

Asynchronous Discussion Forums: A Closer Look at the Structure, Focus and Group Dynamics that Facilitate Reflective Thinking

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Abstract

The purpose of this study was to examine the potential of asynchronous discussion forums (ADFs) as a medium to facilitate reflective thinking among preservice teachers. Of particular interest was the extent and manner in which this potential varies with respect to (a) the structure of the ADF, (b) the focus of the ADF, and (c) group dynamics. Quantitative and qualitative research methods revealed findings that support the potential of this medium as a means to facilitate reflective thinking. Importantly, however, the findings presented here bring to light several additional important considerations for both practice (e.g., strategic student placement within groups to facilitate higher levels of learning) and research (e.g., relationships between social dialogue, group membership, and demonstrated levels of learning) involving the use of asynchronous discussion forums.

Background

Reflective Thinking

Engaging preservice teachers in activities that call for reflective thinking has become a prevalent focus of teacher education programs (Houston & Warner, 2000; Schön, 1991). Preservice teachers are often prompted to reflect critically on reading assignments, peer-teaching activities (e.g., microteaching lessons), and practicum teaching experiences (Merseeth, 1996; Valli, 1992; Zeichner, 2002). Strategies such as individual journal writing, class discussions, and conferencing are widely supported as a means to facilitate as well as to assess and evaluate this type of thinking (Christensen, Wilson & Sunal, 2004; Cruickshank, Bainer, and Metcalf, 1999; Loughran, 2002).

More recently, asynchronous communications have gained considerable attention as an innovative, potential means to facilitate reflective thinking – particularly, via asynchronous discussion forums (ADFs; e.g., Dede, 2002; Edens, 2000; Kahn, 1997). Based on an international analysis of 130 institutions offering courses on the Internet, interviews with key persons at these institutions, and the research literature, Paulsen (2000) noted that this medium “provide(s) time to prepare and reflect on comments and contributions” and “provide(s) unique opportunities to utilize discourse transcripts for analytical and reflective assignments” (p. 130). Levin (1999) examined the purpose and content of the following types of asynchronous communications: (a) student-to-peer emails, (b) student-to-key-pal (preservice teachers in another state) emails, (c) student-to-instructor emails, and (d) student-to-group ADF postings (via TopClass platform). Using a constant comparative method of data analysis, Levin found students to engage in reflective thinking as questions and uncertainties regarding curriculum issues and teaching practices were shared. Among the four types of asynchronous communications, however, Levin reported that reflective thinking was most readily prompted via student-to-group dialogue within the ADF.

As suggested by Levin (1999) and well-supported by others (e.g., Dede, 2002; Jonassen, 2000; Lin, Hmelo, Kinzer, & Secules, 1999), ADFs facilitate reflective thinking as multiple perspectives and individual reasoning are made explicitly visible among groups of peers. Levin further speculated that reflective thinking may be prompted within this larger audience as alternative perspectives and varying levels of reasoning scaffold the learning of others. Additionally, with the inherent preservation of asynchronous text, ADFs prompt careful analysis and thoughtful synthesis of discussion contributions – encouraging reflective thinking (Harasim, Hiltz, Teles, & Turoff, 1995; Jonassen, 2000; Paulsen, 2000).

Structure and Focus of the ADF

While ADFs offer the potential to facilitate reflective thinking, it is important to recognize that this potential is not necessarily inherent in the medium. Parallel to the traditional classroom setting, the structure and focus of ADFs are important facets to consider. Hara, Bonk, and Angeli (2000) examined a highly structured ADF, where students were required to discuss assigned readings utilizing a specifically structured peer-group discussion format. Nicholson and Bond (2003) were interested in the voluntary use of an unstructured ADF, where students were encouraged to discuss observations and insights pertaining to intern teaching experiences.

Although each of these studies support the potential of this medium to facilitate reflective thinking, limitations imposed by the particular structure and focus of each ADF were brought to light, as well. Hara et al. (2000) found that, although this medium provided students with the time needed to “reflect on course content and make in-depth cognitive and social contributions” (p. 140), students limited their participation efforts to the course requirement of one posting per week. Nicholson and Bond (2003) reported that, although reflective thinking developed over time as students voluntarily participated in an unstructured ADF, not all of the students participated in this discussion forum. Further observations also found an overall decrease in participation among groups of students in semesters that followed.

The findings and conclusions drawn by each of these studies bring to light important questions regarding the structure and focus of the ADF. In particular, to what extent and in what manner does the structure and focus of an ADF impact the potential of this medium to facilitate reflective thinking? In conjunction with the structure and focus of

the ADF, to what extent and in what manner do the social dynamics among individuals facilitate this potential? As Nicholson and Bond (2003) found, while an ADF may be widely received by some, it may be ignored by others. Furthermore, while participation may demonstrate careful thought and reflection by some, others may participate in a more superficial manner. To what extent and in what manner do the social dynamics among groups of individuals prompt and/or foster meaningful participation in the ADF?

Examining the Structure and Focus of the ADF

Empirical research examining the potential for ADFs to facilitate reflective thinking is increasing at a remarkable rate (e.g., Levin, 1999; Nicholson & Bond, 2003). Importantly, however, few studies have examined this potential explicitly with respect to the structure and focus of this medium. Furthermore, important insights are needed regarding the extent and manner in which social dynamics among individuals facilitate and/or impede meaningful discussions among groups of peers. Such insights will contribute to the growing body of research in this area – and, in turn, contribute toward achieving the full potential that this medium has to offer teacher education.

Procedure

The purpose of this study was to examine the potential for ADFs to foster reflective thinking among preservice teachers. Of particular interest was (a) the extent to which and manner in which this potential varies with respect to the structure and focus of this medium, and (b) the social dynamics demonstrated among different groups of individuals. Drawing from the work of Benjamin Bloom (1994), reflective thinking was operationalized with respect to levels of cognitive processing. Social dynamics were examined in terms of the interactive and social dialogue that took place within the ADF setting.

