A QUALITATIVE PERSPECTIVE: PRE-SERVICE TEACHERS DISCUSS EDUCATIONAL TECHNOLOGY ONLINE

By

ALEXANDRU SPATARIU * **DENISE L. WINSOR ****

* Assistant Professor, Georgetown College, Kentucky.
** Assistant Professor, University of Memphis, Tennessee.

ABSTRACT

Although there is a push in education to increase the amount of technologies used in the classroom much of the recent literature emphasizes a need to investigate ways to improve the instructional methods used when incorporating technology in education. The focus of the present research is to investigate an instructional technique used in an asynchronous online discussion (i.e., prompts versus no prompts). This research investigates pre-service teachers' positions on the use of technology in K-12 classrooms. Participants were students enrolled in an online Educational Psychology course at a Southwestern urban university; the online discussion transcripts were the data source for this qualitative research design. The treatment group received specific directions and feedback and the control group received very limited directions and feedback. The results of the study indicated that given specific guidelines and expectations for the discussion, the treatment group outperformed the control group in every category consistently within the small group analysis and the between group analysis. In addition, the in-depth analysis points to several findings with regard to how pre-service teachers view Educational Technology in schools, based on the dilemma posed in the online discussion forum.

Keywords: Online Asynchronous Discussions, Argumentation Discourse, Educational Technology.

INTRODUCTION

Online discussion forums are constantly employed in education courses to enhance student discourse leading to an enriched understanding of course content (Chinn & Waggoner, 1992; Spatariu, Hartley, Schraw, Bendixen, & Quinn, 2007). Factors such as background knowledge, instructional tasks, group structure, personal characteristics, assigned reading, and scaffolding are key factors to effective online discourse (Erkens, 1997; Stein, & Miller, 1990; Veerman, Andriessen, & Kanselaar, 1999; Veerman & Treasure-Jones, 1999). Researchers contend that more qualitative analysis of discussions is necessary to understand the intricacies of discourse construction and results within education courses (Marra, Moore, Klimczak, 2004; Gibson, 2003; Rourke & Szabo, 2002; Winiecki, 2003).

Spatariu et al. (2006) explored the influence of a discussion leader procedure with specific instructions on the quality of online argumentation and interactivity from a quantitative perspective. The results of the study indicated that students participating in groups receiving specific instructions produced better argumentation discourse and exhibited increased interactivity patterns. However, the particular participant reactions both at individual and group level were not captured. The researchers examined in-depth the reactions and ideas of each participant as they contributed to the construction of arguments based on the issue at hand, whether or not schools should adopt new educational technologies, which led to instrumental information that can be used for future design and structure of online discussion groups.

Argumentation for the purpose of this study, as well as defined by other researchers, refers to making convincing claims backed up by sound evidence and understanding various aspects of an issue involving recognizing conflict presence and being willing to engage in debate (Stein & Miller, 1991; Coirier, Andriessen, & Lucille 1999; Golder & Pouit, 1999). The aim of the study is to investigate the nature of the discussion among participants in the same group

and collectively between groups. The authors wanted to conduct an in-depth analysis of the participant's reactions, ideas, and positions to identify how they are influenced by the group dynamics and the leader instructions. Thus, the study answered two main research questions:

• Does online instruction impact student discourse during asynchronous online discussions?

• What are the similarities/differences within the treatment and control groups? If there are differences between the treatment and control groups, to what extent are the results between groups different?

This paper is divided into four sections. First, they present a succinct overview of existing qualitative discourse analysis studies. Second, they provide a descriptive overview of the methods used and describe the methodology and data analysis procedures. Third, they report the results and analyze the findings. Finally, based on the results they discuss instructional interventions that can be instrumental in boosting the quality of online arguments.

Qualitative analysis and online discussions

Although there is a growing body of quantitative research on arguments in online settings not much has been done in the realm of qualitative research in this area (Tesch,1990). Existing quantitative research studies show that argumentation is related to factors such as group dynamics (Chang, 2009; Clark, D'Angelo, & Menekse, 2009; Jeong, 2004), message labeling (ChanLin, Chen, & Chan, 2009; Jeong & Joung, 2003; Valcke, De Weaver, Zhu, & Deed, 2010), note starters (Nussbaum, Hartley, Sinatra, Reynolds, & Bendixen, 2002), discussion instructions (Heejung, Sunghee, & Keol, 2009; Jorczak,, & Bart, 2009; Nussbaum, 2005; Richardson, & Ice, 2010; Spatariu, et al., 2007), and personal characteristics of learners (Bendixen, Hartley, Sas, & Spatariu, 2003; Nussbaum et al., 2002; So, 2009; Zhang, Kohler, & Spatariu, 2009).

A number of recent studies employ discourse analysis related to the use of online discussions. Marijke, Hilde, Bram, & Martin (2010) used grounded theory to explore cognitive processes of undergraduate students engaged in online discourse in science education classes. The results identified a number of issues such as strategy use, intervention scope, interaction, previous discussions experience all of them mostly related to peer tutoring. Based on these some suggestions were made to help the tutors feel more at ease as they could experience uneasiness related to lack of subject matter expertise or timing of intervention. The purpose of the current study was not to focus just on the discussion leader participation; it could be that such factors play a role especially in argumentative situations involving peers as leaders. Another study Baran & Correira (2009) applied qualitative inquiry methods to uncover strategies used by graduate educational technology students to manage challenges resulting from instructor dominated online discussions. Results of the study showed, strategies that were inspirational of practice oriented led to a more relaxed and conducive learning participatory environment. In the present study the treatment group was given specific instructor guideline, therefore expectations were imposed on the participants which presented possible pressure. However, the instructions were posted once then the groups took the discussions further with instructor intervention or probing. The control group was provided with less instructor guidance and feedback. A qualitative study on online discourse in a math and science pre-service course (Liang, Ebenzer, & Yost, 2010) revealed that collaboration was employed in developing research proposals. Although the online discourse enhanced the class overall, the critical aspect of evaluating others view points through scientific inquiry was not present. This study prompted participating students to openly think critically and debate an important educational aspect of their career as future teachers.

