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ABSTRACT

In the academic world, the transition from student to researcher is often a difficult step. Novice researchers are often hindered by a lack of mentorship and lack of awareness of the demands of research. The challenges are especially interesting in the study of collaboration and virtual teams, given the added layer of technology and tools that are an essential part of conducting such research. To address these issues, we designed and implemented an experiential doctoral seminar for advanced students in Information Technology. This paper describes the seminar, which focused on the research topic of virtual teams. The paper provides supporting theories for the approach and discusses experiences encountered during the first offering of the seminar.

Keywords

Virtual Team, Collaborative Technology, Research, Seminar, Learning, Mentorship

INTRODUCTION

In the academic world, the transition from student to researcher is often a difficult step. Indeed, the most challenging shift in a doctoral program is that from coursework to dissertation work. Even though doctoral seminars are typically designed to provide opportunities for developing potential research topics, exploring different literatures, and developing writing skills, most students experience a real research project only when they begin their own dissertation work.

We developed a new doctoral seminar that was specifically designed to address this challenge. The goal of the seminar was to guide doctoral students through every aspect of the research process, from research question formulation, to literature review, planning, task selection, research model building, research hypothesis proposal, pilot experimentation, study execution, and paper writing. In addition to experiencing all aspects of the research process, the students and professors benefited from mutual learning and team relationships. We are by no means the first to develop such an idea. However, we do believe that we have a unique experience to report, namely the combination of the experience with the development of an infrastructure for continuing research in this area in the context of virtual teams and collaboration engineering.

This paper describes the design of the seminar and its first implementation. In the next section, we briefly review the educational theories and different team process models that parallel the course experience. Section 3 describes the design of the course and the research project. Section 4 analyzes the experience gained in the seminar in terms of themes that arose from participant reflections. The lessons learned are considered in Section 5, and Section 6 concludes the paper with recommendations for future iterations of this type of seminar. The paper is co-authored by the two professors and five students who took the course, as a reflection of our development from student and professor roles to a research team.

BACKGROUND OF EDUCATIONAL THEORIES AND MODELS OF GROUP DEVELOPMENT

The educational literature supports an involved approach for student learning. For example, Bloom's taxonomy (Bloom, Englehart, Furst, Hill, and Krathwohl, 1956) proposes a continuum of learning from knowledge, comprehension, application, analysis, and synthesis. The final stage involves the ability to apply acquired knowledge to create new knowledge. The research seminar was consistent with Bloom's taxonomy since the seminar's goal was to provide students with an opportunity to create *and* execute a research project. According to Bloom's taxonomy, the research seminar required the students to enter the experience with knowledge and comprehension. The seminar provided the opportunity for students to move through the application, analysis and synthesis phases. In particular, the seminar's goal was to provide an opportunity for the team to spend the majority of their efforts on the synthesis phase.

From a teaching perspective, the design of this seminar applied the adult learning theory of andragogy (Knowles, 1984). Adult learners are mature and self-directed and they expect to take responsibility for decisions. This theory emphasizes that instructions for adults need to focus more on the process and less on the content of learning. Instructors play a role of facilitator or resource rather than lecturer or grader. An essential part of this approach is that adults learn when they see the need to know, which is particularly relevant for doctoral students as they approach the looming task of a developing a dissertation.

From a group development perspective, the research team's development process was generally consistent with well-known stage models of group development, e.g., forming, storming, norming and performing (Tuckman, 1965), albeit with several cycles. In addition, Poole's (1983) sequences of small group development were generally descriptive of the course experience. Poole's Multiple Sequence Descriptive System (MSDS) demonstrates that there are many possible sequences through which decisions can develop in groups. Poole sorted group activities into four general sets, related to proposal development, to socioemotional concerns, to conflict, and to the expression of ambiguity. Poole argued that a unitary model serves as a norm or ideal pattern for group decision processes, whereas the MSDS considers other factors, such as conflict, lack of information, or task difficulty, which create multiple group developmental patterns. Finally, the developmental path of the seminar also reflected the importance of timing with respect to events that changed the equilibrium of the group. Gersick's (1988) model of group development as punctuated equilibrium is especially relevant to describe this aspect of the seminar, in which timing, mechanisms of change, and group members' dynamic relations with their contexts intertwined with the group development process.