Participants and setting. The participants in this study were 32 preservice teachers who were enrolled in a science teaching methods course in an urban university in the southwestern United States. The class was held for 14 weeks in a traditional teaching methods classroom. WebCT (<http://www.webct.com/>) was used to develop three different ADFs that supplemented the learning that occurred within this traditional setting. As an integral component of this science methods course, WebCT participation accounted for 20% of students' final grades. Although students may have accessed WebCT through their home or school systems, access was ultimately ensured by the availability of WebCT throughout the university's libraries and computer labs.

Parallel to strategies used to foster meaningful group discussions in the traditional classroom, ADF-based discussions took place within small groups of five to six students. These groups were randomly assigned at the start of the session and remained intact throughout the duration of the course. As a means of investigating the extent to which and manner in which the structure and focus of ADFs facilitate reflective thinking, WebCT's bulletin board feature was specifically structured into the following three discussion forums: (a) Readings, (b) Methods, and (c) Practicum.

Among these three forums, the Readings forum was the most highly structured. Utilizing Hara et al's (2000) *starter/wrapper* format, each student selected one particular week to assume the role of the starter and another week to take on the role of the wrapper. The starter for each particular week was responsible for initiating a discussion pertaining to the assigned weekly readings by posting pertinent questions within this forum. At the end of the week, the wrapper attempted to summarize key contributions, highlighting

overlapping ideas, problematic issues, student disagreements, and future directions to be explored.

In contrast to the Readings forum, the Methods forum and the Practicum forum were highly unstructured. Students were expected to post a minimum of one reflective summary to each of the two forums every 2 weeks. The focus of the discussions in the Methods forum was on microteaching activities, in which students taught abbreviated science lessons to their peers within the classroom component of the teaching methods course. The focus of the Practicum forum was on students' practicum teaching experiences and related observations. Students were encouraged at the beginning of the course to draw from previous discussions, additional experiences, and course readings as they reflected on these experiences.

Research questions. With this structure in place, this study set out to investigate the following questions:

1. To what extent and in what manner do student's demonstrated levels of cognitive processing develop throughout the course of a semester?
2. Do levels of cognitive processing demonstrated throughout the course of the semester vary with respect to each of the three different discussion forums?
3. Do demonstrated levels of cognitive processing vary with respect to each of the six different teams of preservice teachers?

Ultimately, this study examined possible patterns and relationships between demonstrated levels of cognitive processing and (a) group interactivity and (b) social dialogue.

Methods of Analysis

Using an adapted model of what Tashakkori and Teddlie (1998) described as a QUAN-QUAL sequential analysis, both quantitative and qualitative methods were employed to examine possible relationships between identified levels of cognitive processing and social dynamics among groups of preservice teachers – with respect to the structure and focus of the ADF. Tashakkori and Teddlie explained that the objective of this model is to identify specific components of a construct (subconstructs) through the analysis of quantitative data, then “expand upon the information that is available regarding these subconstructs” (p. 135).

In accordance with this mixed-methods research design, quantitative profile analysis procedures were first used to identify and further examine levels of cognitive processing demonstrated among six different groups of preservice teachers as they participated in three uniquely structured ADFs that served as a supplementary component to a classroom-based teaching methods course. Qualitative procedures were then used to examine the social dynamics within those groups of preservice teachers that demonstrated in-depth levels of cognitive processing. In particular, drawing from the work of Miles and Huberman (1994), matrices were used to identify possible patterns in group interactions and social dialogue – particularly, within those groups of preservice teachers that demonstrated statistically significant levels of cognitive processing.

Content analysis of transcripts. Foundational to this study was the content analysis of the computer-mediated transcripts generated by each of the six teams of preservice teachers, as they participated in each of the three different discussion forums throughout the 14-week semester. Henri (1992) developed an analytical model for the content

analysis of computer-mediated dialogue consisting of the following five dimensions: (a) participative, (b) social, (c) interactive, (d) cognitive, and (e) metacognitive. What Henri referred to as the cognitive dimension was a primary focal point of this study. Drawing from the work of Benjamin Bloom (1994), together with this later work of Henri, the following categories were used for the content analysis of demonstrated levels of cognitive processing via the computer-mediated transcripts generated: (a) knowledge/comprehension, (b) application, (c) analysis/synthesis, and (d) evaluation. With each individual posting established as the unit of analysis, regardless of length, each posting was categorized with respect to this cognitive framework. This cognitive framework, together with a description and example within each category, is provided in the [Appendix](#).

In conjunction with this cognitive framework, the interactive and social dimensions of Henri's (1992) work were used to identify patterns in group interactivity and social dialogue. Group interactivity was examined with respect to the following categories offered by Henri: (a) communication of information, (b) a first response to this information (first-level response), and (c) a second response related to the first response (second-level response). The extent of interactivity that unfolded throughout the course of the semester called for the fourth category, a third response related to the second response (third-level response) to be added to this model.

Henri (1992) defined social dialogue as "a statement or part of a statement not related to formal content of subject matter" (p. 126). Hara et al. (2000) examined this dimension of Henri's framework with respect to the following social cues: (a) a self-introduction, (b) expression of feeling, (c) greeting, (d) closure, and (e) compliments to others. These social cues were used as indicators to identify social dialogue postings. Postings that clearly displayed any one or a combination of these social cues were categorized as "social dialogue."

The coding procedures used to categorize each posting were validated through interrater reliability. Duplicate copies of the postings exchanged during four specific weeks of the semester were independently coded by three different raters. The interrater reliabilities for the social and interactive dimensions were 90% and 85%, respectively, and 85% for the cognitive dimension. All discrepancies were discussed until 100% agreement was reached.

Profile analysis of data. The extent to which and the manner in which demonstrated levels of cognitive processing developed throughout the course of the semester, within each of the three different discussion forums, and within each of the six teams of preservice teachers, were analyzed using quantitative measures. Specifically, a profile analysis approach, as described by Tabachnick and Fidell (1996), was used to determine if the levels of cognitive processing demonstrated throughout a 14-week semester varied statistically significantly among the six teams of preservice teachers as they participated in each of the three different discussion forums.