Methodology

Technology is a hot topic in education and receives positive and negative attention in the literature from a variety of perspectives (i.e., students, teachers, parents, government). In this study the researchers investigate asynchronous online discussion from an instructional perspective. In this section they present their method for this research and provide an overview of the method of analysis. They conducted preliminary quantitative analysis which revealed statistical significance; these results are in-line with recent research literature; and guided more in-

depth qualitative analysis. They will discuss the quantitative results that coincide with the qualitative data analysis only to identify the foundation for this fine-grained analysis; and demonstrate their motivation to examine the data more closely, using content analysis, which is the focus of this research.

Participants

The participants were 44 pre-service teachers enrolled in undergraduate educational technology courses at a large Southwestern university in the United States. Demographic and discussion data was collected via WebCT, an online management system tool. All participants were randomly assigned to either a treatment position (N=23), 6 small discussion groups with a leader and pre-determined argumentation instructions, or control position (N=23), 6 small discussion groups with a leader but no instructions. Study procedures involved completion of consent forms and demographic profile. Neither student leaders nor group members had any knowledge of the assessed discussion outcomes as per this study.

Procedure

This study investigates pre-service teachers by proposing an educational technology dilemma that required them to think critically about the topic, as they will inevitably be faced with making decisions about technology in their own classrooms in the near future. The goal in this research was two-fold: (i) to investigate the potential impact of online instruction using increased detailed instructions, instructor feedback and probing (treatment group) versus skeletal instructions and less than useful feedback and no probing from the instructor (control group); and (ii) to identify the similarities/differences within the treatment and control

groups. If the authors prediction that the treatment group would excel was correct, they wanted to delve deeper into the different reactions between the treatment and control groups. In order to accomplish this goal the instruction and instructors involvement needed to be identifiably different for each group but the dilemma was the same for the treatment and control groups. The dilemma used in this study was chosen from a collection of controversial issues in education; should teachers adopt new technologies in K-12 schools (Abbeduto, 2000)? The online discussion took place over a two week period of asynchronous online discussions regarding the dilemma about educational technology in the schools. The guidelines were different for each week (see Appendix A for instructions for week 1; and see Appendix B for instructions for week 2).

The dilemma and instructions for the control and treatment groups for week 1 were posted on the discussion board after a face to face meeting. The directions for week 1 were to discuss the dilemma asynchronously online. The treatment group received instructions to read the dilemma and post at least 3 times during the week following these specific guidelines:

• Provide an initial posting (taking one side);

• Then a challenge (debating a group member position); and

• A response to a challenge (responding to the debate).

The control group was given the same dilemma to read and simply asked to post 3 times with no other explanations (see Appendix A for instructions for treatment and control groups).

At the end of the first week the leaders in the control and treatment groups were asked to provide their group with a brief summary of the discussion trend that developed over the course of the first week. During the second week of the asynchronous dilemma discussion the control and treatment groups were asked to respond to two items: (i) what is your reaction to the discussion topic as it evolved in your group; and (ii) what is your final resolution to the dilemma?

In terms of the instructor's feedback to the groups, this was thoughtfully executed between the control and treatment

Control Groups N=23		Treatment Groups N=23	
Group C1	3 Female 1 Male	Group T1	3 Female 1 Male
Group C2	3 Female 1 Male	Group T2	4 Female
Group C3	4 Female	Group T3	3 Female 1 Male
Group C4	2 Female 1 Male	Group T4	3 Female 1 Male
Group C5	4 Female	Group T5	3 Female 1 Male
Group C6	3 Female 1 Male	Group T6	2 Female 1 Male

Table 1. Group Distributions by Size and Gender

groups. During the first week of discussion, the treatment groups received brief but regular interaction from the instructor. The feedback from the instructor was supportive and directed toward individual responses, often it highlighted critical points that an individual made and aimed at posing more probing questions that required the groups to reflect on their knowledge and beliefs about educational technology. Below are four samples from the instructor's posting to different treatment groups, because there were six separate treatment groups the transcripts convey a variety of different comments but the nature of the instructor's responses remained consistently guiding, supportive, and probing.

Sample 1

I Encourage you to think and generate as many reasons as you can to support your claim. For example, if you are on the pro side of the issue try to go beyond what is presented in the dilemma by bringing in ideas from other classroom readings, your own experiences, and/or established facts. This would also be the case if you adopt the con side of the argument. When you do your second posting this week, which is the challenge to a group member's initial post, I encourage you to do the same. For instance, when you adopt the con side as a response to a pro side posting, make the case for why technology is so beneficial all the time by bringing in evidence from readings, experiences, facts etc. Even though you may not agree with the con side imagine that you do and think broadly and deeply for reasons and evidence that could be valid arguments for the position. Then in your third posting you can restate your belief again. They may be the same or you may see things somewhat differently after being engaged in this disagreement process.

Sample 2

These are very important concerns. It looks like you are not against new technologies but advocate for wise ways to use them. Any thoughts on what teachers can do to avoid technology dependency and still benefit from its use?

