposed by distance removes a vital "link" of communication between these two parties. The link can be restored through the open and prompt communication of a virtual team. With advanced technologies, the concept of community can be applied to formally structured classroom settings in distance education by taking on the issue of how best to design and conduct online programs that fosters social interactions among learners who are physically separated from each other (Rovai, 2002).

Using electronic media in distance learning can inadvertently exclude students who lack computing or writing skills. They may not have access to reliable computers. Students may need assistance developing study survival skills or obtaining study materials and technical assistance. The frustrations resulting from technical problems can affect motivation directly (Goel, 2002). Relationships and communication through virtual teaming provide support for all students.

Research Questions

In an attempt to put in perspective what they had experienced and to maximize their lessons learned from virtually teaming to study graduate-level statistics, the researchers purposed the following research questions.

1. What skill development was targeted in the statistics course taken by the researchers in summer 2003?
2. What was the nature of virtual teaming used in conjunction with the statistics course taken by the researchers in summer 2003?
3. What preliminary decision-making launched the generation of value-adding learning dimensions and effects experienced by the researchers in summer 2003?
4. What were the integrative components of the research experience acquired by the researchers in summer 2003?
5. What were the serendipitous outcomes that occurred after the statistics course was finished?

Methodology

A qualitative design was used for researching the transcendent outcomes of a quantitative research project conducted in conjunction with a compressed 10-week summer school graduate statistics course. Two graduate student researchers (one master's level and one doctoral level) enrolled in an online statistics course; both were unaware of the other's participation in the course until the first day of class. The professor assigned homework and a cumulative project that could be completed either individually or as part of a team, but teamwork was not a requirement. The researchers decided to collaborate as a virtual team for the homework and the project based on similar research agendas that had been disclosed previously through other courses and discussed in a research community established by their mutual academic program advisor.

The quantitative research project involved preparing a research proposal that was due shortly before the project report. The proposal requirements included (a) a descriptive title, (b) a research question to be answered and the rationale for the question, (c) the research question stated as a statistical hypothesis, (d) definitions of the variables of interest and how they would be determined, (e) explanation of the sample used and how data would be collected, and (f) explanation of the statistical procedures to be used to answer the question. Data could be collected from student research, a faculty advisor, previously published theses or dissertations, published articles, an internet database, or other sources. The project report format requirements were (a) an introduction, (b) a literature review or rationale for the study, (c) a description of methodology used, (d) a description of the data analysis and findings, and (e) conclusions and recommendations.

When the quantitative research project was first assigned, the researchers contacted their academic program advisor to inquire about original data. The advisor did not have any data that needed to be analyzed but suggested an original research project. The student researchers agreed on the research topic and proceeded with submitting the necessary human subjects form. Upon approval of the human subjects form, the researchers developed a digital

survey using the *SPSS Suite 11.5 Data Entry Builder* in conjunction with the statistical consulting services on campus. The designated statistical consulting services consultant placed the graduate student researcher generated survey online and provided the researchers with the URL for launching the survey.

The prospective subjects included undergraduate students participating in Human Resource Development online courses during summer 2003. Instructors of those online courses were asked to invite their students to participate in the survey; a link to the survey was provided in an email message. Instructors were asked a second and, finally, a third time to invite their students to participate in the survey. Of the 60 undergraduate students that were invited to participate in the survey, 34 completed the survey for a response rate of 56.7%.

Data were collected using the digital survey via a server hosted by designated statistical consulting services consultant. The data were emailed to researchers periodically as an SPSS file. After the last day of class for the summer session a final data file was emailed to the researchers. For the statistics course project, the researchers used data collected two weeks after the subjects were invited to complete the survey.

Data were analyzed using linear regression analysis, which indicated a strong positive relationship between the variables that were studied as predicted by the research question for the project. The final project report was submitted to the statistics professor. Based on successful completion of the quantitative research project, both researchers obtained the grade of A at the end of the course.

While reflecting upon completion of the quantitative research project and the statistics course, the graduate student researchers, as guided by their academic program advisor, launched a qualitative investigation of lessons learned in their integrative research experience. Subsequently, the researchers sought to put their experience in perspective by comparing and contrasting their lessons learned with those experienced by fellow students in the same statistics course. Accordingly, the researchers created an email survey and subsequently sent the survey to fellow students and the statistics professor using the email tool within their statistics course's Blackboard website. After one week's time, the researchers sent a reminder email about the survey to their fellow students and statistics professor. Data were collected on 24 of the 25 students (96%). The data were discussed, analyzed, and interpreted by the researchers, and a case study was completed.

Limitation

This in-depth case study depicts the integrative value-added learning dimensions experienced by two graduate student researchers in a 10-week summer school online statistics course. The researchers acknowledge that their lessons learned as graduate student researchers have limited generalizability. No comparable face-to-face statistics course was held during the summer, so using a control group was not possible. While not addressed in this study, future research should investigate differences in research skill development and team effectiveness between online courses and their traditional equivalents.