In accordance with the profile analysis approach described by Tabachnick and Fidell (1996), the numeric representations of the coded transcripts generated through the preliminary content analysis procedures were used to analyze the main effects and interactions among the three different discussion forums and six different teaching teams that developed throughout the semester. The interactions examined the levels of cognitive processing demonstrated within each of the six teams of preservice teachers as they participated in three different discussion forums throughout the semester (i.e., the *parallelism*). The main effects examined the following patterns: (a) the levels of cognitive processing demonstrated throughout the semester within each of the three discussion

forums, independent of teaching teams, (b) the levels of cognitive processing demonstrated throughout the semester within each of the six different teaching teams, independent of discussion forums, and (c) the levels of cognitive processing that were demonstrated throughout the semester, independent of discussion forums and teaching teams (i.e., the *flatness*).

Post hoc and sequential analysis. Since this analysis involved more than two levels of possible statistically significant effects, it was necessary to perform a contrast analysis to determine the specific source of any variation revealed. Based on the recommendation of Tabachnick and Fidell (1996) with regard to profile analysis procedures, Scheffé's (1953) contrast analysis was most appropriate for this study. Following Tashakkori and Teddlie's (1998) sequential mixed-methods research design, in conjunction with Miles and Huberman's (1994) recommendations for the analysis of qualitative data, the structure and focus of the ADF was further examined with respect to the extent of interactive and social dialogue exchanged among those teams of preservice teachers who demonstrated in-depth levels of cognitive processing.

Results

Content Analysis

A total of 1,145 postings were exchanged among the 32 students who were enrolled in the 14-week semester teaching methods course. Among the 1,145 postings, 877 were coded according to the level of cognitive processing made explicitly visible (knowledge/comprehension, application, analysis/synthesis, or evaluation). The 268 postings omitted from this analysis were those that were simply questions about assignments, project due dates, and absenteeism. An overview of the number of postings that were exchanged among each of the six teams of preservice teachers within each of the three discussion forums is provided in Table 1.

Table 1
Number of Postings Exchanged Within (a) Six Teams of Preservice Teachers and (b) Three Discussion Forums

Team	Discussion Forums			Total
	Readings	Methods	Practicum	
1	62	44	72	178
2	65	40	59	164
3	44	33	68	145
4	53	32	43	128
5	38	20	39	97
6	48	62	55	165
Total	310	231	336	877

Interactive dialogue. Using Henri's (1992) recommendation for the analysis of interactive dialogue, all 877 postings were coded according to the manner in which they contributed to an interactive dialogue. This precise classification schema, together with detailed observations of the postings exchanged within each of the six teams of preservice teachers

readily illustrated the highly interactive nature of the asynchronous discussions that took place within Team 1 and Team 6. Individuals within each team not only responded to each posting identified as a first communication of information (first-level response), but also to the responses of their peers (second-level contribution), who in turn, most often provided a final (third-level) response. As substantiated via further observations of the dialogue exchanged, topics and issues were thoroughly addressed within each of these teams prior to moving on to a different topic. No postings were made in isolation of the topic being addressed.

Social dialogue. Out of the 877 postings exchanged throughout the course of the semester, 416 of these postings contained social dialogue. Among the six teams of preservice teachers, the greatest amount of social dialogue was identified in the postings exchanged within Team 6. Sixty-four percent of the 165 postings exchanged within this team contained dialogue of a social nature (105 postings). Among the three uniquely structured ADFs, the greatest amount of social dialogue took place within the Practicum discussion forum. Within this forum, 206 of the 336 postings exchanged contained social dialogue.

Profile Analysis of Cognitive Processing

A profile analysis was performed on the 877 postings coded according to the type of cognitive processing that was made explicitly visible. Cognitive processing was measured on a scale of 1 through 4, with 1 = *knowledge/comprehension*, 2 = *application*, 3 = *analysis/synthesis*, and 4 = *evaluation*. To examine the patterns in cognitive processing throughout the course of the semester, means were calculated within four 3-week intervals. The profiles of the cognitive processing means demonstrated in the computer-mediated dialogue exchanged within each of the six teams of preservice teachers as they participated in each of the three different discussion forums throughout each of the four 3-week intervals are displayed in Table 2.

SPSS (Statistical Package for the Social Sciences) multivariate analysis of the variance (MANOVA) was used for the primary analysis of cognitive processing patterns. Reflecting a multivariate approach of repeated measures analysis of the variance (ANOVA), measures of cognitive processing at each of the four 3-week intervals throughout the course of the semester were treated as a set of four dependent variables. The variation in the cognitive processing displayed throughout these four 3-week intervals was found to be a statistically significant deviation from flatness, $F(3, 873) = 7.98, p < .001$. With partial eta squared (η^2) = .027, however, the practical significance was not substantial. When examined as a function of both (a) teaching team and (b) discussion forum, the patterns of demonstrated cognitive processing levels throughout the course of the semester indicated a statistically significant deviation from parallelism, $F(30, 805) = 1.803, p = .006$. With partial $\eta^2 = .063$, this deviation was also of practical significance – suggesting an important relationship between these two factors and demonstrated levels of cognitive processing.