Sample 3

I am glad you took the con side. It is important to analyze both sides of the issue. You discuss most of the cons from your experience with online classes as a student. However,

if you put yourself in the role of the teacher, can you talk about any technological cons? For example, distance education entails more prep work on the instructors as they have to design the courses.

Sample 4

The Internet provides great resources but not everyone has access to it. Some parents may be able to buy a book for their children but not a computer. Even though they may have a PC, they might not have internet access. This is speaking in terms of families; but what about schools? There are many 'at risk' schools that do not have computers. Then we need to look at the schools who might have the technologies but do not use them; still kids do not get computer exposure either way. Do you think there is anything that can be done about availability of computers in schools? How do veteran teachers who have computers in their classrooms but lack knowledge and understanding to capitalize on the student learning? Can anyone find statistics about how many families or schools have or do not have access to computers or the Internet?

During the first week of the discussion the control group did not receive any consistent feedback, it was generally once for each of the six control groups. The feedback did not address individual participants; it usually reiterated what was presented in a vague and generic manner. More importantly in the end it might be more important to notice what was missing in the feedback; such as, amount of instructor involvement, consistent and regular instructor interaction, void of positive comments, lack of specific examples or extrapolation of the student's thinking, and the absence of any type of probing questions. For example, this is an excerpt from instructor's feedback to a control group.

Some good points being mentioned. Technology is already present, we just need to learn how to use it.

During the second week of the discussion, again the control and treatment groups received different directions (see Appendix B for instructions). There was one other difference in the directions for week 2; the directions were not posted on the discussion board as with week 1, but rather appeared as informal discussion from the instructor in each group's small group discussion area. The feedback

for week 2 followed the same patterns for the treatment and control groups as they did for week 1. Here are abbreviated transcripts from feedback to the treatment and control groups for week 2.

Treatment Sample 1

This is an excellent point that is being made by a couple of the group members. It is true that today's students are more technologically advanced and educators have to try to keep up with that. Does this have to be a negative consequence? Can you talk more about benefits of students being more advanced than teachers? What might be some activities that could support technology if the students are more advanced?

Treatment Sample 2

This group is really exposing some great points! I am Glad that you are able to look in-depth at both sides of the issues that are being raised in your discussion. It seems that you are moving to the idea that technology in isolation is not so much a problem but how it is being utilized is what really makes the difference. What do you all think are some key elements to executing the use of technology? Do you see any differences in how this should be done for different age groups or to meet the individual differences of students with special needs or who come from culturally different backgrounds?

Control Sample 1

It helps move the discussion along if everyone participates in the discussion. I think you all have some knowledge of this based on your personal experiences.

Control Sample 2

It could be that there are students who are not interested In technology and would rather not use a computer to Accomplish classroom tasks.

Initial preliminary analysis was conducted using t tests to compare the two groups and support our qualitative investigation (quantitative results were reported in detail by Spatariu et al. 2007). In summary, argumentation was measured and results indicated subjects performed better both weeks in the treatment group (first week M= 3.088, SD= .361; second week M= 2.934, SD= .816; N=23) than in the control group (first week M= 2.845, SD= .464; second

week M= 2.193; SD= .734; N=21). Interactivity was also measured and results indicated subjects performed better both weeks in the experimental group (first week M= 3.036, SD= .557; second week M= 2.978, SD= 1.060; N=23) than in the control group (first week M= 1.872, SD= .324; second week M= 1.838, SD= .941; N=21). However, the argument quality was not statistically significant the first week even though the mean was higher in the treatment group ($t_{(42)}$ = 1.942, p = .059). This prompted a more in-depth qualitative analysis of the content and quality of the discussions.

The qualitative analysis was done on 272 discussion transcripts generated by both groups over the two week duration of the study. Transcripts were coded based on group (treatment/control), small group (1, 2, 3 etc.), and participant; and uploaded into Atlas-Ti, a qualitative software program used for assisting in the coding, organization, analysis, and interpretation of the data. The researchers took a three step systematic design approach, open, selective, and axial coding to analyze the online postings (Creswell, 2008). Data was coded initially and then subsequently by two researchers for inter-rater reliability (.90).

Results and Discussion

In this section the researchers will report their findings for the treatment group in depth and provide the final analysis of the control group. The analysis procedure was conducted with three levels of content analysis; (i) conventional, (ii) directed, and (iii) summative (Hsieh & Shannon, 2005). The findings are rich in content, particularly for the treatment groups which demonstrated the most consistency and continuity within and between the six groups. Their belief is, this is the case due to the explicit guidelines and feedback that the treatment groups received compared to the control groups. All levels of analysis were initially conducted by the researchers and subsequently underwent two separate rounds of interrater reliability checking completed by graduate assistants working in the field of online discussions and argumentation but were not involved with the data collection or the course.

Level 1 analysis used the conventional approach to organize the large amount of data. The conventional

content analysis uses the text from the data to identify codes for a particular way of thinking or position which was later able to be placed in larger categories. Level one conventional content analysis was completed on all 272 posted responses which resulted in 84 codes emerge from the (see Appendix C). In appendix C the numbered items reflect the initial level of coding and represent that all items were identified in the treatment and control groups. These items were further reduced into categories (see Appendix C; lettered and bolded items). Appendix C is presented to demonstrate the rigor of the qualitative analysis and to allow other researchers to use a similar coding scheme in future research; space does not permit extrapolation of the coding scheme. They found that the responses had a high degree of evaluative characteristics (especially within the treatment groups), that is, the responses were not dichotomous; such as, simply a pro or con for educational technology. Instead, the breadth of participant responses went beyond; to include a pro and con label; in addition they included the following: don't know, don't care, could be both, and it all depends. Later the 6 initial coding labels for the category used as the example above were reduced to the following 4 labels: (i) pro, (ii) con, (iii) don't know and don't care; and (iv) could be both and it depends. This approach to content analysis is a mixture of inductive and deductive perspectives, below are a sample of the coding from the original transcripts.