Results

The findings of this research are clustered on the basis of responding to each of the five research questions.
In response to Research Question 1,

What skill development was targeted in the statistics course taken by the researchers in summer 2003?

the researchers documented that the statistics course covered (a) univariate and bivariate data collection and organization; (b) statistical estimation and hypothesis testing; and (c) analysis of relationships for numerical and categorical data, including Chi-square tests and simple linear and quadratic regressions. Researchers learned these statistical concepts along with beginner- to intermediate-level skills using SPSS Suite 11.5.
In response to Research Question 2,

What was the nature of virtual teaming used in conjunction with the statistics course taken by the researchers in summer 2003?

the researchers maintained two-way communication between themselves. Ongoing communication transpired among the researchers and their academic program advisor, the statistics professor, the designated statistical consulting services consultant, and other students enrolled in the course on a regular basis. This communication was conducted via email using Blackboard and regular email, telephone, and Centra technology. Figure 1 provides a model illustrative of the interrelatedness that evolved within this virtual team. This model supports integrative research skill development.

Figure 1. An Integrative Model for Graduate Student Research Skill Development

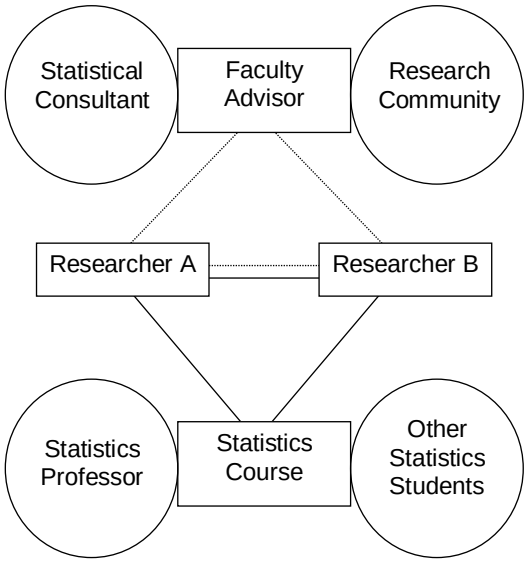


Figure 1. An integrative model for graduate student research skill development.

The researchers were separated by geography and were enrolled in different levels of the Human Resource Development graduate program. However, their relationship which had been established in previous courses and in the research community to which they belong provided the solid foundation of trust and mutual respect that is so essential for successful collaboration. Researchers and their academic program advisor had a previous relationship based on a research community established by the academic program advisor. The process of creating the research community included clarifying individual mission statements with regard to the research community, which provided a common thread for the researchers. This relationship also allowed for proactive access to the academic program advisor during summer.

Data supportive of answering Research Question 3,

What preliminary decision-making launched the generation of value-adding learning dimensions and effects experienced by the researchers in summer 2003?

indicated that once the decision was made to conduct original research as a virtual team, additional decision making transpired in an almost chain-reaction-like manner. Having an established relationship and clarified research agendas enabled the researchers to work with their academic program advisor in order to make decisions like choosing a topic, establishing research questions, designing the methodology, selecting instrumentation, and choosing data collection and analysis methods fairly quickly. The relationship also provided the framework for reflecting upon the project at its conclusion and deciding to submit the case study to AHRD.

Post-statistics course data collection revealed that of the 25 students enrolled in the statistics course, 23 students completed the survey for a response rate of 92%. The results indicated that the researchers' were the only students that (a) participated in a virtual team, (b) conceived a project and collected original data during the course, and (c) used a digital survey to collect the data. Students attended class while at home, at work, and on campus. Two students attended class from other states, and one student attended class while in another country.

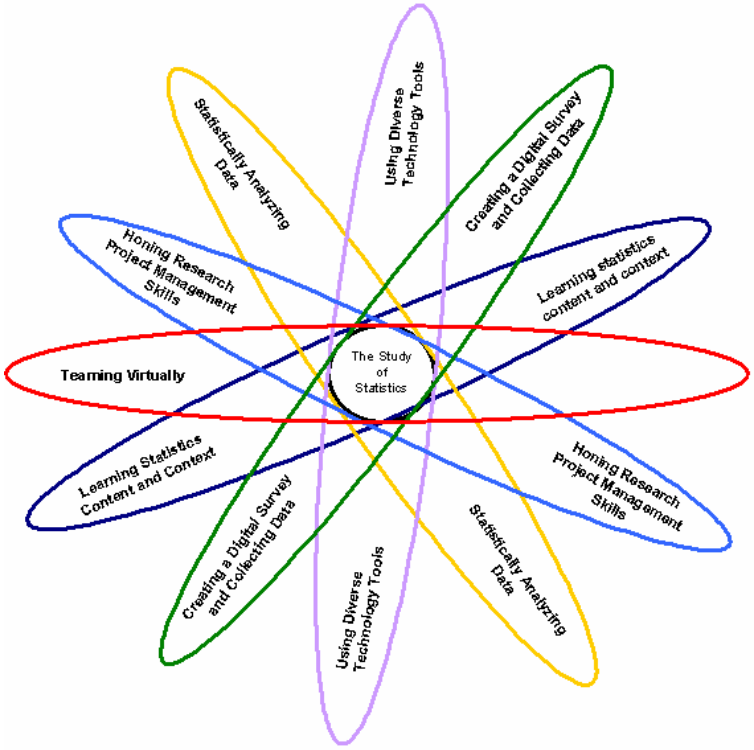
Responding to Research Question 4,

What were the integrative components of the research experience acquired by the researchers in summer 2003?