Table 2 <i>Profiles of Cognitive Processing Means Displayed in the CMC Within (a) Six Teams of Preservice Teachers, and (b) Three Discussion Forums Across Four 3-Week Intervals</i>						
Team	Forum	Intervals				M
		I	II	III	IV	
1	R	2.41	3.35	2.71	3.50	2.89
	M	2.60	3.13	3.12	2.43	2.84
	P	1.81	2.23	2.87	2.30	2.28
	M ^a	2.18	2.73	2.89	2.54	2.63 ^b
2	R	2.31	1.85	2.00	2.25	2.09
	M	2.38	2.35	1.88	1.50	2.23
	P	2.19	1.73	1.83	2.00	1.95
	M ^a	2.29	2.02	1.92	2.07	2.07 ^b
3	R	1.95	2.41	3.00	3.38	2.45
	M	2.25	2.00	2.89	1.67	2.25
	P	1.42	2.10	1.91	1.90	1.81
	M ^a	1.85	2.22	2.52	2.33	2.19 ^b
4	R	2.24	2.11	2.25	1.80	2.11
	M	2.00	2.50	2.64	2.25	2.42
	P	2.06	1.88	2.40	2.38	2.13
	M ^a	2.14	2.07	2.44	2.12	2.19 ^b
5	R	1.63	1.63	2.90	3.50	2.16
	M	1.00	1.00	1.60	2.00	1.45
	P	1.50	1.64	2.11	2.29	1.82
	M ^a	1.48	1.44	2.33	2.60	1.88 ^b
6	R	1.92	2.68	2.38	2.75	2.43
	M	2.83	2.72	3.85	3.67	3.27
	P	2.14	2.56	2.11	2.83	2.41
	M ^a	2.29	2.65	3.02	3.08	2.76 ^b
	M ^c	2.04	2.29	2.53	2.45	2.29 ^d
<p>Note. R = Readings forum; M = Methods forum; P = Practicum forum. ^aMean of team within each of the four separate intervals. ^bOverall mean of each team. ^cMean of each interval. ^dOverall mean of teams across intervals.</p>						

Development Over Time

Pairwise comparisons of the marginal means in each of the four 3-week intervals were used to analyze the statistically significant deviation from flatness. With alpha set at .0125 to achieve an experiment-wise $\alpha = .05$, Interval I was found to vary statistically significantly from Interval III ($p < .001$). Although no statistically significant difference was found in the remaining pairwise comparisons, a graphic illustration of each of these means (see Figure 1) depicts an increase in cognitive processing throughout intervals I, II, and III, followed by a decrease during the final 3-week interval (2.04, 2.29, 2.54, and 2.45, respectively).

Interactions: Teaching teams and discussion forums. A doubly multivariate design was used to analyze the effects of (a) teaching team and (b) discussion forums on the levels of cognitive processing demonstrated throughout the course of the semester. Multivariate analysis revealed a statistically significant difference among the six teams of preservice teachers in the combined cognitive processing means from each of the four 3-week intervals, $F(15, 805) = 1.803, p < .001, \eta^2 = .054$. No statistically significant effect was found, however, between each of the three discussion forums in the combined means of the cognitive processing within each the four 3-week intervals, $F(6, 805) = 1.085, p = .370$.

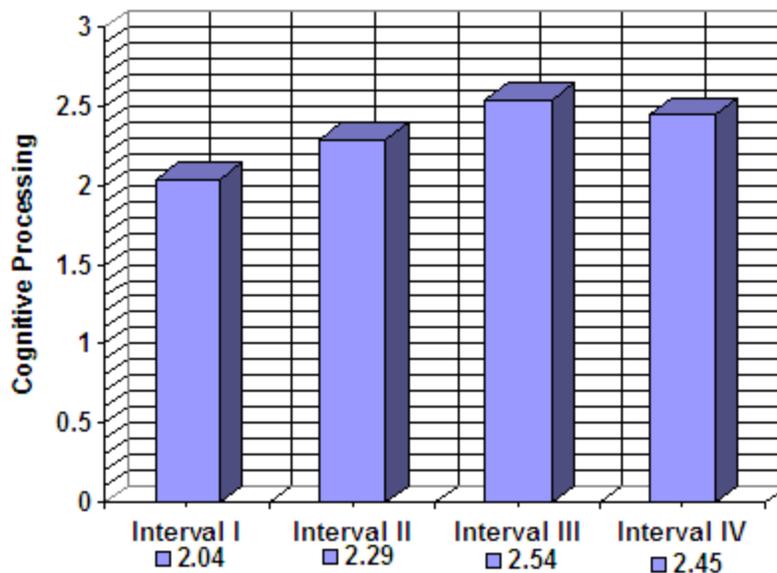


Figure 1. Cognitive processing across intervals

Interactions: Teaching teams over time. Two-way ANOVA procedures were used to examine the statistically significant difference in the cognitive processing means between each of the six teams of preservice teachers in each of the four 3-week semester intervals. Confidence limits were calculated around the combined mean of the profiles for the six teams of preservice teachers in each of the four 3-week intervals. To achieve an experiment-wise error at 5%, the cognitive processing mean of each teaching team was evaluated within a 99.8% confidence interval ($\alpha = .002$).

As displayed in Table 3, the mean of one or more teaching teams fell outside of these limits in each of the four intervals. With a mean of 1.38 and 1.44 in cognitive processing displayed during Interval I and II, respectively, Team 5 was the only team with a mean reliably lower than the combined mean in each of the four 3-week intervals. With a mean of 2.90 and 2.65, respectively, the cognitive processing displayed by Team 1 and Team 6 was reliably higher than the combined mean during Interval II ($M = 2.29$). The mean in cognitive processing displayed by Team 1 and Team 6 (2.89 and 3.02, respectively) continued to be reliably higher than that of the combined mean during Interval III. During Interval IV, only the cognitive processing displayed in the postings by Team 6 ($M = 3.08$) was found to be reliably higher than that of the combined mean for this final interval ($M = 2.45$).

Table 3
Comparisons in Cognitive Processing Profile Means of Each Teaching Team Across Each of the Four 3-Week Intervals

Team	Intervals				M^a
	I	II	III	IV	
1	2.18	2.90*	2.89*	2.54	2.63
2	2.29	2.02	1.92	2.07	2.07
3	1.85	2.22	2.52	2.33	2.19
4	2.14	2.07	2.44	2.12	2.19
5	1.38*	1.44*	2.33	2.60	1.88
6	2.17	2.65*	3.02*	3.08*	2.73
M^b	2.04	2.29	2.53	2.45	

^aMean of each team across intervals.
^bMean of each interval over teams.
 * $p < .002$

The extent to which and the manner in which demonstrated levels of cognitive processing varied between each of the teaching teams throughout the course of the semester was further examined by plotting the cognitive processing means of each of the six teams for each of the four 3-week semester intervals. An analysis of these plots revealed both ordinal and disordinal interactions among the six teams of preservice teachers throughout the course of the semester. These interactions are graphically illustrated in Figure 2.