The educational theories formed the foundation for the basic goals of the seminar, as well as its overall structure and format. The different perspectives on group development provide a view of expectations in terms of how participants in the course might evolve from being students (and professors) to being members of a team. The next sections describe the specific format of the seminar and then discuss how our expectations played out in terms of actual experience.

OVERVIEW AND DESIGN OF THE SEMINAR

The course was designed as an advanced research seminar on virtual collaboration. The instructors and students worked together to plan and execute a research study and conclude with writing a paper from the study. The overall topic of the research concerned convergence and shared understanding in virtual teams. Every phase of a research study was covered, from the development of the original idea to the final presentation and submission of an article. Each phase had a deliverable associated with it. In general, each class period involved: (1) discussion of articles on theories, methods, and techniques related to the deliverable under development that week; (2) discussion of readings that constituted exemplars of the deliverable under study that week; (3) student reports on articles related to the deliverable under study; and (4) presentation and discussion of student deliverables relating to the class' research study itself. The professors assigned paper readings before the semester started to provide the students with a foundation and introduction to virtual team research.

Five doctoral students with different levels of prior experience in research comprised the seminar in the fall of 2005, which was co-taught by two professors. The class meetings were three-hour, weekly meetings. Meeting minutes were kept for each class meeting and made available to the entire class. These meeting minutes proved to be an important source of information during the process of writing for publication, since they recorded all important information about decisions made during meetings.

Since the topic of the course was virtual collaboration, the research team created an environment to study the design of virtual collaboration processes. The team was tasked to create an environment that was realistic, yet that would allow for sufficient control to study virtual team processes in depth. The research team executed every step of the research process during the semester. They first decided on what topic to study in the area of virtual collaboration based on a review of the assigned papers and each student's interests. A research plan was then formed to conduct the study. The team conducted a pre-pilot

session, two pilot sessions, and the first complete study that involved fourteen teams of students from three different universities.

Each class meeting was designed to get students involved in discussing and eventually deciding how to move forward with the research. This process of critical thinking proved to be one of the most significant parts of the study. Some of the decisions made in the design process of the research included:

- What phenomenon of interest should we pursue?
- What task should be used for this research?
- What hypotheses or research questions should we try to answer?
- What technology should we use for this study?
- How many groups and group members do we need?
- How we should incorporate collaboration engineering into this research?
- What tools should we use to measure the variables of interest?

Each of the decisions was made after lively (and sometimes lengthy) discussion, which proved to be an important learning process for students. After pre-pilot or pilot studies, those decisions would be reviewed and revised as necessary.

Formal class meetings were supplemented with "anytime/anywhere" interactions through Groove, a virtual team collaboration technology. Groove was used as the platform for sharing information or files, scheduling, and communicating. Furthermore, Groove was also used for discussing ideas between class meetings. In order to increase the motivation among students to participate in this online discussion, a "Groove champion" was chosen each week and awarded a "Groove doll." The Groove champion was the person who had contributed the most in terms of quantity, quality or both to online discussions during that week. This idea proved to be successful for getting students involved in Groove discussion between class meetings. In fact, the Groove doll constituted a turning point in the seminar, because it changed our mental model from a "once-a-week-class" to an "anytime/anywhere" research team.

The timeline of course expectations, actual results and the themes discovered in the course is shown in the following table. The analysis of the themes discovered came from the "self-reflection" diary that each participant was asked to write.

WEEK	TOPIC	EXPECTED DELIVERABLES	WHAT REALLY HAPPENED	THEMES DISCOVERED
1	Course Introduction and Overview; Background on Virtual Teams	Get certified by Institutional Research Board	On schedule	Excited/enthusiastic
2	Crafting a research project; Performing a literature review	Research question and justification; List of relevant disciplines	On schedule	Feel challenged
3	Field exploration	Literature review per discipline	On schedule	Feel challenged and struggled
4	Theory development	Field exploration and theory	Difficulty finding supporting theory	Confused, doubt/concerned, yet satisfied
5	Theory development	Field exploration and theory	On schedule	Confused, doubt/concerned, socio-emotional concerns
6	Theory testing	Propositions/Hypotheses	Discussion on propositions / hypotheses. Discussion on technology platform.	Struggled, yet satisfied