TEBSP: Treatment Group Evaluation Based on Student Perspective

I am definitely for using technology to help teach students in the classroom. The fact that students can be figuring things out for themselves can be much more beneficial than someone simply showing them how to do it.

TEPE: Treatment Group Evaluation Based on Personal Experience

Even though I took the con side, at home I am addicted to the internet and other computer software! I do learn things that I do not learn in class but sometimes it keeps me from doing what I need to do and I am not focused on what the teacher wants me to focus on. Students need to stay focused and I see computers and other technology as a big distraction for today's young students.

TB: Treatment Group Both (it depends)

Let me clearly state that I do not believe that technology should be the only method of instruction in order to yield desirable results. It all depends on how we choose to incorporate it that could potentially make the difference.

Level 2 was primarily deductive directed content analysis based on preliminary quantitative data analysis; and categories found in the research (see Appendix C). In a directed content analysis the researcher begins with a theory or relevant research as a driving force for the initial coding of large amounts of data (Hsieh & Shannon, 2005). In appendix C we identified 5 categories that appear as boldface: (i) position on dilemma; (ii) support of position on dilemma; (iii) perspective of dilemma evaluation; (iv) nature of dilemma evaluation; and (v) nature of response to others. For example, using the quotes used in level 1; TEBSP and TEPE were place under the category of Perspective of Dilemma Evaluation; and TB was categorized under Position on Dilemma. Once all codes were evaluated and they were assigned to a category, all codes for each category were counted and ranked highest to lowest within each category for each group. Then the rankings were compared between all of the treatment groups and all of the control groups. The findings of the study show that there were similar rank orders for the categories of most of the treatment groups but not the control groups. Out of the six treatment groups the researchers found 5 groups that had very similar trends in their rank orders in three of the categories:

- Perspective of dilemma evaluation (Figure 1);
- Nature of dilemma evaluation (Figure 2);
- Support of position on dilemma (Figure 3).

Perspective of dilemma evaluation comprised the arguments that had to do with how the student presented support for their position on educational technology. This category encompassed arguments that were set in the context of personal experience (54%), background knowledge (28%), based on a teacher's perspective (9%), or from a student's perspective (18%) (Figure 1). Treatment group 6 was the only treatment group that had a different ranking in this category. It was primarily the females in this group that shifted the results; they used more information
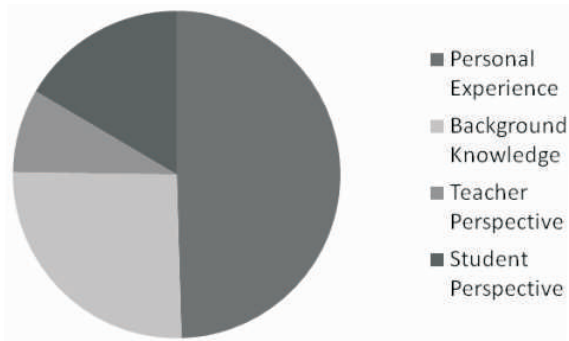
Figure 1. Treatment Perspective of Dilemma Evaluation

from the text and background knowledge as opposed to personal experience. This could be because admittedly they disclosed they were not computer savvy; they found it to be cumbersome and time consuming. Treatment group 6 also had the bulk of the student perspective responses. Interestingly, the responses that were derived from a teacher perspective were the least represented. We think this may be because of the undergraduate status of the students and the lack of teaching experience. It is standard for pre-service teachers to view themselves in the role of the teacher; and conversely identify with a student role which they are currently experiencing. The control groups varied drastically in this category, there was little continuity between the groups and typically each of the control groups took on the perspective of their leader. That is, if the leader used a personal experience, the others followed in suite. Two of the control groups were identified as personal experience, three groups supported their positions with background knowledge or more objective text and research materials, and one group represented the student viewpoint in their discussions. The large amount of text-based background knowledge responses indicated a lack of individual thinking and a lack of critical perspective-taking that appeared to be present in the treatment groups. The control groups had less interaction and the discussion was more linear.