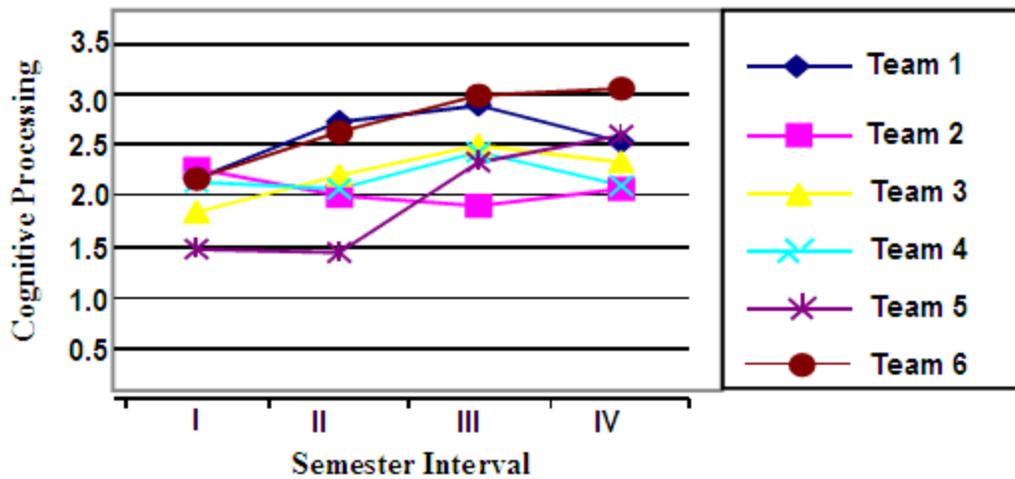


Figure 2. Interactions between cognitive processing means of each of the six teams of preservice teachers throughout each of the four 3-week intervals of the semester

Discussion forums. With no statistically significant difference found among the three discussion forums in the combined means of cognitive processing that unfolded throughout the course of the semester, further analysis of their interactions throughout each of the four 3-week semester intervals was not warranted. However, to gain further insight toward the speculated importance of the structure and focus of ADFs, the relationship between each of these three forums and demonstrated levels of cognitive processing was examined. Using one-way ANOVA procedures, differences in the cognitive processing means of each of the three discussion forums was found to be statistically significant, $F(2, 872) = 9.312, p < .001$. With $\eta^2 = .021$, however, the practical significance of this difference was minimal. Scheffe's (1953) post hoc comparison procedures indicated that the demonstrated levels of cognitive processing within the Practicum discussion forum was statistically significantly lower than that displayed within both (a) the Readings discussion forum ($p < .005$) and (b) the Methods discussion forum ($p < .001$; see Table 4).

Table 4
Results of Scheffé's (1953) Post Hoc Comparisons of Cognitive Processing Levels Displayed in Each Discussion Forum

	M	Readings	Methods	Practicum
Readings	2.37	-	.09	.28*
Methods	2.46	.09	-	.37**
Practicum	2.09	.28*	.37**	-
Overall M	2.29			

Note. M = Mean level of cognitive processing displayed within each discussion forum
 * $p < .005$
 ** $p < .001$

Discussion

The quantitative profile analysis and subsequent qualitative analysis of the computer-mediated dialogue exchanged among these six different teams of preservice teachers within these three different discussion forums throughout a 14-week semester teaching methods course support conclusions drawn by others (e.g., Hara et al., 2000; Nicholas & Bond, 2003). In particular, ADFs do have the potential to facilitate reflective thinking among preservice teachers. Importantly, based on these findings, such thinking processes seemed to develop over time and varied with respect to (a) the structure and focus of the medium and (b) social dynamics within groups. The section that follows will elaborate first on the demonstrated levels of cognitive processing that developed over time and within each of the three uniquely structured discussion forums. Interpretations and implications of the identified levels of interactive and social dialogue will then be discussed.

Progression of Demonstrated Levels of Cognitive Processing

The levels of cognitive processing demonstrated in each of the 877 postings examined varied throughout the course of the semester. This variation in cognitive processing suggests that students began to think about teaching and learning in a more cognitively complex manner throughout the first 12 weeks of the semester. During the last interval of the semester, however, cognitive processing levels were found to decrease. Examining the written dialogue exchanged within this last interval strongly suggests that this decline was merely indicative of the increasingly relaxed manner in which students contributed to discussions as the semester was winding down. Thus, the findings from this study illustrate the potential for ADFs to facilitate reflective thinking among preservice teachers.

Following Clark's (1994) line of reasoning, although demonstrated cognitive processing levels increased throughout the course of the semester as students engaged in computer-mediated dialogue, this increase is not necessarily inherent in the use of this instructional medium. This medium merely provided a potential means to facilitate higher levels of cognitive processing. As the findings of this study suggest, the structure and focus of the medium play an important role in recognizing this potential. A closer look at the dialogue exchanged within each of the uniquely structured and focused discussion forums provides further insight toward this role.

ADFs: Structure and Focus

Practicum forum. Among the three different discussion forums, the Practicum discussion forum was the least structured in terms of its focus and participation format. Every 2 weeks students were simply expected to share their practicum teaching observations and experiences. Supporting practical speculation, the computer-mediated dialogue exchanged in this forum did not demonstrate in-depth levels of cognitive processing. Rather than synthesizing and analyzing various aspects of practicum teaching experiences, students simply shared these experiences in a storytelling manner. Thus, continuing to support practical speculation, these findings suggest that when left highly unstructured and open ended, ADFs do not readily lend themselves to cognitively in-depth discussions.

Although in-depth levels of cognitive processing were not demonstrated in this ADF, it is important to note that students posted the greatest number of postings to this forum. As made apparent through further observations of the nature of the dialogue exchanged in this forum, students readily took advantage of this ADF as a medium to solicit and provide input concerning shared teaching experiences. Furthermore, throughout the course of the semester, several students expressed their appreciation for this forum, as it provided a means to share teaching experiences. Thus, while unstructured ADFs may not prompt in-depth levels of cognitive processing, this research does support conclusions drawn by several others (e.g., Bodzin & Park, 1998; Edens, 2002) – namely, unstructured ADFs can be a valuable resource for preservice teachers to seek social-emotional support among peers with shared teaching experiences.

