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Critical Thinking Criteria for Evaluating Online Discussion

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Abstract

A 21st Century challenge for educators is to promote meaningful engagement in online courses, and student development of critical thinking skills is an essential aspect of higher order learning. Evaluation of critical thinking in online discussions is often facilitated by the use of rubrics; however, it is not unusual for rubrics to either omit critical thinking as a component of the rubric or to reference it in a vague way. For the purposes of this study, quantitative and qualitative data were collected from faculty to identify their attitudes about critical thinking attributes as performance measures for evaluation rubrics. Factor analysis revealed that the response patterns clustered for each factor represented the themes 1) demonstrates logic and reasoning” (described as offering accurate supporting evidence and strategies and solutions); and 2) “creative critical thought processes” (described as novel perceptions, bias refutation, and alternative-seeking). From this study, we would suggest that faculty should use an evaluation rubric that encompasses these two dimensions.

Keywords

Online Discussion, Critical Thinking, Rubrics, Logic and Creative Thinking

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Cover Page Footnote
We wish to express our appreciation to the Mercer University Center for Teaching and Learning for the grant that supported the original literature review for this research. We also want to express our thanks to Dr. Joseph Balloun, Professor of Research, Tift College of Education, Mercer University for his insightful assistance in the data analysis for our paper.

Critical Thinking Criteria for Evaluating Online Discussion

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A 21st-century challenge for educators is to promote meaningful engagement in online courses, and student development of critical thinking skills is an essential aspect of higher order learning. Evaluation of critical thinking in online discussions is often facilitated by the use of rubrics; however, it is not unusual for rubrics to either omit critical thinking as a component of the rubric or to reference it in a vague way. For the purposes of this study, quantitative and qualitative data were collected from faculty to identify their attitudes about critical thinking attributes as performance measures for evaluation rubrics. Factor analysis revealed that the response patterns clustered for each factor represented the themes 1) “demonstrates logic and reasoning” (described as offering accurate supporting evidence and strategies and solutions); and 2) “creative critical thought processes” (described as novel perceptions, bias refutation, and alternative-seeking). From this study, we would suggest that faculty should use an evaluation rubric that encompasses these two dimensions.

INTRODUCTION

Online approaches continue to be important and rapidly developing approaches to teaching and learning in higher education (Wyss, Freedman, & Siebart, 2014), and the prevalence of online enrollments in college courses has tripled in recent years (Allen, Seaman, Sloan, Babson Survey Research, & Pearson, 2013). Online courses should include detailed feedback as well as constant engagement to encompass a variety of learning styles (Dietz-Uhler, Fisher, & Han, 2007; Ice, Curtis, Phillips, & Wells, 2007). A 21st-century challenge for educators is to promote meaningful engagement in online courses. In addition, student development of critical thinking skills is an essential aspect of higher order learning. The ways which both engagement and critical thinking are fostered currently in an online environment are via students’ participation in online discussions. Online discussion is important for building a foundation of knowledge to promote higher order thinking and problem solving for students (Baker, 2011).

The purpose of this study is to identify critical thinking components of online discussion and how to use them in evaluation rubrics that (1) guide the structure and content of these discussions; and (2) formulate assessment of online discussion. “Critical thinking is a common objective of various disciplines” and the discussion board offers the possibility for guiding student discussion to a deeper level of reflective learning (MacKnight, 2000, p. 38). Faculty input into the development of criteria and descriptors or dimensions of criteria for a critical thinking rubric was based on “collaboratively developing and validating a rubric that integrated baseline data” (Allen & Knight, 2009) from qualitative and quantitative research.

This paper outlines a sequential exploratory, mixed-method study that consists of qualitative focus group research and quantitative survey research. The literature review focuses on the use of evaluative rubrics for guiding and assessing students’ critical thinking in online discussion. Learning outcomes related to critical thinking are reflected in the criteria and descriptive dimensions generated by the mixed-method study.