Nature of dilemma evaluation comprised excerpts of the discussions that could be labeled as cognitive (39%), solution-oriented (or metacognitive) (31%), emotional (26%), and social (14%) (Figure 2). The researchers saw the exact same trend in all six of the treatment groups. However, the trend in this category was more consistent among the control groups; it was not remotely consistent with the treatment group. The nature of the dilemma for the control groups were based primarily on and fueled by social and emotional responses. There were no varying levels of cognitive perspective as seen in the treatment groups. Again, this speaks to the linear course of the control groups' discussions and this category demonstrated the lack of evaluation between the objective and subjective perspectives that lead to proper evaluation of a dilemma. The control groups discussion were more opinion and not well developed for adequate solutions; this was promptly visible in the week 2 discussion of the control groups as seen in the short responses and frequency of responses. The treatment groups all had the same rank order and the nature of the dilemma was more evenly distributed among the treatment groups; typically a response would cover two or more of the areas in this category. For example, a student would begin with lower level thinking and develop a train of thinking that would consist of higher-order thinking (application, synthesis, evaluation). The responses of the treatment groups appeared to be more organized (another indication of critical thinking); integrated amongst group members (they were interacting and responding to each other), and the trajectories of each groups discussion was solution-oriented. This level of thinking set the groups up nicely for the second week of discussions. They had more exhaustive debates on both sides of the dilemma because they had to look at alternatives that they may or may not have agreed with because they were directed to respond and argue the opposite point of their group-members. This clearly had an impact on the sophistication of the treatment group's discussions. As indicated earlier, there were clear complexities in the nature of evaluation in the treatment groups as was seen in the integration of domains
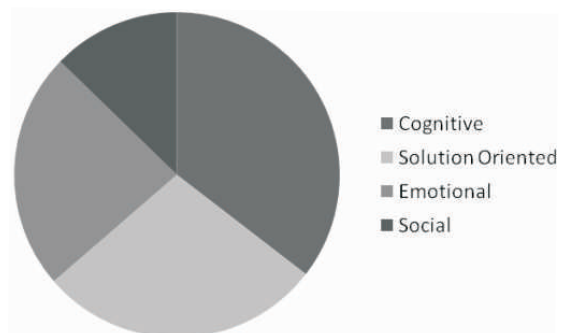

Figure 2. Nature of Dilemma Evaluation

within single responses. That is, a single response entailed not only cognitive views but integrated views that included emotional and social dynamics; this was more the norm among the treatment group's responses.

Support of position on dilemma was comprised of the responses according where the individuals stood on the dilemma regarding educational technology in the schools. This category looked at two variables; whether they were for or against educational technology and whether or not they provided explicit examples for their position. The distribution was as follows: examples for support (71%), no examples for support (4%), examples against (9%), and no examples against (6%) (Figure 3). Five of the treatment groups presented the same rank order for this category. The outlier in this category was treatment Group 3; which consisted of 4 females who were more against educational technology. The interesting part of treatment Group 3 being the outlier in this category was that the bulk of the social response in the Nature of the Dilemma Evaluation category were derived from Group 3 participants as the primary reason they were against educational technology. Even more interesting was that when the other treatment groups provided examples for supporting educational technology one of the most prominent reasons for supporting it was because they believe in a constructivist approach to learning or they favored a Vygotskian approach which included peer or collaborative learning. Now two things are important to mention here; when these were the emphasis of their argument it was coded as cognitive because of the application of learning theory; but one could also have interpreted that they were getting at a social perspective

Figure 3. Support of Position on Dilemma

because that underpins Vygotskian and constructivist approaches. They contemplated this issue and decided that their intention was not so explicitly social but more entailed more critical thinking and reflection but the researchers mention it here because it could be an argument for a social perspective. Therefore, their first finding for this category was that the treatment group had a significantly broader and more in-depth view of the dilemma due to the overwhelming support of their responses by providing examples for their position. The second finding was the treatment group overwhelmingly supported educational technology in schools. On the other hand, the control groups, who were more mixed on the dilemma with regard to being for or against educational technology. In addition, the control groups demonstrated more limitations to their discussions by having far less support for their positions. The control groups floundered by comparison to the treatment groups in this category by far the most. They did not have enough depth or breadth in their discussions to justify support for educational technology and it was primarily driven by emotional responses to the dilemma.

Level 3 analysis procedures were conducted to show the process of the discussions between the treatment and control groups. The frequency distributions do not enable, however, the examination of the evolution of the process (e.g., changes in the knowledge production over time, differences in discourse patterns, or the role of individual ideas in broader context). The researchers used more descriptive methods to evaluate the differences in the nature and style of the knowledge production in the differing conditions. For this purpose, the unit of analysis was extended to cover the entire material for each group to enable a process perspective on the discourse. Small group data was merged and recoded using the more narrow categories. Consequently, the process analysis presents a synthesis of what were considered distinguishing features of the process in between group differences. The following features were judged as representing plausible operations, background knowledge, personal experience, explanation process, developing ideas in dialogue, and self-reflection.
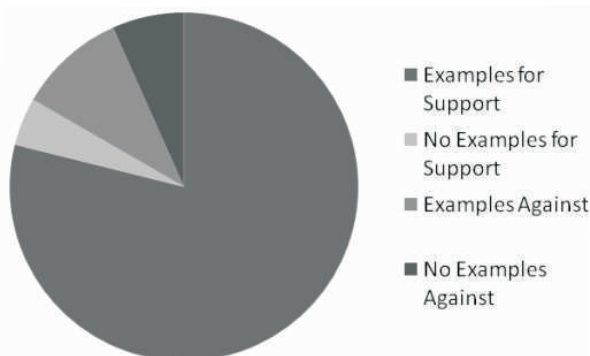
It was clear by the findings in level 2 analysis that the treatment groups out preformed the control groups. Also, the researchers identified patterns among the treatment groups but they did not find any coherent patterns among the control groups. This raised the curious question about the discourse processes that occurred between the control and treatment groups. They conducted a summative content analysis, which is inductive, guided by emerging categories in the data. Here they reduced the data further by collapsing the treatment groups and the control groups as a means of identifying a broader perspective about the course or process on the discussions as they related to the larger categories. In other words, they wanted to know how the larger categories were represented in the treatment group versus the control group. Summative content analysis involves counting and comparing groups within and between by using keywords or content, followed by interpreting the underlying context. Using this method of analysis patterns emerged in terms of how the categories were addressed and evolved throughout the discussions. This provided an overview about the nature of students' knowledge, critical thinking, argumentation, and counter-argumentation.

