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Implementing Active Learning in an Online Teacher Education Course

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The purpose of this project was to evaluate an online course in child development in which active learning strategies were infused. Preservice teachers taking the course were future elementary teachers seeking initial prekindergarten to sixth-grade teaching certification. Sixty-one persons were enrolled in a traditional face-to-face section of the course, and fifty-four were enrolled in an online section of the same course. Online discussion postings and reflective journals were analyzed to determine the preservice teachers' use of higher-level thinking skills. Mastery of course content was measured through final course grades. Results showed no significant difference between the two groups in overall achievement, but a significant difference was seen in the use of higher-level thinking. Preservice teachers in the online class showed a significant increase in the use of higher-level thinking from the beginning of the course to the end; however, those in the face-to-face course did not. In addition, higher-level thinking for all preservice teachers in the study was positively correlated with greater course achievement. Finally, preservice teachers in the online course experienced the most higher-level thinking when posting to the online discussion board.

BACKGROUND

Active Learning

Constructivism—the idea that people construct their own understanding and knowledge of the world through experiencing things and reflecting on those experiences—is the theoretical foundation of this study. According to Bruner (1961), learning is an active process during which learners construct new ideas based on their current understanding and perspectives. They do this by selecting, then transforming, information by organization, elaboration, scaffolding, and other cognitive strategies.

The idea of "active learning" is a direct decedent of constructivism. Succinctly stated, "active participation strengthens learning" (Harasim et al. 1997, 29). Active learning requires "intellectual effort, encouraging higher-order thinking (analysis, synthesis, evaluation)" (Harasim et al. 1997, 29) and provides a means for the learner to assimilate, apply, and retain learning (Bonwell and Eison 1991; Harasim et al. 1997). Strategies promoting active learning are superior to passive learning (lectures) in promoting the development of students' skills in higher-level thinking (Bonwell and Eison 1991; Burbach, Matkin, and Fritz 2004).

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Emerging research in the field suggests that active learning is not only an effective instructional strategy in the traditional learning environment but it is also effective in an online environment. In some cases, the online environment can be a more favorable learning environment for students in that all have equal opportunity to participate, share thoughts, and develop ideas over periods of time. Students' expressions are not limited by the class size, being called upon by the instructor, or how much time is allotted for participation (Harasim et al. 1997).

Collaborative activities such as group discussions and student-to-student interactions are specifically related to active learning in online courses. Gaytan and McEwen (2007) found that rapport and collaboration between students, thought-provoking questions, and dynamic interaction are among the top instructional strategies related to student success. Levy (2008) found collaborative activities along with other interactions such as reading students' posts were valued by students. Graham et al. (2001) stated that a "well designed discussion facilitates meaningful cooperation" (2). Collaborative/interactive activities seem to be a necessary component to effective online instruction.

Higher-Level Thinking Skills

Higher-order thinking skills include critical, logical, reflective, metacognitive, and creative thinking. They are activated when individuals encounter unfamiliar problems, uncertainties, questions, or dilemmas. Successful applications of the skills result in explanations, decisions, performances, and products that are valid within the context of available knowledge and experience and that promote continued growth in these and other intellectual skills. Higher-level thinking skills are grounded in lower-level skills such as discriminations, simple application and analysis, and cognitive strategies and are linked to prior knowledge of subject-matter content. Teaching strategies such as active learning and learning environments facilitate their growth as do student persistence; self-monitoring; and open-minded, flexible attitudes.

According to Bloom et al. (1956), higher-order skills include analysis, synthesis, and evaluation and require mastery of previous levels. Costa (1985) developed a model of intellectual functioning to describe a hierarchy of critical thinking. Level 1 thinking focuses on gathering and recalling information, Level 2 on making sense of gathered information, and Level 3 on applying and evaluating information (Costa 1985). For this study, Costa's three levels of think were used to classify the preservice teachers' critical thinking as evidenced in their reflections and discussion postings.

Instructor Presence

The literature also indicates that instructors need to be actively involved in the learning of their students (Gaytan and McEwen 2007; Young 2006). Instructors should be minimally active in discussions (Dennen, Darabi, and Smith 2007; Levy 2008; Shea, Li, and Pickett 2006; Young 2006) and use e-mail appropriately (Dennen, Darabi, and Smith 2007; Gaytan and McEwen 2007; Levy 2008). Dennen, Darabi, and Smith (2007) did find, however, that too much instructor participation in activities such as discussion boards can actually decrease student participation. Social presence of instructors and students is a concern of online researchers. Social presence is the phenomenon that helps translate virtual activities into impressions of "real" people.