Readings Forum. The computer-mediated dialogue exchanged within the Readings forum demonstrated higher levels in cognitive processing than did the dialogue within the Practicum forum. Contributing toward this demonstrated level in thinking was the focus of the discussions within this forum. The discussions that took place within the Readings forum were structured explicitly to generate meaningful dialogue concerning the issues and topics addressed in the assigned readings. The assigned starter for each week was responsible for posting two to three questions that would generate in-depth discussions concerning what was thought to be among the most relevant issues and topics addressed in the readings. Thus, unlike the Practicum forum, this forum did not elicit discussions based merely upon shared experiences, but rather insights and understandings concerning particular topics of teaching and learning.

Although the explicit focus of the discussions within this forum seemed to prompt in-depth levels of cognitive processing, further observations of the dialogue exchanged within this forum revealed a lack of reflective thought toward posted responses. Contributing to this shortcoming was the lack of interactivity fostered via this highly structured, starter/wrapper format. In particular, supporting the findings from Hara et al.'s (2000) study, this highly structured format impeded interactive dialogue, as students limited their participation to the requirement of one posting per week, responding to the weekly starter questions. As a result, while many individual postings contained responses that demonstrated in-depth levels of cognitive processing, many of these postings were made in a rather didactic manner – simply addressing the questions at hand.

This structure prompted responses that were of this didactic nature. Further observations of student postings, however, found little evidence of students taking advantage of this medium to deliberately lurk – looking for a correct response for the week's discussion question(s). While lurking has been well cited as one of the disadvantages inherent to this instructional medium (e.g., Hatton & Smith, 1995; Mason, 1991), this study did not find lurking to be problematic. To the contrary, students who were among the last to post a response to a starter question often expressed frustration, as they were challenged to contribute insights that were not already posted by their peers. Thus, in light of the extent to which and the manner in which students recognized the ideas presented by their peers, these findings suggest that explicitly focused ADFs have the potential to facilitate meaningful learning. However, given the limited participation and lack of interactivity, highly structured ADFs may not be particularly conducive to developing the habits of the mind that facilitate reflective thinking.

Methods Forum. The dialogue exchanged in the Methods forum demonstrated in-depth levels of cognitive processing. Similar to the Readings forum, a likely factor contributing to this demonstrated depth may have been the directed focus – addressing various aspects of learning to teach. Students were to address a particular aspect of learning to teach, within the context of microteaching experiences in the classroom component of the

course. Unlike the Readings forum, however, rather than providing an explicitly structured format for student participation, students were simply required to discuss their thoughts on the given topic approximately every other week. Closer examination of this dialogue revealed a less regimented manner in which students contributed to this ADF, as thoughts, insights, and understandings were openly and willingly exchanged.

Social Dynamics

It is important to note that not all teams demonstrated in-depth levels of cognitive processing in the dialogue exchanged within this ADF. In particular, as revealed by profile analysis of the levels of cognitive processing demonstrated within each of the six teams of preservice teachers, only two teams – Team 1 and Team 6 demonstrated levels of cognitive processing statistically significantly greater than the mean cognitive processing level. Further observations of the postings exchanged within each of these two teams provided meaningful insights toward the importance of (a) group interactivity, and (b) social dialogue – within the ADF context. Interpretations and implications of these findings will be elaborated upon in the discussion that follows.

Team 1: Group interactions. The content analysis of the computer-mediated transcripts generated by Team 1 throughout the course of the semester revealed a progression of demonstrated levels of cognitive processing – from low to cognitively complex. This finding becomes increasingly interesting when juxtaposed with the nature of the interactive dialogue observed within this team. In particular, close examination of the nature of the interactive dialogue that was exchanged within this team suggests that the progression toward higher levels of cognitive processing was fostered via peer scaffolding. Specifically, situated within Vygotsky's (1978) notion of the zone of proximal development, individuals demonstrating higher levels of cognitive processing appeared to scaffold the learning of others, prompting and supporting more complex levels of thinking.

Playing a key role in this progression was the notably high level of cognitive processing demonstrated consistently by one student within this team, Katherine. (Names are replaced with pseudonyms.) Demonstrating in-depth levels of thinking from the start of the semester, Katherine seemed to take on the role of an informal mentor as she prompted her peers to reflect on existing thoughts and interpretations regarding various aspects of teaching and learning. Demonstrating the nature of such interactions is the following dialogue between Katherine and two of her peers, Emily and Lisa:

Emily: I have no idea what we were to get out of today's class. I had fun using the equipment and measuring things, but how will that help us learn to teach? I was thinking that maybe we were missing a lesson plan for this? Any other thoughts?

Lisa: I totally agree with you. I have no idea what the purpose of this activity was. I think we were missing the lesson plan for the activity.

Katherine Hi Emily and Lisa. I don't think we were missing a lesson plan for this activity. Let me ask you this. What did YOU learn about measurements and the properties of water in the activity? How did YOU learn this? Was a lesson plan involved? I think this activity was intended to demonstrate a new way of learning that we are not use to. How do you think this will influence our own teaching?

As Katherine continued to prompt and model in-depth levels of reflective thinking, the computer-mediated dialogue exchanged within this team demonstrated increasingly complex levels of cognitive processing.

Although these observations illustrate the potential for this medium to foster in-depth levels of thought processing via this mode of peer scaffolding, it is important to recognize that additional factors may facilitate or impede the success of this pedagogical strategy. A closer examination of the computer-mediated dialogue exchanged among the individuals within this particular context illustrates how basic metacognitive thought processing is perhaps a foundational step toward in-depth levels of thinking. Statements such as, "I don't know, that's just what I think," "Maybe it is just me, but I don't understand the purpose of this," and "I'm just not used to this," suggested that individuals within this team were aware of the limitations in their own thinking. With these limitations made explicitly visible in the ADF environment, individuals such as Katherine are given a "foothold" to begin scaffolding peers toward higher levels of thought processing.