The important finding identified in the level 3 analysis was the clearly different patterns that emerged between the treatment and control groups regarding how the participant's thinking about the dilemma evolved throughout the discussion. Evaluation of the treatment groups indicated a more complex and sophisticated developmental pattern that took seven steps to achieve a viable solution to the dilemma of educational technology in the schools (Figure 4). The treatment group appeared to be manipulating the information that was presented in the discussion to achieve a solution; and perhaps the participants had a notion or understood that they may be heading for a change in their perspective based on the information that was produced during the discussion. Although, it is thought through our analysis that even though they may have anticipated some change in their viewpoint, there was an underlying sense of ambivalence and some amount of struggle during the process. This apparent struggle was noticeable at this level of analysis because all groups revisited two of the larger categories
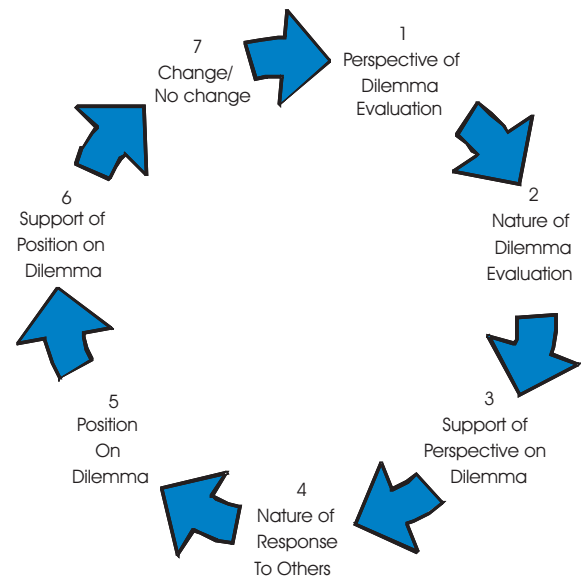

Figure 4. Treatment Group Discourse Process

identified in level two analysis; perspective of dilemma evaluation and support of position on dilemma.

Figure 4 helps to explain the treatment groups discourse process as it unfolded. The groups began by, first, providing a perspective of the dilemma, second, they moved to providing some indication about how they viewed the nature of the dilemma, third, each member of the group provided support for their perspective, and then fourth, each member progressed to responding to other's. Rather than continuing to proceed with the goal of the assignment (provide solutions for the dilemma), the treatment groups consistently across all 6 groups retreated back to rehashing their position on the dilemma; and then again revisited support for their position prior to indicating a change. From Figure 4, step 1 and 5 are the same but we chose to name step 5 slightly different to distinguish the recycling back to this category. Although the topic was the same, there were some definite differences the second time around. For example, this is where many of the responses for the treatment group's emotional nature of the dilemma were identified; and the length of the responses were more brief but straight to the point at hand; and this is also a section of the discussion in which responses were posted without support.

The last of the differences (posting without support) is particularly interesting because it is the second category to be revisited by the treatment group. From Figure 4, steps 3

and 6 are the same; they chose to use the same label because there was no apparent difference in the discussions. What did occur here was that initially when the participants supported their perspective is was generated by the individuals, but when it was revisited in step 6 it was because other group members pointed out that some members were posting perspective without support and responded accordingly to request that support be provided. Where individuals did not generate the support, their peers activated a request for support and so the category was revisited. These 6 steps prompted some changes to individual's responses to the educational technology dilemma, some changes were drastic and others were mild to moderate..

The control group's discussion patterns were more abbreviated in the process. Like the treatment group, the control group demonstrated overlapping characteristics in the content of the discussions and patterns in the discussion; however they could only uncover three stages within the control group's discussions (Figure 5). The first stage in the discussion was shared among two of the categories identified in level 2 of the content analysis; perspective on the dilemma and support for perspective; the second stage in the development of the discussion was the nature of the dilemma; and third nature of the response to others.

Addressing the first stage which is shared by two categories is important because it occurred often in the control groups but not at all in the treatment groups. Frequently, participants would not state their own perspective but rather they adopted the perspective of the previously
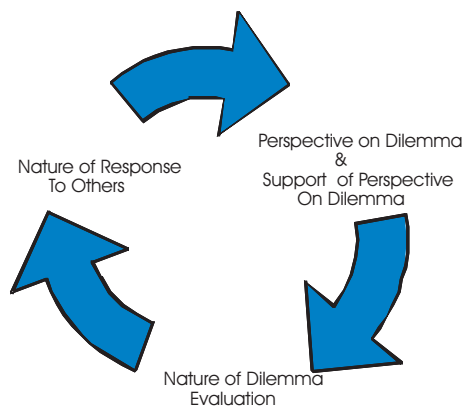
posted response and proceeded to discuss support for another participant's perspective. It was not uncommon to see initial postings that stated a perspective without any support. This lack of support may have prompted the other students to feel the need to provide support for another participant's perspective due to the absence in the original posts. In general, the control groups had little organization that could be identified in their responses. There seemed to be disjointedness in the control groups, in that there was not movement or advancement in the discussions. This made the findings of the third stage (nature of response to others) not surprising on one hand but somewhat perplexing on the other hand. The nature of response to others for the control group was completely dichotomous to the treatment group. In the control groups there were no challenges to others comments, no matter how poor in thought quality they may have been; there were detachment among posted responses that clearly did not even align with any post previously made in the groups. It was as if the individual thought of the post in advance and posted it regardless of what anyone else had to say. There were no attempts do any problem solving or identify possible solutions, in fact, the underlying feeling of apparent change that was prominent in the treatment group was not even remotely scratching the surface in the control groups. The emphasis was more on opinions and subjectivity than on objective knowledge; this is interesting because they seemed to use the text as a point of reference but there was no ownership of the content. There was an absence of social and emotional domains aligned with their low level cognitive responses.