The Importance of Online Discussion for Critical Thinking

Discussion boards are one of the major constructs of online learning, due to their interactive and communicative nature. Discussion boards, especially those that are asynchronous, allow

students time to reflect and refer to related information that they have read and researched (Morrison, et al., 2012; Wegmann & McCauley, 2014), thereby providing students an opportunity to develop a “more thorough understanding of course content” (Knowlton, 2003, p. 31). The constructivist approach of online discussion helps to build content by student sharing of ideas and experiences (Knowlton, 2003). Discussion boards also have the potential to contribute to higher order thinking, as in Bloom’s taxonomy of application, analysis, synthesis, & evaluation (Eccarius, 2012). Through a process of meaningful discourse involving collaboration and social negotiation, students can share different viewpoints and collaborate on problem solving and knowledge building. (Gilbert & Dabbagh, 2005).

The Importance of Critical Thinking within Online Discussion

Critical thinking activities should encourage higher order thinking that leads to a deeper understanding of content (Bahr, 2010; Jonsson & Svingby, 2007; Wegmann & McCauley, 2014). Although critical thinking is a common objective among disciplines and “a goal that most faculty can aspire to” (MacKnight, 2000, p. 38), critical thinking has not been highly promoted in evaluating the quality of online discussions for the following reasons: (1) faculty members themselves lack understanding of the concept of critical thinking (Bahr, 2010); and (2) many faculty members still use “traditional teaching methods of spoon feeding knowledge” and expect students to memorize information transmitted without necessarily understanding their deeper meaning (Hsiao, 2013, p. 22).

Critical thinking skills applicable to online discussion include conceptualizing, applying, analyzing, synthesizing, and evaluating information gathered from observation, experience, reflection, reasoning, or communication (MacKnight, 2000, p. 38). In addition, “the written communication inherent in discussion forums aid in the development of students’ critical thinking” (Morrison, et al., 2012, p. 168). Discussions rubrics can be effective in promoting and encouraging critical thinking, and questioning by the instructor is paramount to higher order thinking, because the level of questions asked influences the depth of student thinking (MacKnight, 2000). It is the instructor’s responsibility to maintain a focused discussion and stimulate the discussion by asking probing questions of the students (MacKnight, 2000).

Evaluative Criteria of Rubrics as Prompts for Meaningful Discussion

Critical thinking is an important aspect of the quality of online discussions, and “the content of online discussions should exhibit a certain level of thinking such as being able to recognize the problem, gather relevant information, explore possible explanations or contradictions, synthesize ideas and create possible solutions” (Hsiao, et al., 2013, p. 15). Discussion formats that lend themselves to critical thinking can include “Socratic Questioning Prompts,” such as: “Do you have any evidence for that?” or “Could you give me an example?” or “Could you explain your reasons to us?” (MacKnight, 2000, p. 40). These types of questions relate to critical thinking criteria in rubrics and can make instructor expectations explicit, thereby encouraging rich interactions among students (Wegmann & McCauley, 2014). Instructors can also encourage student’s connections to assigned readings, research, reflection, experience, initiating novel perspectives (Wegmann & McCauley, 2014), and to original thought (Cato, 2010). A requisite foundation for deeper learning through discussion is clear, coherent, and cohesive writing. These techniques can induce constructivism by building understanding of course content by sharing of ideas and experiences through student writing that leads to deeper thinking about them (Knowlton, 2003). The discussions can be guided by the evaluative criteria in critical thinking components of rubrics as “The quality of online discussions is significantly affected by posted expectations as well as evaluative feedback” (Lynch et al., 2009, np).

In addition to evaluative use by educators, rubrics have formative pedagogical functions (Knowlton, 2003) and can relate to various teaching approaches for online discussion. Two particular teaching approaches can significantly enhance the quality of online discussions by letting students know what an instructor’s expectations are and how they can meet the associated objectives (formative). First, providing an evaluation rubric that specifically addresses critical thinking components provides a formative view of those expectations. Second, using “Socratic Questioning Prompts” (MacKnight, 2000, p. 38) to encourage critical thinking, both at the onset and during the forum, can significantly enrich student discussion. These two approaches to enhance the pedagogical outcomes of online discussion are complementary in that rubrics guide the student use of rhetorical tools and Socratic Questioning guides student application of the structure to specific issues. In online discussions, they employ deeper, higher-order thinking that can result in more engaged learning.