The extent to which and the manner in which such cognitive awareness facilitates a progression toward in-depth thinking goes beyond the scope of this study. This dimension of cognitive processing will be further addressed with respect to the implications it has for future research.

Social Dialogue: Team 6. Throughout the course of the semester, computer-mediated discussions became increasingly less formal as students' displayed a steady increase in social dialogue. Notably congruent to this trend were the patterns in demonstrated levels of cognitive processing that unfolded throughout the semester. That is, as students demonstrated increasingly higher levels in cognitive processing, the computer-mediated dialogue that was exchanged became increasingly more social.

Interestingly, Team 6 exemplified this trend, as the discussions taking place within this team not only demonstrated notably high levels in cognitive processing, but also the greatest extent of social dialogue. The following excerpt illustrates the nature of the socializing that became intertwined throughout the dialogue within this team as one member, Derek, used sarcasm to encourage greater participation among his teammates.

Where's the love for K.C., girls? Can't you see she is a distraught individual going through some difficult times right now?...searching hopelessly for the incomprehensible, seemingly unreachable meaning of life...embarking on an inquiry-based journey to understand and make meaning of the world around us...to unveil the very secrets of science which we too desire to have revealed to us...hence driving us all to become overachievers in our science methods course and perplex even [instructor] beyond the point of reason.

While this sense of sarcasm became embedded in the discussions that took place throughout the course of the semester, it did not seem to impede the high level of cognitive processing that continued to be displayed within this team. This was of particular interest, as it marks an important distinction between the traditional classroom context and that of the ADF. In particular, unlike in the traditional classroom environment, the findings presented here suggest that social dialogue in the ADF does not readily impede learning. Given the removal of time constraints, choosing to engage in social dialogue is not inherently at the expense of focused learning. As demonstrated here, social dialogue can take place in conjunction with meaningful exchanges of insights and understandings without readily distracting the learning of others.

While social dialogue in the ADF context may not interfere with the learning process in the same way it does in the traditional classroom setting, it is important to recognize that social dialogue may impact learning in less obvious ways in the ADF context. For instance, while not an auditory distracter, social dialogue within the ADF context can be visually distracting. This aspect of social dialogue will be further addressed with respect to the implications it has for further research.

Summary

In conjunction with the structure and focus of ADFs, the findings presented here suggest that social dynamics within groups play an important role in facilitating cognitively in-depth levels of reflective thinking within this medium. With the inherent ability to make one's thinking explicitly visible, this medium seems to lend itself readily to peer scaffolding. Additionally, given the removal of time constraints, there is not a trade-off between social dialogue and meaningful learning in the ADF context. Unlike in the traditional classroom setting, students who are more cognitively advanced may engage in social dialogue without distracting the learning of others.

Although these findings have important implications for practice, it is important to recognize the limitations of this study. These limitations, in turn, have important implications for future research, as well. These limitations and implications for practice and future research will be addressed in the concluding section of this discussion.

Conclusions

Limitations

The main limitations of this study center around the way reflective thinking is interpreted, recognized, and operationalized. In particular, although reflective thinking continues to be well-supported in practice and receives considerable attention in the research literature, various conceptualizations of this term have resulted in a lack of shared meanings among scholars who write about reflective thinking within the context of teacher education (e.g., Calderhead, 1992; Feiman-Nemser, 1990). Reflective thinking has been conceptualized as (a) an underlying goal of a teacher education program, (b) a means toward the attainment of that or other goals, and (c) the craft of teaching that is derived from professional experience (e.g., Schön, 1991; Valli, 1992). Emerging from each of these conceptualizations are studies examining reflective thinking within the context of (a) preservice teacher education, (b) field experiences, and (c) informal and formal professional development. In addition, studies on reflective thinking historically have been framed from the perspective of exploring what beginning teachers need to know and how they can be trained (Zeichner, 1992) and the role of research-derived knowledge and educational theory in the process of learning to teach (Grimmett, MacKinnon, Erickson, & Reicken, 1990).

The conceptualization of reflective thinking that formed the basis of this study drew from the larger body of literature on learning to teach, in which reflective practices are viewed as a means to facilitate the development of preservice teachers' understandings of teaching and learning (e.g., Carter & Anders, 1996; Loughran & Russell, 1997). Situated within a constructivist framework, this conceptualization highlights the importance of the preconceptions of teaching and learning with which preservice teachers enter into teacher education programs (e.g., Houston & Warner, 2000; Loughran & Russell, 1997). Being reinforced through many years of learning about teaching through an *apprenticeship of observation* (Lortie, 1975), these preconceptions are often deeply rooted and resistant to

change. Supporting prominent researchers and prevalent practices (e.g., Cruickshank et al., 1999; Houston & Warner, 2000), this study conceptualized reflective thinking as a means of facilitating this change.

Situated within this overarching conceptualization, reflective thinking was specifically operationalized within a cognitive framework – simply drawing from the work of Benjamin Bloom (1994) to identify particular levels of cognitive processing demonstrated in the computer-mediated dialogue. With the use of a well-established framework to identify and further analyze demonstrated levels of cognitive processing, this study strived to provide an objective depiction of reflective thinking – leaving it up to the reader to interpret the findings with respect to one’s own conceptualization of reflective thinking.

Bloom’s taxonomy can be an invaluable tool for both practice and research. Importantly, however, understanding how people learn is an inherently complex and multifaceted area of study. Thus, while drawing from a renowned expert in the field, categorizing demonstrated levels of cognitive processing via this framework does oversimplify a dynamically complex process that is not yet fully understood. Consequently, although reliability was established with regard to the coding of the computer-mediated transcripts analyzed in this study, established categories may not be representative of all types of student dialogue. Additionally, student dialogue could perhaps readily “fit” within more than one category of such a specific framework.