The researchers believe the profound differences that were identified in the control groups, as compared to the treatment groups, on an individual group basis and collectively were strongly indicative of the lack of specific guidelines provided to the control groups. Remember that the control group was not given directions to think or reflect in a metacognitive manner. In addition, the control group received only minimal vague feedback from the instructor. This is a good indication that instruction during the use of educational technology platforms may require both detailed instruction; and constant and consistent feedback from the instructor.

Figure 5. Control Group Discourse Process

Discussion and Conclusion

The selected dilemma pertained to the level of the cognitive (topic appropriate for discussion in an undergraduate educational technology course), social (an issue that directly concerns current schooling system), and domain level of the subjects (the issue concerns them directly as future teachers faced with the rapid advancement of learning technologies) thus meeting basic argumentation requirements (Coirier et al., 1999; Golder & Pouit, 1999; Stein & Miller, 1991). This analysis indicated that the treatment group outperformed the control group in every category consistently within the small group analysis and the between group analysis; and provided richer text in order to specifically identify the following main themes: Position on Dilemma; Support of Position on Dilemma; Perspective of Dilemma Evaluation; Support on Perspective of Dilemma Evaluation; Nature of Dilemma Evaluation; Nature of Response to Others; Nature of Position Change.

The primary research questions involved with the present study were: (i) What are participants' reactions to the educational technology dilemma within and between groups; and (ii) are the reactions within and between groups different? If so, how are they different? The above analysis of the discussions shows what the particular reactions were and how they differ at both group levels.

In summary, first, the process between the treatment group and control group, demonstrated more sophisticated critical thinking in the treatment group. The most distinctive result is the emphasis between the perspective-taking (opinion-based) and deciding on a position (evidence-based); and the nature of the support. The treatment group progressed through a series of discourse and evaluation (7 steps); whereas, the control group functioned much less critically (3 steps) and rarely settled on a position but rather provided more opinion than evidence based perspectives.

Second, the treatment group reflected more perspectives initially and interacted with their peers prior to settling on a position; and because of this some students indicated a change of perspective. The control group never indicated a change in their perspective.

Third, support in the treatment group, reflected 3 main areas in a clear hierarchical manner: (i) personal experience; (ii) use of technology examples; and (iii) background knowledge; and rarely based support on teacher or peers. The control group lumped their perspective and support in a single effort; and generally based on personal experience and peers (often no support was ever provided). Additionally, some gender differences were observed but more research would be necessary to make valid inferences since there were very few males present in all groups.

This study realizes the complexity and rigor of a qualitative analysis in this area. This study summarizes categories that may promote or inhibit higher order thinking during on-line discourse and demonstrates that discussion leader prompts can generate better arguments and increase the interactivity within small group online discussions. When instruction is structured and goal oriented students thinking is less impacted by the instructor's comments. They also recommend training students in being the discussion leaders within the groups. That way they are more empowered and overtly trained in critical thinking engagement and strategies. From a research perspective there may also be a difference in between student lead discussion and instructor lead discussion as students interact differently with their peers.

In terms of future research, they recommend a more in-depth look at the, nature of the responses category in order to better evaluate the cognitive, social, and emotion facets of the two groups (e.g., have the students write a reflective paper or take a survey specifically geared to these areas). This may provide a richer understanding of the differences that underlie critical thinking skills, argumentation, and decision-making/reasoning abilities.

With the rapid advancement of technologies, another important future recommendation for research is to automate prompts by programming them in the discussion board software. For example, a more intelligent system can be built, based on key critical thinking words, which give students prompts such as metacognitive questions while they write their posts.

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Appendix A

Instruction given by the discussion group leader to the treatment group:

- Read the technology dilemma carefully. You have to do at least 3 posts for this week's discussion (initial, challenge, and response to challenge).

- Make the first posting. In this first posting you will adopt the side of the dilemma you mostly agree with (either the pro or the con presented). State your claim clearly and support it with evidence and/or reasoning.

- Read other group members postings. Respond to at least one of them. The response has to be a challenge to the posting you are responding to. The challenge means adopting and supporting with evidence the opposite side of what is presented in the posting you are responding to.

- Make a third posting. This will be a response to one of the challenges addressed to you.

Instructions given by the discussion group leader to the control group:

- Read the technology dilemma carefully.

- You have to do at least 3 posts for this week's discussion.

- Make an initial posting as an answer to the dilemma.

- Respond to at least 2 other people postings.

Appendix B

Instructions given to the treatment groups for week 2 dilemma discussion:

- Here is what we have to do this week. After discussing the dilemma of whether new technologies should be adopted by the schools or not; a certain group direction has emerged. Read your group leaders summary carefully and respond to the following to questions.

1. What is your reaction to the discussion topic as it evolved within the group?

2. What is your final resolution to the dilemma?

- Respond to each of these two questions in separate postings. First, post your response to question 1, then, wait a day or two before you post your response to question 2. By waiting to post your response to question 2, you will have the opportunity to read other group members' reaction to the group direction. Take the time to reflect on your initial thoughts and the reaction of your group-mates; think through your response thoroughly using your abilities to be critical thinkers.