It is important for instructors to make expectations for online discussion explicit (e.g. through evaluation rubrics) in order to encourage rich interactions (Wegmann & McCauley, 2014). This is particularly true for evaluating critical thinking. However, it is not unusual for rubrics to either omit critical thinking as a component of the discussion rubric or to reference it in a vague way. Lack of specificity can leave both instructors and students unclear about how to grade for critical thinking and how to address it as a student discussant. Despite the lack of definitive critical thinking criteria in many discussion rubrics, a number of authors have made contributions in this area of evaluation.

Rubrics for Evaluation of Critical Thinking

Rubrics provide an “effective, efficient, equitable assessment method that can be understood by both student learner and

academic assessor” (Allen & Knight, 2009, p. 1). As such, they add structure to online discussion (Gilbert, 2005) and help to develop the scope of discussion in a meaningful way (Knowlton, 2003). A literature review by Jonsson & Svingby (2007) found 75 studies that were relevant for scoring in rubrics, noting that reliable scoring of performance assessments overall can be enhanced by the use of rubrics. “The rubric tells both instructor and student what is considered important and what to look for when assessing (Jonsson & Svingby, 2007, p. 131).

In the current study, as background for developing a rubric focused on critical thinking attributes, the literature review focuses on critical thinking components and criteria for rating a prioritized list of performance dimensions. Critical thinking components in the current study were derived from a search for articles about “discussion rubrics” and “critical thinking.” After reviewing critical thinking criteria in the literature containing rubrics, components for evaluation of critical thinking online discussion emerged as depicted in Table 1.

The criteria by which various authors associated the components of critical thinking with specific descriptors reflect shades of interpretation for evaluating critical thinking. In the literature reviewed, the authors referenced in Table 1 associated the critical thinking components as follows:

- **Problem identification:** Hsiao, et al. (2013) categorized problem recognition as an indicator of critical thinking associated with background information that triggers a question, while Mertler (2001) described it holistically as demonstrating an understanding of a problem.
- **Clarifying question:** Gilbert and Dabbagh (2005) associated clarifying content with paraphrasing or personal interpretation of content, while Wegmann & McCauley (2014) associated it with curiosity.
- **Logic of argument:** Rezaei & Lovorn (2010) defined reasoning of argument as critical thinking.
- **Evidence/supportive information:** Rezaei & Lovorn (2010) associated evidence with reasoning of argument.
- **Synthesis of ideas:** Hsiao, et al. (2013) categorized synthesis of ideas as integration related to substantiating an argument or building on others’ ideas, while Wegmann & McCauley (2014) associated synthesis with connecting to a previous thought.
- **References to readings:** Cato (2010) associated critical thinking with contemplation of readings and showing original thought related to the readings; Frey (2016) associated references to readings with supporting evidence; Gilbert & Dabbagh associate references to reading with citing to make a point.
- **Problem Solving:** Hsiao, et al. (2013) associated problem solving with application to real world.

METHOD

In this study and previous studies (Jonsson & Svingby, 2007), expert opinions from faculty were the source of empirical evidence for the validity of evaluative criteria and their dimensions. The current exploratory study consisted of two data collection phases, the purpose of which has been to identify expertly defined descriptors for the critical thinking evaluation criteria extracted from the literature review. Phase one collected data from a focus group discussion and Phase two collected data from a subsequent online survey.