METHODS

The purpose of this study was to evaluate the effect of an online course in child development, in which active learning strategies were infused, on preservice teachers' use of higher-level thinking and overall achievement. The following research questions were investigated:

1. What is the effect of an online course infused with active learning strategies versus a face-to-face version of the same course on students' use of higher-level thinking skills as evidenced through journal entries reflecting upon their observations of children?
2. Is there a relationship between higher-level thinking skills as evidenced through students' journal entries reflecting upon their observations of children and overall achievement in the course?
3. What is the effect of an online course infused with active learning strategies on students' use of higher-level thinking skills as evidenced through group discussion board postings?
4. What is the effect of an online course infused with active learning strategies versus a face-to-face version of the same course on student achievement as evidenced through final course grades?

Participants

The participants were preservice teachers who were in their first year of a teacher education program preparing them to teach children in prekindergarten through sixth grade. The preservice teachers were all enrolled in a required child development course. There were fifty-four preservice teachers in the online course and sixty-one in the face-to-face course.

Research Design

This project used a mixed-model approach. The term *mixed model* refers to studies that integrate quantitative and qualitative data in a way that changes one form of data into another so that the data collected can be merged (Caracelli and Greene 1993; Onwuegbuzie and Teddlie 2003). A mixed-model design was chosen for this study in order to capture the preservice teachers' use of higher-level thinking skills through their reflections and discussions and be able to then compare them with the control group as well as overall course achievement as evidenced by the final course grade. The preservice teachers self-selected the section in which they were enrolled, so this was a quasi-experimental design. Also, there was no way of determining the preservice teachers' prior experiences with active learning or higher-level thinking skills, so for the purposes of this study the two groups were assumed to have begun the course with similar backgrounds and abilities. The study took place during the fall semester at a large public university in the southwest region of the United States.

The Course

For this study, an online section of a teacher-preparation course in child development was infused with active learning strategies adapted to the online environment. The purpose of this course is to examine the major theories and principles of cognitive, social, emotional, physical, and

aesthetic development and learning. The course emphasizes development and learning from prenatal through the eleventh year as well as the application of play theories as they apply to the total development of the child and cultural dynamics of families. This course is required for all preservice teachers during their first semester in the teacher-preparation program.

Specific active learning strategies that were incorporated into this online course include the use of reflective questioning using an online journal, collaborative learning group discussions via online discussion boards, completion of collaborative group activities, WebQuest presentations of group projects, cases studies, multimedia content, and authentic assessment. These techniques are known to promote critical thinking skills in students when implemented in traditional learning environments (Bonwell and Eison 1991; Hidayat, Patel, and Veltri 2012).

Each week of the online course, the preservice teachers were required to complete the Collaborative Discussions assignment. The Collaborative Discussions consisted of three discussion questions based on the topic of that week's lesson. The questions were designed to elicit higher-level thinking from the preservice teachers. Each preservice teacher's weekly response to the three questions was due on Wednesday with a required response to at least two members of his/her collaborative group due by Saturday. Examples of discussion questions include the following:

- Think about your past relationships with teachers. How did your personal temperament influence these relationships?
- As a future teacher, how might you help your aggressive students improve their ability to interpret social cues more accurately?
- To what degree should teachers be responsible for motivating students and to what degree should teachers be responsible in helping students motivate themselves?

Preservice teachers were also required to complete twelve observations of children ages birth to twelve in a variety of settings. They were directed to observe a child for fifteen to twenty minutes each week, completing an objective record of the child's behavior and interactions with others. After the preservice teachers had completed the observation, they were to write a reflection of the observation including any developmental milestones the child displayed. Finally, for each observation the preservice teachers were asked to respond to the following three questions:

- How does what you have observed line up with what you are learning about that particular type of development or age group?
- What was the most interesting or surprising thing you have learned from this particular observation?
- What questions or considerations does this observation raise for you as a future educator?

The instructor responded to the preservice teachers' discussion postings and reflections each week with further comments or suggestions for improvement. The instructor also was available to answer student questions via a question-and-answer discussion board forum and through the Instant Messaging function of the course software.