WEEK	TOPIC	EXPECTED DELIVERABLES	WHAT REALLY HAPPENED	THEMES DISCOVERED
7	Multi method research; Experimental design	Design of procedures and instruments	Definition and selection of propositions / hypotheses Selection of technology platform	Struggled, yet satisfied
8	Discussion of progress	Design of procedures and instruments	On schedule Implementation of process and task on technology platform	Struggled, yet felt progress
9	Discussion of progress	Pilot study	Executed pilot – later than originally planned	Confused, doubt/concerned, yet satisfied
10	Discussion of progress	Revision of procedures and instruments	Interviewed pilot participants; Revised procedures, instruments and implementation on technology platform	Felt challenged, doubt/concerned, felt progress, and satisfied
11	Discussion of progress	Data collection	Executed second pilot	Doubt/concerned and felt progress
12	Discussion of progress	Data analysis	Interviewed second pilot participants; Revised procedures, instruments and technology platform	Doubt/concerned, struggled and felt progress
13	Writing an academic paper		Live experiment starts	Excited/enthusiastic
14		Presentation of results to college research colloquium	Data collection	Confused, socio-emotional concerns and satisfied
15		Paper ready for submission to journal	Data analysis, paper and presentation preparation	Doubt/concerned, yet satisfied with the course

Table 1. Expectations, Results and Themes

REFLECTIONS ON THE SEMINAR EXPERIENCE

Throughout the semester, each doctoral student and professor in the research team was asked to keep a weekly reflection journal. The journals were not shared with the research team until the grades had been awarded. Thus, the students did not need to worry about whether their opinions about the course and the team would affect their grades. Eight themes have been identified from the reflections: 1) excited/enthusiastic, 2) felt challenged, 3) confused, 4) doubt/concerned, 5) struggled, 6) felt progress, 7) satisfied, and 8) socio-emotional concerns. Each of these themes is discussed in more detail in this section, supported by selected quotes from the self-reflection diaries.

The students were very excited about the class at the beginning of the class. They were looking forward to the upcoming class. They felt excited before the real experiment after several weeks' hard work of planning and preparation. As the reflections said:

> *It felt exciting after the meeting. Hope I'll learn a lot from this course and better yet, have my first publication ready by the end of the semester.*

> *We got off to a great start with lots of enthusiasm from everyone.*

> *(I felt) excited for real data collection*

During the semester, the students experienced confusion, doubt, and concern, and they felt challenged and struggled, all of which are inevitable feelings during the research process.

> *The group is struggling with knowing what, when, where, why and how. We (I) seem to be struggling with knowing/understanding our model and what happens in the black 'process' box. We are starting to move into becoming a functional group. We all care, but time seems scarce.*

In the meantime, the students were satisfied with the team and felt the struggling during the semester was worthwhile and rewarding.

> *We really have evolved into a working team, with everyone taking on different roles (not necessarily mutually exclusive or fixed roles – there is flexibility) and rather than waiting to be told to do something, people just do it. Excellent.*

> *WOW. Wrap up. Executed the study. Disappointing, but expected results. We have lots of lessons learned and lots of future excitement. Overall, it has been an excellent learning experience. It is likely the most beneficial experience for dissertation thought. It is almost a 'capstone' to coursework type class. Unfortunately, it takes so long to establish the 'what', 'how', 'where', 'why' that the actual execution is really to late in the semester. But, that is life. The learning was invaluable.*

The students had learned from each other. They felt bound together after working in a team for almost four months. Some of them felt that professional friendship had been established.

The feelings expressed in the reflections showed that "4) doubt/concerned" and "7) satisfied" both were prominent – these two feelings expressed more than others as shown in Table 1. The timeline showed that the students went through multiple cycles of confusion, starting early in the semester, then in the middle of the semester, and even towards the end of semester.

At the beginning of the semester, the students were confused about all the discussion of idea generation and got nervous about the vagueness of the project. Before the pre-pilot experiment, most of the students were still confused about the expected project outcome. They were concerned about what to expect and what to measure and what could occur. At the end of the semester, some students still felt a bit confused as to how to present a semester-long experiment in research papers.

These cycles of confusion and excitement reflect the kind of group development models that were presented earlier in the paper. They also reflect what we try to teach in doctoral seminars about how research ideas progress, but in this case, the students actually experienced it. Indeed, one of the students commented that the class was like a mystery dinner theater where the actors help guide the guests through an excellent experience.