Table 1: Critical Thinking Components of Discussion

Components of Critical Thinking	Source(s)
Problem identification	Hsiao, Chen, & Hu (2013); Mertler (2001).
Clarifying question	Gilbert, & Dabbagh (2005); Wegmann & McCauley (2014).
Logic of argument	Health Care Ethics: Discussion Board Guidelines (2016); Rezaei & Lovorn (2010); Wegmann, & McCauley (2014).
Evidence/supportive information	Health Care Ethics: Discussion Board Guidelines (2016); Rezaei & Lovorn (2010); Vandervelde (2016).
Synthesis of ideas	Hsiao, Chen, & Hu (2013); Rezaei & Lovorn (2010); Wegmann, & McCauley (2014).
References to readings	Cato (2010); Frey (2016); Gilbert (2005); Lynch, et al. (2009); Vandervelde (2016); Wegmann (2014).
Problem solving	Hsiao, Chen, & Hu (2013); Rochester Institute of Technology (2017).

Phase One: Focus Group Discussion

A focus group discussion was conducted at the 2017 Higher Education Pedagogy Conference at Virginia Polytechnic Institute and State University (Bernstein, 2017). The objective of the focus group discussion was to generate critical thinking descriptors for the seven evaluative criteria related to critical thinking that were identified in the literature review. These descriptors could then be used to explore faculty judgments concerning their relative importance as depicted in an online survey. One week prior to the conference, conference registrants were provided the literature review for the current study. The review contained a summary table (Table 1) of previous studies related to critical thinking for discussion rubrics.

Focus Group Participants: Thirty faculty members from 29 colleges and universities across the United States and Canada who attended the Higher Education Pedagogy Conference at Virginia Tech on February 15, 2017 voluntarily participated in the focus group discussion, where self-identified faculty attended a conference session titled “Conversation: Critical Thinking Criteria for Evaluating Online Discussion.” The first author facilitated this 50 minute group interaction with specific questions derived from the literature regarding critical thinking (Barbour, 2013). Easel-size post-it sheets were posted on the walls to record participants’ responses.

Discussion Questions: Discussion questions were generated from information in the literature review summary table (Table 1). The moderator introduced the purpose of the session and asked the group the following questions regarding critical thinking in online discussion:

1. What descriptors would you use to evaluate *problem identification*?
2. What descriptors would you use to evaluate *clarifying question*?
3. What descriptors would you use to evaluate *logic of argument*?
4. What descriptors would you use to evaluate *evidence/supportive information*?

5. What descriptors would you use to evaluate *synthesis of ideas*?
6. What descriptors would you use to evaluate *references to readings*?
7. What descriptors would you use to evaluate *problem solving*?

After the moderator stated each question, participants were given several minutes to discuss the questions in self-selected, small sub-groups and responses from each sub-group were written on the post-it sheets. During the large group discussion, between two and four descriptors for each of the seven criterion-based questions were developed for a total of 21 descriptors (see Appendix). Responses were recorded.

Phase Two: Online Survey

A survey questionnaire was developed from the seven criteria and 21 descriptors (Appendix), a research method commonly used for a mixed methods QUAL → quan design (Morse, 2017). Subsequent to Institutional Review Board approval by the authors’ University, an online survey was distributed to 90 full-time faculty members at a private, nonprofit southeastern university in the United States. The survey was conducted anonymously through Survey Monkey in order to gather data regarding faculty attitudes about the critical thinking descriptors generated in the focus group discussion. Thirty-five questionnaires were submitted by faculty respondents. Ninety-four percent indicated that they had taught online courses and 86% reported using online discussions. Seven questions pertained to the critical thinking criteria and their 21 descriptors, with Likert-type response choices of strongly disagree, disagree, agree, and strongly agree. The questionnaire is in the Appendix.

MEASURES

In order to describe the seven evaluative criteria that emerged from the literature review, the focus group participants named 21 critical thinking descriptors that aligned to the seven criteria, including:

Problem identification: clear problem statement, nature of problem, novel perception, linked to historical phenomenon

Clarifying question: accurate paraphrasing, provides dichotomy, refutes bias

Logic of argument: clear and valid assumptions, flow of arguments, sequence of ideas

Evidence/supportive information: clear connection to logic, relevant examples

Synthesis of ideas: clearly connects concepts, identifies differences and commonalities, reveals patterns

References to readings: attribution, accuracy in paraphrasing and quotations, demonstrates understanding, original thought related to readings

Problem solving: clearly expresses solution or strategy, logical result of evidence

The 21 descriptive measures were used in the data analysis to comprise indices for the seven evaluative criteria.