Preservice teachers in another section of the same child development course were used as a control group. Both courses followed the same syllabus and were designed by the same faculty researcher. Both sections of the course were infused with active learning strategies and used the same key assessments to measure achievement and mastery of the course objectives. Besides the difference in the format of the courses, the face-to-face course did not include the Collaborative

Discussion assignment. The online section of the course was taught by the faculty researcher whereas the face-to-face section was taught by a colleague. Both instructors received extensive training in the implementation of active learning strategies via professional development conferences as well as professional development made available at the university where both faculty were associated. Appendix A shows a side-by-side comparison of sample teaching activities in both sections of the course.

DATA COLLECTION AND ANALYSIS PROCEDURES

Qualitative Analysis

Reflections of the preservice teachers' observations of children were collected from the online course as well as from the face-to-face section. Discussion postings were collected from the online course only because the discussions in the face-to-face course were not recorded for analysis. Reflections for both the face-to-face and the online course sections and discussions for the online course section were coded using Costa's (1985) three levels of thinking as a framework. To establish interrater reliability, each reflection and discussion was coded by two researchers. Coding qualitative data allows researchers to classify and assign meaning to help make sense of the data (Lofland and Lofland 1995). Examples of each of the three levels of thinking include the following:

- Level 1 (gathering and recalling information)—"Child demonstrated gross motor skills by going in circles and running around the dance floor."
- Level 2 (making sense of gathered information)—"This child displayed behaviors that are very typical of her age group. She was hesitant of a new experience but started to feel more comfortable once she witnessed people she knew having fun."
- Level 3 (applying and evaluating information)—"The most interesting thing that I have learned from this observation is that children play pretend with anything around them. The child seemed more proud of himself and his accomplishments than the other person there (me). He never got bored and never stopped playing."

These results were then quantified (Level 1 = 1; Level 2 = 2; Level 3 = 3) and compared with those from the face-to-face course using *t* tests. A statistically significant level was determined at $\alpha = .05$. See Appendix B and Appendix C for the rubric used for grading the Discussion and Observation reflections.

Quantitative Analysis

To determine the effects of an online course infused with active learning strategies on the overall achievement of preservice teachers, the final course grades for preservice teachers in both the online course and the face-to-face course were compared using an independent samples *t* test. In addition, a Pearson's *r* was computed to determine if there was a relationship between the preservice teachers' use of higher-level thinking and overall achievement as evidence by their final course grade. A statistically significant level was determined at $\alpha = .05$.

RESULTS

Higher-Level Thinking Skills

Question 1 asked the following: What is the effect of an online course infused with active learning strategies versus a face-to-face version of the same course on students' use of higher-level thinking skills as evidenced through journal entries reflecting upon their observations of children? Overall, preservice teachers in the online course lagged behind their counterparts in the face-to-face course in their use of higher-level thinking in their reflections. When looking at just higher-level thinking skills (Costa's [1985] Levels 2 and 3), preservice teachers in the face-to-face course used significantly more higher-level thinking skills in their reflections than the preservice teachers in the online course, $t(102) = 2.46$, $p = .016$ (see Figure 1).

However, there was a difference when it came to growth in the use of higher-level thinking from the beginning of the course to the end. When the number of Levels 2 and 3 reflections given by preservice teachers in the online course during the first half of the semester was compared with the number of Levels 2 and 3 reflections given in the second half of the course, paired samples t test results indicated that there was a significant increase, $t(53) = –2.50$, $p = .016$. The same was not true for the preservice teachers in the face-to-face course, $t(60) = –.64$, $p = .524$. A comparison of the overall number of Levels 2 and 3 responses showed that the face-to-face preservice teachers had a significant edge over the preservice teachers in the online course, but there was no evidence of the same amount of growth in the use of higher-level thinking skills.

Higher-Level Thinking Skills and Achievement

Question 2 asked the following: Is there a relationship between higher-level thinking skills as evidenced through students' journal entries reflecting upon their observations of children and