The timeline shows that satisfaction was expressed throughout the semester. The students felt satisfied with the research progress, the research experience, learning experience, accountability of teammates, instructors, and the course experience. As one of the instructors said:

> *I think everyone is beginning to appreciate just how complicated these studies are and how much has to be taken into account. If they learn only that, then the semester may have been worth it.*

KEY LESSONS LEARNED

Our experiences from this research seminar resulted in the following lessons learned:

- Course size must be kept small, ideally around five students
- The seminar works best with second-year students who have prior experience with doctoral seminars and research and an approximately equal level of development
- Balance between structure and improvisation is a constant challenge
- Communication and shared understanding are not the same thing, and the development of shared understanding is a special challenge in an experiential environment
- Explicit attention needs to be paid to norm development, and the norms themselves are different from those of a traditional course

This first offering of the seminar had five students and two professors, and this class size was at times helpful and other times challenging. A seven-person team did mean that we had sufficient resources to provide support and backup for experiment execution and support. For example, it was especially beneficial during execution of the real experiment which had 70 subjects participating. The seven members staffed a help desk function 17 hours a day to answer subjects' technical and non-technical questions. Even with a small team size, at times, it was difficult to have shared understanding among everyone in the team and it took longer to build consensus on ideas. In the formative stages, members often do not speak up when things are not clear and other group members are often hesitant to ask for clarification on group decisions. In the early stages of the experience, this could be attributed to the professor / student relationship being dominant. As time passed, the team functioned at a peer to peer level. We recommend a course size of no more than six or seven people total, including professors.

Due to the interactive nature of the course, students should be both advanced and at approximately the same level. It is important that students have established levels of knowledge, comprehension, and application learning. The seminar should be offered as an advanced research seminar and the student participants should be in the final phases of their doctoral course work.

The tradeoff between structure and improvisation is a constant struggle in the course. Much like a case discussion course, professors want the 'big board' in their heads – the notion of what the board will look like by the time the class discussion is over – at the same time that the professors want to let things flow in interesting directions as they arise. The challenge is to find the right balance between structure and creativity, between plans and free thinking. We observed very different levels of comfort among the students with the format and style of the seminar. There were differences in terms of tolerance for ambiguity, for instance. Some students were more anxious to establish deadlines and structure, while others did not mind repeated cycles of revisiting research questions and decisions. These types of differences are part of the art of balancing structure with improvisation.

Shared understanding is both an essential outcome and an important part of the learning process. We realized that more structured discussion with testing of shared understanding is important. Furthermore, more virtual meeting time, such as chat time on Groove with research team members working online at the same time, helped team members to get acquainted with each other quickly and helped them to speak up during the face-to-face weekly meeting.

Norm development is always an essential ingredient of effective team functioning. The professors need to provide time for group formation so that the group can transition from a group of individuals to a highly functioning team. In the beginning, participants tended to flounder and seek direction. It is important to allow the students to establish confidence and begin to question and participate. We started out with our usual (and unspoken) assumptions about the course norms based on it being a course, yet what we really needed to have develop were the norms of a research team. The model of collaboration in a research team is quite different from a traditional course model, and it took time for everyone in the seminar to appreciate and experience this change.

CONCLUSION

In general, a doctoral seminar needs to invoke students' free thinking and creativity. The professor's role is that of a resource and facilitator. The example that we have described here gave the students the opportunity to go through every aspect of the research process under the guidance of the instructors. During the research, professors shared the workload and the professors and students participated as a true team.

As was stated at the beginning of the paper, the transition from student to researcher is often a difficult step. This kind of doctoral seminar serves as both teaching and research. It teaches students how to conduct research through the design and

execution of a real research project. The students gained an appreciation for the research process and acquired first-hand experience.

The technology environment that was both a product of the research project and an environment used during the course added another layer of complexity. Students had to learn both the technology and the subject matter at the same time, but their learning mirrored what the research subjects had to accomplish, thus providing another learning opportunity at the intersection of teaching and research.

The seminar also provided unique challenges for the instructors. The challenge is to find the right balance between structure and creativity, between plans and free thinking. The challenge is to manage the team, to make students contribute to the best of their abilities and to develop the synergy of the team to gain a wide range of meaningful outcomes.

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