DATA ANALYSIS

The survey data were loaded in an SPSS data file, and reliability analysis and factor analysis procedures were performed on SPSS 23 software in order to test the internal consistency of the 21 descriptors as a composite index for a comprehensive model of critical thinking. This comprehensive model of critical thinking consisted of the 21 descriptors that emerged in the focus group discussion and tested in the online survey.

Reliability and Factor Analyses: The reliability and factor analyses measured critical thinking as a comprehensive model. A principal axis factor analysis was conducted for the comprehensive model containing all 21 descriptors (Field, 2013). Alpha levels of .60 and above were accepted (Chua, 2004).

RESULTS

Descriptives of the Sample

The online survey was distributed through the SurveyMonkey program to 90 faculty members at a private, nonprofit, south-eastern university. Forty-eight faculty responded to the first two questions about teaching online; we suspect that faculty who do not use online discussion in their courses did not complete the questionnaire. Thirty-five respondents completed the questionnaire. However, due to missing values, the number of “complete” respondents were reduced to 29. Means and standard deviations for all descriptor variables are listed in Table 2.

Next, a principal axis factor analysis was conducted on the 21 descriptors with oblique rotation (direct oblimin). The Kaiser-Meyer-Olkin (KMO) measure verified the sampling adequacy for the analysis, KMO = .54, passable (Cerny & Kaiser, 1977). Initial analysis was run to obtain eigenvalues for each factor in the data. Two factors had eigenvalues over Kaiser’s criterion of 1 and the combination explained 70.84% of the variance. Table 3 shows

Table 2: Means and Standard Deviations for Critical Thinking Descriptors

Descriptor	Mean	SD
Clear problem Statement	3.47	.788
Nature of problem	3.35	.774
Novel perception	2.75	.718
Linked to historical phenomenon	2.78	.751
Accurate paraphrasing	3.41	.701
Provides dichotomy/alternatives	3.18	.727
Refutes bias	3.09	.734
Clear and valid assumptions	3.44	.824
Flow of arguments	3.27	.674
Sequence of ideas	3.29	.760
Clear connection to logic	3.41	.783
Relevant examples	3.47	.788
Clearly connects concepts	3.47	.788
Identifies differences, commonalities	3.32	.768
Reveals patterns	3.26	.790
Attribution	3.33	.692
Accuracy in paraphrasing, quotes	3.47	.662
Demonstrates understanding	3.53	.825
Original thought related to reading	3.26	.751
Clearly expresses solution	3.44	.786
Logical result of evidence	3.32	.768

the results of the factor loadings of each descriptor element after rotation. The items that cluster on each factor suggests that factor 1 represents “demonstrates logic and reasoning with accurate supportive evidence leading to strategies,” and factor 2 represents “creative critical thought processes.”

DISCUSSION

Critical thinking is important to the quality of online discussions, and the literature indicates that students should be able to “recognize the problem, gather relevant information, explore possible explanations or contradictions, synthesize ideas and create possible solutions” (Hsiao, et al., 2013, p. 15). Evaluation rubrics are important to clarify expectations to encourage rich interactions for online discussions (Wegmann & McCauley, 2014). Our research question sought to explore the evaluation criteria and associated descriptors that faculty recommend to assess students’ critical thinking in online discussion. The literature review conducted in this study generated seven evaluative criteria and the focus group discussion generated 21 related descriptors for evaluating critical thinking in online discussions. The descriptors were tested in a survey of faculty attitudes and were validated.

Table 3: Summary of exploratory factor analysis results for each descriptor derived from the seven criteria generated from literature review and focus group discussion.