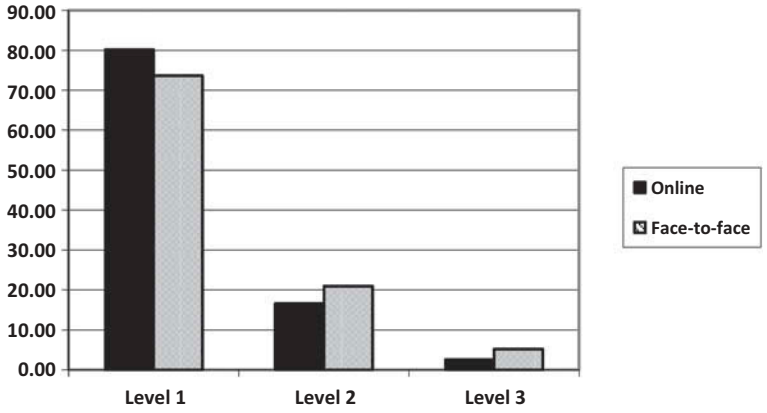

FIGURE 1 Preservice Teachers' Use of Higher-Level Thinking (Grouped by Costa's [1985] Three Levels) during Their Reflections of Child Observations.

overall achievement in the course? There does seem to be a relationship between the preservice teachers' use of higher-level thinking skills (Levels 2 and 3) in their reflections and their overall achievement in the course as evidenced by their final course grades. Results of a Pearson's r correlation were significant when looking across both courses, $r = .268$, $p = .006$.

Higher-Level Thinking Skills and Discussions

Question 3 asked the following: What is the effect of an online course infused with active learning strategies on students' use of higher-level thinking skills as evidenced through group discussion board postings? When examining the use of higher-level thinking in the online discussion postings, preservice teachers in the online course used higher-level thinking at a much higher rate than in their reflections. Although the rate did not increase significantly from the beginning of the course (66.67%) to the end of the course (50.75%), the average is significantly higher (45.96%) than that of the reflections (19.21%). See Table 1 for all of the percentages of higher-level thinking used each week.

Overall Course Achievement

Question 4 asked the following: What is the effect of an online course infused with active learning strategies versus a face-to-face version of the same course on student achievement as evidenced through final course grades? To examine the effect of an online course infused with active learning strategies on student achievement, an independent samples t test was performed between the final course grades of the online and face-to-face courses. The mean final grade for the online course was 91.66 ($SD = 5.43$), whereas the mean final course for the face-to-face course was 91.25 ($SD = 5.07$). This difference was not statistically significant at the .05 level, $t(102) = .397$, $p = .692$, indicating that there was no difference in the achievement levels of the preservice teachers in the study.

TABLE 1
Percentage of Postings to Online Discussion Board by Costa's (1985) Levels of Thinking

Course Week	*Level 1*	*Level 2*	*Level 3*	*Levels 2 and 3*
Week 2	33.33	58.05	8.61	66.67
Week 3	66.67	13.06	20.27	33.33
Week 4	50.34	36.145	13.51	49.66
Week 5	56.00	29.45	14.55	44.00
Week 6	38.75	50.18	11.07	61.25
Week 7	66.12	31.92	1.95	33.88
Week 9	73.29	24.55	2.17	26.17
Week 10	51.76	33.10	15.14	48.24
Week 11	44.02	48.91	7.07	55.98
Week 12	41.43	57.14	1.43	58.57
Week 13	70.32	20.49	9.19	29.68
Week 14	60.43	32.37	7.19	39.57
Week 15	49.25	49.63	1.12	50.75

DISCUSSION

The findings of this study indicate that, when active learning strategies are embedded, preservice teachers benefit from their experience in an online course as much as they would from the same course taught in a traditional face-to-face manner. Although preservice teachers in the face-to-face course more often used higher-level thinking in their reflections, the preservice teachers in the online class experienced more growth in the use of higher-level thinking from the beginning of the course to the end. One reason for the slow start of the preservice teachers in the online course in the use of higher-level thinking might be their initial expectations of what an online course entails. The majority of the preservice teachers indicated in an end-of-course survey that they had not ever taken an online course that required student interaction and group collaboration. The lack of experience with this type of online course could explain why it took several weeks for the preservice teachers to begin using higher-level thinking during their reflections and discussions. During the beginning of the course, the cognitive adjustment to the use of active learning strategies and the expectations of collaboration lessened their use of higher-level thinking. Once the preservice teachers in the online course had adjusted, their use of higher-level thinking increased.

The increase in the preservice teachers' use of higher-level thinking skills from the beginning of the course to the end of the course seems to indicate that the intentional use of active learning strategies in the online course had an effect on the preservice teachers' development of higher-level thinking. This finding supports research that links higher-level thinking with the use of active learning strategies—specifically online (Burbach, Matkin, and Fritz 2004; Campbell 1998; Hidayat, Patel, and Veltri 2012).