the researchers made the decision to conduct an original research project which was a huge undertaking. Not only were the researchers learning statistics, they were also learning the proper procedures required for a research study at their institution. Figure 2 depicts the value-added learning dimensions experienced by the researchers. The first step included the completion of a human subjects form. Each researcher learned how to operate several new modes of technology (i.e. Centra, SPSS Suite 11.5). One researcher worked with the designated statistical consulting services consultant in creating the digital survey while the other researcher developed the email survey for the post-project data collection. Once the digital survey data were collected, the virtual team members analyzed the data and

presented the results as their course project to the statistics professor. This entire research project was managed through email communication and teleconferencing.

Figure 2. Value-Added Learning Dimensions Resulting From the Ue of an Integrative Model for Graduate Student Rsearch Skill Development.



In response to Research Question 5,

What were the serendipitous outcomes that occurred after the statistics course was finished?

the researchers shared their statistic course experience with their academic program advisor, and noted that working as a virtual team on the research project provided an opportunity to help others in similar situations. The experience proffered the following individual gains:

a. experience with and confidence building in research project design, data collection, and data analysis and analysis interpretation, and using appropriate statistical techniques and technological tools;
b. empowerment emanating from the creation and ownership of an original data set ;
c. realization that the integrative research experience as a whole yielded insights potentially transferable to other graduate student researchers and their academic program advisor;
d. generation of a case study portraying the project;
e. creation of a dynamic integrative model for graduate student research skill development;
f. development of a scholarly research manuscript inclusive of presentation graphics depicting research results;
g. growth and enrichment of a closer, personal, and professional relationship between the researchers and their academic program advisor that has now developed into a face-to-face relationship;
h. initiation of individual research agenda progress; and
i. experience with and confidence building in conducting qualitative and quantitative research.

Conclusions

The outcomes of this project give rise to suggestions of what to do in a similar situation as well as some general conclusions about virtual teaming among distance education students. Conclusions resulting from this research consist of the following:

- Distance education is a viable methodology for the study of statistics;
- Virtual teaming is possible in an online statistics course;
- Diverse research skills in addition to statistics skills can be cultivated via execution of a statistics research project;
- Rich and enriching communication can result from synchronous and asynchronous collaboration;
- The decision to originate a data set spawns multifaceted opportunities to integrate research skills;
- Clarification of individual and collaborative research agendas promotes more efficient virtual teams and provides students with opportunities to integrate course assignments and research interests; and
- Serendipitous outcomes result when students are empowered by opportunities to conduct self-directed research.

Implications

The integrative approach and ensuing learning processes and research skill development through studying statistics merit consideration in terms of potential transfer for use by other graduate students and their academic program advisors.

From a student perspective, the development of research skills helps future researchers contribute to the HRD body of knowledge. The entire research project lasted fewer than 10 weeks due to the online statistics course being taught in summer. The compressed schedule did not prohibit original research from being conducted for the course.

From a teacher/academic program advisor perspective, the development of personal and professional relationships with students provides opportunities to facilitate student identification and clarification research affinities. Such mentoring can foster the growth of research communities, which, in turn, promote collaboration between and among students and faculty.

This research experience was proof positive as to why students need to be proactive in communicating with their academic program advisor. The relationship between the researchers and their academic program advisor allowed this project to become a reality. Time was of the essence, and the existing relationship allowed maximal efficiency with regard to decision-making and determining the critical path of the project. The academic program advisor provided a safety net for student researchers in this project. The academic program advisor guided and directed the research while allowing the researchers to experience the highs and lows that go along with scientific research. This safety net allowed for graduate student research skill development in a secure environment.

Contributions to HRD

Virtual teaming skills, as illustrated by this integrative research experience, can be developed using student projects as a medium. Temporary project teams created for a specific purpose are experiencing growing prominence in the workplace (Werner & Lester, 2001). In response to this, educators in areas such as public administration (Dickson, 1997), marketing (Deeter-Schmelz & Ramsey, 1998), and management (Bacon, Stewart, & Silver, 1999) have noted the increased use of student teams to promote teamwork skills among college students. These types of activities can prepare students for the kinds of team experiences they will face in employment settings (Dickson, 1997). Cohen (1993) predicts that organizations will continue to integrate teams into their organizational structures and increase their authority. In light of this information, continued studies are needed to determine the characteristics of effective and ineffective virtual teams. As virtual team-based structures increase in organizations, the demand for college graduates with strong virtual teaming skills will also increase. Even though the statistics project reported in this present study was not conducted in a corporate setting, the project had real meaning for the graduate student researcher virtual team members. Both researchers honed their virtual teaming skills as a result of conducting their statistics course research project.

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