Pattern Matrix	Factor	
	1	2
Clearly expresses solution or strategy	1.01	-.23
Logical result of evidence	.93	-.08
Clearly connects concepts	.85	.00
Attribution	.82	.03
Demonstrates understanding	.79	.12
Accuracy in paraphrasing and quotations	.78	.06
Relevant examples	.74	.06
Sequence of ideas	.72	.16
Clear connection to logic	.70	.26
Identifies differences & commonalities	.70	.24
Flow of arguments	.56	.37
Clear and valid assumptions	.52	.37
Original thought related to reading	.44	.38
Novel perception	-.18	.92
Refutes bias	.04	.83
Accurate paraphrasing	.07	.81
Nature of problem	.22	.65
Provides dichotomy/alternatives	.16	.60
Reveals patterns	.23	.60
Linked to historical phenomenon	.10	.54
Clear problem statement	.41	.49
Eigenvalues	13.29	1.58
% of variance	63.31	7.54
	.97	.91
Extraction Method: Principal Axis Factoring.		
Rotation Method: Oblimin with Kaiser Normalization.a		
Rotation converged in 9 iterations.		
Factor loadings over .60 appear in bold		

ed through factor analysis. These items can be used to create an evaluative rubric for critical thinking. This type of rubric can be used both formatively for guiding student expectations and fulfillment of online discussion assignments and summatively for educator evaluation of critical thinking in online discussion by students.

The findings in this study indicate that critical thinking is two-dimensional—Factor 1 represents *logical* critical thinking and factor 2 represents *creative* critical thinking or critical thinking “outside the box.” This concept is supported in an article by Richard Paul, who argues that creative and critical thinking are both “perfections of thought which are, in fact, inseparable in everyday reasoning” because “criticality and creativity have an intimate relationship to the ability to figure things out” and that the creative dimension of thinking is best fostered by joining it with the critical dimension (Paul, 1993, p.22). Along similar lines in pedagogical thinking, Padgett (2013) states that “creativity and critical thinking can, in my view, be regarded as two sides of the same coin” (p. 17). This perception of the relationship between creativity and critical thinking emerges in the current study as faculty in the online survey rated descriptors for critical thinking pertaining to online discussion evaluation. Although creative thinking is considered important in the literature, in this sample creative critical thinking only represented 7.54 percent of the variance while logic and evidence perspectives represented over 63 percent of the variance. Further investigation is warranted.

Decisions regarding interpretation concerned the clustering of logic and evidence perspectives for factor 1, consistent with Rezaei & Lovorn (2010); factor 2 was more difficult to interpret but included novel perception, refutes bias, and provides dichotomies and alternatives (Table 4). The suggested rubric in Table 4 depicts three “distinct and mutually exclusive” descriptors from each of the two factors. Based on the factor analysis, faculty can expand the number of descriptors, if desired.

Of additional interest were the descriptors that were seen as less important to the sample of faculty in the survey. These included “flow of arguments,” “clear and valid assumptions,” “original thought related to reading,” “linked to historical phenomenon,” and “clear problem statement.” Although these descriptors were still highly correlated in the factor analysis, these were surprising areas that were not seen as relevant to the evaluation of online discussion. These areas deserve further research for further delineation of what critical thinking characteristics best evaluate students’ online discussion.

Limitations of Study

This exploratory study was limited in two areas—time and sample. As an exploratory study, there were limitations of time in the

focus group discussion and limited sample size provided in the survey. However, the survey results supported the focus group discussion results, as there were high correlations among the descriptors, and sufficient data were generated for preliminary analysis and results related to evaluative criteria for critical thinking in online discussion. A future study of faculty attitudes needs to replicate the method used here with a larger sample, perhaps over multiple institutions.

Implications for Future Research

Future research should replicate the two-phase, mixed method used in the current study. Additional time for the focus group session could generate additional descriptors, particularly for criteria with only two descriptors. An increased sample size for the survey in a future study could increase the reliability of findings in this study. In addition to these quantitative increases, a future study should expand the scope by gathering faculty input regarding the *weighting* of criteria in evaluating critical thinking. For example, critical thinking is often associated with reasoning (Rezaei & Lovorn, 2010), so weighting of reasoning-related criteria might be warranted to increase the validity of critical thinking assessment. This theoretical assumption should be tested through further investigation.