Also, the number of higher-level thinking responses from preservice teachers in both the online and face-to-face courses correlated significantly with their final grade in the course. This supports the research by Bonwell and Eison (1991) that active learning strategies are superior to passive learning in promoting the development of higher-level thinking and learning.

The most impressive use of higher-level thinking skills occurred with the preservice teachers in the online course during their discussion board postings. Preservice teachers in the online course used higher-level thinking an average of 46% of the time when posting to the weekly discussion board. Discussion boards are reflective in nature because they force students to read other perspectives and carefully consider a response. This could explain why preservice teachers used higher-level thinking skills more than twice as frequently as when just reflecting on their own observations. According to Bunker and Vardi (2001), students are more likely to utilize critical thinking skills when discussions occur online due to the fact that they often feel less intimidated and more free to express themselves.

Finally, preservice teachers in the online course had no difference in overall achievement than those preservice teachers in the face-to-face course. This finding supports The No Significant Difference Phenomenon coined by Russell (1999). Russell summarized 355 research reports, papers, and summaries on the subject of online versus traditional learning. He found no significant difference in grades, satisfaction, or effectiveness when e-learning was compared with traditional learning.

Even though preservice teachers in the face-to-face course used higher-level thinking more frequently in the beginning of the course, the fact that the online preservice teachers had a higher rate of growth in the use of higher-level thinking seemed to be just as effective for overall course

achievement. It seems from these results that preservice teachers in both the face-to-face course and the online course had enough experiences with active learning and higher-level thinking to demonstrate achievement in the course.

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APPENDIX A

Side-by-Side Comparison of Active Learning Activities in the Online and Face-to-Face Course

Activity	*Online instructions*	*Face-to-face instructions*
3-2-1 Summary: 3—New concepts you learned 2—Things you found to be the most interesting 1—Question you still have about what you read	Based on the information from the Piaget and Vygotsky Prezi, post your response to the 3-2-1 Summary on your Collaborative Learning Group's Discussion Board. Be sure to respond to at least one of the questions posted by your other group members.	Based on this information about Piaget and Vygotsky write down your response to the 3-2-1 Summary. *After the preservice teachers write down their responses, the instructor asks for volunteers to share their responses.*
Philosophical Chairs: Philosophical Chairs is similar to a debate. Students are given a central topic or question that they must choose to agree, disagree, or be neutral regarding the answer. Topics that work best are topics that are important to students or that they feel strongly about.	• Students read the article "Deliberate Practice: What Is It and Why You Need It," taking notes as they read. • Considering the concepts in this article, write a response to the following question describing your point of view using specific information form the article to support your position: "Can deliberate practice make someone an expert?" • Post your response under the Philosophical Chair Discussion Forum's corresponding thread based on your position to the aforementioned "Philosophical Chairs" discussion question (this Discussion Forum is on the main Discussion Board—not in your group's). • Read the posts of your classmates' that had a different position than you to the question. Reply to at least five other classmates' responses. Your response to them should include the following: ◦ Restate their argument. ◦ Use examples from the text to explain and extend your argument. • If after reading and responding to your classmates, if you have changed your mind you may "move" to one of the other positions by creating a new post explaining why you have moved.	• Students read the article "Deliberate Practice: What Is It and Why You Need It," taking notes as they read; bring those notes to class. • Students are told they will argue the merits of the question and that their choice of seat during the discussion will illustrate their position. • In class, the students were presented with the following question: "Can deliberate practice make someone an expert?" • The chairs are then placed in a horseshoe seating arrangement with the two ends longer than the back. • If they believe the answer to the question is "yes," they should sit on the right. • If they believe the answer to the question is "no," they should sit on the left. • If they are "undecided," they should sit at the back of the horseshoe. They will have the opportunity to move as their minds change. • Choose a student moderator whose job is to see that everyone gets a chance to speak. • To gain full credit, a student must speak at least two times.