Instructions given to the control groups for week 2 dilemma discussion:

- Here is what we have to do this week. After discussing the dilemma of whether new technologies should be adopted by the schools or not; a certain group direction has emerged. Read your group leaders summary carefully and respond to the following to questions.

1. What is your reaction to the discussion topic as it evolved within the group?

2. What is your final resolution to the dilemma?

Appendix C

	CODES	MEANING		CODES	MEANING
A	Control Position on Dilemma		AA	Tx Position on Dilemma	
1	CPRO	Control Pro (for computer technology)	43	TPRO	Treatment Pro (for computer technology)
2	CCON	Control Con (against computer tech.)	44	TCON	Treatment Con (against computer tech.)
3	CN	Control Neutral (don't care, don't know)	45	TN	Treatment Neutral (don't care, don't know)
4	CB	Control Both (could be both, it depends)	46	TB	Treatment Both (could be both, it depends)
B	Control Support of Position on Dilemma		BB	Tx Support of Position on Dilemma	
5	CSUPPRO	Supports Argument for Tech.	47	TSUPPRO	Supports Argument for Tech.
6	CNSUPPRO	No Support of Argument Tech.	48	TNSUPPRO	No Support of Argument Tech.
7	CEXSUPPRO	Uses Examples for Support Tech.	49	TEXSUPPRO	Uses Examples for Support Tech.
8	CNEXSUPPRO	No Use of Examples for Support Tech.	50	TNEXSUPPRO	No Use of Examples for Support Tech.
9	CSUPCON	Supports Argument for Against Tech.	51	TSUPCON	Supports Argument for Against Tech.
10	CNSUPCON	No Support of Argument Against Tech.	52	TNSUPCON	No Support of Argument Against Tech.
11	CEXSUPCON	Uses Examples for Support Against Tech.	53	TEXSUPCON	Uses Examples for Support Against Tech.
12	CNEXSUPCON	No Use of Examples for Support Against Tech.	54	TNEXSUPCON	No Use of Examples for Support Against Tech.
C	Control Perspective of Dilemma Evaluation		CC	Tx Perspective of Dilemma Evaluation	
13	CEPE	Control Evaluation Based on Personal Experience	55	TEPE	Tx Evaluation Based on Personal Experience
14	CEBK	Control Evaluation Based on Background Knowledge	56	TEBK	Tx Evaluation Based on Background Knowledge
15	CEBTP	Control Evaluation Based on Teacher Perspective	57	TEBTP	Tx Evaluation Based on Teacher Perspective
16	CEBSP	Control Evaluation Based on Student Perspective	58	TEBSP	Tx Evaluation Based on Student Perspective

D	Control Nature of Dilemma Evaluation		DD	Tx Nature of Dilemma Evaluation	
17	CEC	Control Evaluation Cognitive	59	TEC	Tx Evaluation Cognitive
18	CEE	Control Evaluation Emotional	60	TEE	Tx Evaluation Emotional
19	CES	Control Evaluation Social	61	TES	Tx Social
20	CEPRB	Control Evaluation Problem	62	TEPRB	Tx Evaluation Problem
21	CESOL	Control Evaluation Solution	63	TESOL	Tx Evaluation Solution
22	CER	Control Evaluation Reasoning	64	TER	Tx Evaluation Reasoning
23	CECT	Control Evaluation Critical Thinking	65	TECT	Tx Evaluation Critical Thinking
24	CEDM	Control Evaluation Decision Making	66	TEDM	Tx Evaluation Decision Making
25	CECMPR	Control Evaluation Compromise	67	TECMPR	Tx Evaluation Compromise
E	Control Nature of Response to Others		EE	Tx Nature of Response to Others	
26	CRCH	Control Response Challenging	68	TRCH	Tx Response Challenging
27	CRCHM	Control Response Challenge Multiple Points	69	TRCHM	Tx Response Challenge Multiple Points
28	CRU	Control Response Understanding	70	TRU	Tx Response Understanding
29	CRA	Control Response Aggressive	71	TRA	Tx Response Aggressive
30	CRD	Control Response Detached	72	TRD	Tx Response Detached
31	CRC	Control Response Cognitive	73	TRC	Tx Response Cognitive
32	CRE	Control Response Emotional	74	TRE	Tx Response Emotional
33	CRS	Control Response Social	75	TRS	Tx Response Social
34	CRPRB	Control Response Problem	76	TPRB	Tx Response Problem
35	CRSOL	Control Response Solution	77	TSOL	Tx Response Solution
36	CRR	Control Response Reasoning	78	TR	Tx Response Reasoning
37	CRCT	Control Response Critical Thinking	79	TCT	Tx Response Critical Thinking
38	CRDM	Control Response Decision Making	80	TDM	Tx Response Decision Making
39	CRCMPR	Control Response Compromise	81	TCMPR	Tx Response Compromise
F	Control Nature of Position Change		FF	Tx Nature of Position Change	
40	CCGG	Control Change	82	TCGG	Tx Change
41	CCGL	Control Change Based on Logic	83	TCGL	Tx Change Based on Logic
42	CCGNL	Control Change Based on NO Logic	84	TCGNL	Tx Change Based on NO Logic

ABOUT THE AUTHORS

Dr. Spatariu is an Assistant Professor teaching research methods courses in the Graduate Education Department at Georgetown College. His research interests are online asynchronous discussions, web-based Math problem solving feedback, and teachers' epistemological beliefs.

Dr. Winsor is an Assistant Professor teaching doctoral level Educational psychology courses at the University of Memphis. Her research interests are the use of technology in the early childhood and teacher education; and student personal epistemology.