CONCLUSION

This two-phase, exploratory, mixed-method study generated seven evaluative criteria and 21 associated descriptor indices that can be used to create an evaluative rubric for critical thinking in online discussion. The focus group provided qualitative data that confirmed findings in the literature review. Factor and reliability analyses for survey data supported the findings of the literature review and focus group discussion. The items that clustered on each factor represented 1) “demonstrates logic and reasoning with accurate supportive evidence leading to strategies,” and 2) “creative critical thought processes.” From this study, we would suggest that faculty should use an evaluation rubric that encompasses these two dimensions of critical thinking.

There is a need for evaluation rubrics to clarify expectations to encourage rich interactions for online discussions (Wegmann & McCauley, 2014). Creating a rubric based on evidence-based practice may improve the evaluation of critical thinking in online discussion forums. A research-based approach to designing an evaluative matrix was reflected in this study, which identified critical thinking components of online discussion and how to use them in evaluation rubrics for performance assessment.

Factors	Levels of Achievement		
	Exemplary	Competent	Needs Improvement
Demonstrates logic and reasoning: 1. logical result of supportive evidence 2. clear expression of strategies & solutions 3. identifies differences-commonalities with relevant examples			
Creative critical thought: 1. novel perceptions 2. refutes bias 3. provides alternatives			

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Appendix

SURVEY QUESTIONNAIRE

1. Have you taught any online courses? ___yes ___no
2. If yes in # 1, have you used online discussion in any of your courses? ___yes ___no

Instructions: For each of the following questions, there is a criterion that can be used in a rubric to evaluate students' critical thinking in an online course discussion. Indicate whether you agree or disagree that each descriptor should be included in a rubric for the identified criterion (e.g., problem identification). Also, please add any descriptors for a specific criterion that you think are appropriate in the provided box.

3. For the critical thinking criterion **problem identification**, I agree/disagree with the following descriptors:

Critical Thinking Descriptors	Strongly disagree 1	Disagree 2	Agree 3	Strongly Agree 4
Clear problem statement	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nature of problem	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Novel perception	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Linked to historical phenomenon	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other descriptor:				

4. For the critical thinking criterion **clarifying question**, I agree/disagree with the following descriptors:

Critical Thinking Descriptors	Strongly disagree 1	Disagree 2	Agree 3	Strongly Agree 4
Accurate paraphrasing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Provides dichotomy / alternatives	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Refutes bias	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other descriptor:				

5. For the critical thinking criterion **logic of argument**, I agree/disagree with the following descriptors:

Critical Thinking Descriptors	Strongly disagree 1	Disagree 2	Agree 3	Strongly Agree 4
Clear and valid assumptions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Flow of arguments	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sequence of ideas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other descriptor:				

6. For the critical thinking criterion **evidence/supportive information**, I agree/disagree with the following descriptors:

Critical Thinking Descriptors	Strongly disagree 1	Disagree 2	Agree 3	Strongly Agree 4
Clear connection to logic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Relevant examples	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other descriptor:				

7. For the critical thinking criterion **synthesis of ideas**, I agree/disagree with the following descriptors:

Critical Thinking Descriptors	Strongly disagree 1	Disagree 2	Agree 3	Strongly Agree 4
Clear connection concepts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Identifies differences and commonalities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reveals patterns	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other descriptor:				

8. For the critical thinking criterion **references to readings**, I agree/disagree with the following descriptors:

Critical Thinking Descriptors	Strongly disagree 1	Disagree 2	Agree 3	Strongly Agree 4
Attribution	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Accuracy in paraphrasing and quotations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Demonstrates understanding	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Original thought related to reading	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other descriptor:				

For the critical thinking criterion **problem solving**, I agree/disagree with the following descriptors:

Critical Thinking Descriptors	Strongly disagree 1	Disagree 2	Agree 3	Strongly Agree 4
Clearly expresses solution or strategy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Logical result of evidence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other descriptor:				

THANK YOU FOR PARTICIPATING IN THIS SURVEY!