(*Continued*)

APPENDIX A
(Continued)

Activity	*Online instructions*	*Face-to-face instructions*
Jigsaw: The jigsaw technique is a method of organizing classroom activity that makes students dependent on each other to succeed. It breaks classes into groups and breaks assignments into pieces that the group assembles to complete the (jigsaw) puzzle.	• Each group member will choose one of the resources available on the Center on the Social and Emotional Foundations for Early Learning website http://csefel.vanderbilt.edu. • Explore your chosen resource and post a description on your Collaborative Learning Group's Discussion Board. • Review your other group members' posts and reply with a brief comment about how you might use that resource in the future.	• Divide students into five-person jigsaw groups. • Assign each group member a number from 1 to 5. Assign each number a specific resource available on the Center on the Social and Emotional Foundations for Early Learning website http://csefel.vanderbilt.edu. • Give students time to read over their resource at least twice and become familiar with it. There is no need for them to memorize it. • Form temporary "expert groups" by having one student from each jigsaw group join other students assigned to the same resource. Give students in these expert groups time to discuss the main points of their resource and to rehearse the presentations they will make to their jigsaw group. • Bring the students back into their jigsaw groups. • Ask each student to present her or his resource to the group. Encourage others in the group to ask questions for clarification. • Ask each student to write a brief statement about how they might use that resource in the future.

APPENDIX B

Child Development Observation Rubric

Criteria	*Target*	*Acceptable*	*Unacceptable*
Choosing a child	Child is under twelve years old. Child of this age has not been previously observed. Parental consent obtained when necessary. _____/ 5 points		Child is NOT under twelve years old. Child of this age has been previously observed. Parental consent wasn't obtained when necessary. _____/ 0 points
Setting information	Includes the date, time, and location of observation. _____/ 5 points		Does not include the date, time, and location of observation. _____/ 0 points
Objective record of events	Includes a detailed objective summary free of judgmental language. _____/ 30 points	Includes an average objective summary with some use of judgmental language. _____/ 15 points	Includes an inadequate objective summary with frequent use of judgmental language. _____/ 0 points
Discussion of events	Includes an in-depth discussion of the recorded events making connections to the type of development and proficiency displayed. _____/ 30 points	Includes minimal discussion of the recorded events. Makes a few connections to the type of development and proficiency displayed but not with all of the recorded events. _____/ 15 points	Does not include a discussion of the recorded events or make connections to the type of development and proficiency displayed. _____/ 0 points
Observation questions	Includes a thoughtful response to each of the three observation questions. Reflections include higher-level thinking about the development of the child. _____/ 20 points	Includes a minimal response to each of the three observation questions or omits one or more of the questions. Reflections include minimal higher-level thinking about the development of the child. _____/ 10 points	Does not include a response to any of the three observation questions. _____/ 0 points
Present a well-written observation using proper spelling, punctuation, and grammar. American Psychological Association (APA) formatting used throughout.	Candidate presents an observation with no errors in grammar, punctuation, and/or spelling. Uses APA formatting style for the article reference as well as in-text citations. _____/ 10 points TOTAL = _____/100 points	Candidate presents an observation with minimal errors in grammar, punctuation, and/or spelling. Uses improper APA formatting style for the article reference as well as in-text citations. _____/ 5 points	Candidate presents an observation with several errors in grammar, punctuation, and/or spelling. Does not use APA formatting style for the article reference as well as in-text citations. _____/ 0 points

APPENDIX C
Weekly Discussion Rubric

Criteria	*Target (20 points)*	*Acceptable (10 points)*	*Unacceptable (0 points)*
Initial assignment posting	Posts well-developed assignment that fully addresses and develops all aspects of the task.	Posts adequate assignment with superficial thought and preparation; doesn't address all aspects of the task.	Posts no assignment.
Follow-up postings	Demonstrates analysis of others' posts; extends meaningful discussion by building on previous posts.	Posts shallow contribution to discussion (e.g., agrees or disagrees); does not enrich discussion.	Posts no follow-up responses to others.
Content contribution	Posts factually correct, reflective, and substantive contribution; advances discussion.	Repeats but does not add substantive information to the discussion.	Posts information that is off-topic, incorrect, or irrelevant to discussion.
Reference and support	Uses references to literature, readings, or personal experience to support comments.	Uses personal experience but no references to readings or research.	Includes no references or supporting experience.
Clarity and mechanics	Contributes to discussion with clear, concise comments formatted in an easy-to-read style that is free of grammatical or spelling errors.	Communicates in friendly, courteous, and helpful manner with some errors in clarity or mechanics.	Posts long, unorganized, or rude content that may contain multiple errors or may be inappropriate.

Note. Adapted from: http://www.udel.edu/janet/MARC2006/rubric.html.

Examples of postings that demonstrate higher levels of thinking:

- "Some common themes I see between your experiences and our textbook are . . ." (***Analysis***)
- "These newer trends are significant if we consider the relationship between . . ." (***Synthesis***)
- "The body of literature should be assessed by these standards . . ." (***Evaluation***)