An additional limitation of this study was the assumption that students’ computer-mediated dialogue provided an accurate gauge of cognitive processing levels. Although reliability was established with regard to the manner in which this dialogue was coded, the meaning that was drawn from these coded transcripts was based upon the assumption that this dialogue reflected cognitive processing abilities. Extraneous factors such as comfort level, experience, and accessibility are a few among many other factors that may have impacted the level of cognitive processing that was demonstrated in a student’s computer-mediated dialogue.

Implications for Practice and Future Research

The limitations of this study bring to light important areas calling for further research. For instance, given the various ways in which reflective thinking has been conceptualized over the past several decades, a meta-analysis of the various conceptualizations forming the basis of existing studies – particularly, those within the context of the online learning environment – would provide a valuable framework to situate the implications of empirical findings. Along this same line, while the number of studies examining ADFs are growing, it is important to recognize the precise context in which the use of ADFs are situated. Surely there are important distinctions to be made between the use of ADFs as a supplement to the traditional classroom environment and its use as a virtual classroom (i.e., in lieu of the traditional classroom).

As the potential of this relatively new medium for learning continues to be placed under careful scrutiny from a variety of sources, it is of utmost importance that policy makers and other key stakeholders are aware of such distinctions and are subsequently informed by empirical findings that clearly address the precise context in which ADFs are being used. Toward this end, a meta-analysis in which existing studies are situated according to the extent and manner in which ADFs are used would be most valuable in ensuring the success of this new medium for learning.

As this study examined the extent in which and manner in which computer-mediated dialogue varied with respect to the structure and focus of ADFs, it also highlighted additional factors possibly playing an important role in shaping this dialogue. For instance, with the inherent capacity to make individual reasoning explicitly visible, the level of cognitive processing demonstrated among peers can be an important factor influencing or perhaps prompting more advanced levels of thought processing among individual students. Further research that more closely examines the extent and manner in which the demonstrated levels of cognitive processing among peers influences the progression of others toward higher levels of thinking would provide important insights needed to appropriately guide practice. For instance, rather than placing students randomly into groups for discussion, the potential of this medium may best be achieved by the deliberate assignment of students into particular discussion groups based on demonstrated levels of cognitive processing. This strategy, in turn, may be readily accomplished by the examination of preliminary computer-mediated transcripts at the start of a semester.

While ADF computer-mediated transcripts provide an ideal means to create student groups based on particular student attributes, such practices would benefit greatly from additional research that examines these attributes in greater detail. In particular, while practitioners may utilize preliminary computer-mediated discussion transcripts to identify various types of cognitive processing demonstrated by students, questions remain concerning how this information should be utilized. Should those students who demonstrate in-depth levels of cognitive processing be grouped with students demonstrating a range of different levels and types of cognitive processing? What additional attributes – cognitive and/or social – should be considered when placing students into small groups in the ADF environment? The findings presented here suggest that metacognitive dispositions may be an important attribute to take into consideration toward this end. Given the complex nature of such thought processing, clearly, additional research would be needed to address the importance of this particular attribute.

In addition to demonstrated cognitive attributes, demonstrated social attributes may also be an important factor to consider when placing students into groups in the ADF environment. Although this study found social dialogue to be undisruptive, this finding may have been influenced by the particular attributes of the students within these groups. Social dialogue could perhaps impede, as well as facilitate, learning – depending on the attributes and subsequent dynamics of the group members involved. Additional research is needed to provide further insights toward the relationship between social dialogue and demonstrating levels of learning.

Final Considerations

ADFs clearly have the potential to facilitate reflective thinking among preservice teachers. Recognizing this potential, however, is dependent on an array of explicit and implicit factors involved with the complexities of teaching and learning. This study shed light on just a few of these factors. For the potential of ADFs to be fully recognized, it is necessary for additional research to continue examining factors involved with teaching and learning within this medium. Such insights will contribute toward the growing body of research in this area – and, in turn, contribute toward achieving the full potential this medium has to offer teacher education.

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**Appendix
Content Analysis Framework**

Readings Inquiry Teaching/Learning	Methods Learning to Teach	Practicum Experiences in Teaching
Knowledge/comprehension		
Responds to question.	Discusses process of learning to teach in concrete/layperson terms.	Describes what is taking place in practicum classroom.
<p><i>Example: Inquiry based assessment involves in-depth reasoning and concept application. It checks to see what each student understands and what can be done with current knowledge. It works to help students generate questions, develop explanations, design investigations, and use data as evidence for their explanations. On the other hand, more conventional assessments ask students to identify facts, concepts, or definitions. The conventional ways are extremely broad, shallow in depth of reasoning, and too narrow in measuring outcomes.</i></p>		
Application		
Relates topics of readings to concrete personal/professional experiences.	Relates experiences in methods classroom to concrete teaching and learning experiences.	Relates experiences in practicum classroom with relevant concrete pedagogical insights.
<p><i>Example: I'm having some problems with behavioral management. I tried using the suggestion with the lights – but it backfired on me. Does anyone else have any other suggestions?</i></p>		
Analysis/Synthesis		
Examines topic and issues from readings against the backdrop of scholarly resources and well-founded insights.	Critically considers experiences in the methods classroom against the backdrop of scholarly resources and well-founded insights.	Critically considers practicum experiences against the backdrop of scholarly resources and well-founded insights.

Example: *About one month into my practicum, I was still very discouraged with the lack of interest of the students. Students wander around the room constantly for no reason and talk with each other whenever they want. I must confess however that if I were a student I would be doing the same. This teacher acts like a dispenser of knowledge and assumes that the students are empty vessels waiting to be filled. She makes no effort to motivate students or give them a “need to know”. I would be interested in seeing how these students would respond to a more constructivist teacher.*

Evaluation

Examines readings within the context of social/political and personal limitations.

Examines complexities of learning to teach within the context of social/political and personal limitations.

Examines personal & societal limitations.

Examines multiple views/options of learning and teaching.

Example: *...but science is taught more of like a health lesson than science. I know that health is a type of science and the CEF requirements are many so it's probably easier to put the two together, but I think there is so much more out there that needs to be dealt with. Somehow I know that I will bring more of what I consider science to be...asking questions about nature, etc. into my classroom.*