AC 2007-20: DESIGNING WEEKLY ONLINE GRADUATE COURSE DISCUSSION AND RUBRICS FOR ASSESSMENT AND EVALUATION

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Designing Weekly Online Graduate Course Discussion and Rubrics for Assessment and Evaluation

Abstract

This paper stresses the importance of weekly discussions and provides a framework for designing effective weekly discussions in online graduate-level courses. The framework outlined in this paper is based upon the author's experience in designing, developing and teaching three graduate-level engineering courses online during the past five years. These courses were MIE 7300 – Design of Experiments, MIE 7430 – Quality Engineering and Management, and MIE 7440 – Taguchi Methods of Robust Design. In these courses discussions were structured to reinforce course materials by requiring students to apply the tools, techniques, models, and other analyses to various aspects of their past or current work and life. This paper discusses how the entire class may be involved in discussions by appropriate design of discussion assignments and presents rubrics for evaluating discussions.

Introduction

In an online graduate-level course two or more textbooks may be used and breadth and depth of topics are substantial. Lack of face-to-face contact with the instructor makes it difficult for the instructor to get good and timely feedback. If the course is not designed properly, interactions among students seem to be limited in scope and opportunities for students to learn from each other are wasted. More importantly, an instructor has very few options for ensuring that students develop critical thinking skills.

Discussions are extremely important in distance education courses. Tests and assignments from the textbooks are individual activities that do not provide opportunities for to students to learn from each other about applications of course materials in diverse fields. This paper illustrates through examples of discussion assignments how critical thinking skills may be inculcated in students and how the entire class can be involved in learning about real world applications of course materials. These examples show how a discussion topic may be made more interesting to students, how to link course materials to students' work and life experiences, how to get the entire distance education class involved in the discussion topics, and how to structure discussions so that every one in the course learns from the others. Discussions are usually open-ended and if these are not properly designed, students tend not to put much effort into them. The examples in this paper show how it is possible to design open-ended discussions that are very highly structured to provide opportunities for students to reflect on the course materials from an angle that is not in the textbook and other course materials.

The effectiveness of distance education can be enhanced by promoting opportunities for students to exchange ideas. However, students in distance education courses are usually very brief in discussions due to many activities at their jobs and personal lives. Therefore, it is the responsibility of the course developer and designer to create discussions that require students to "think outside the box" and demonstrate critical thinking skills. The structure of discussions and

the rubrics for grading convey the importance of responses and lead to very meaningful and substantive responses from students.

Process Oriented Approach

A process oriented approach to the design and use of weekly discussions in online courses is recommended. This approach is shown in Figure 1. The goal of the process approach is to inculcate critical thinking skills in students, promote interactive discussion among students, and obtain timely feedback about the depth of understanding of topics covered each week in the course. The next section of this paper presents briefly the standards, elements and intellectual traits of critical thinking.

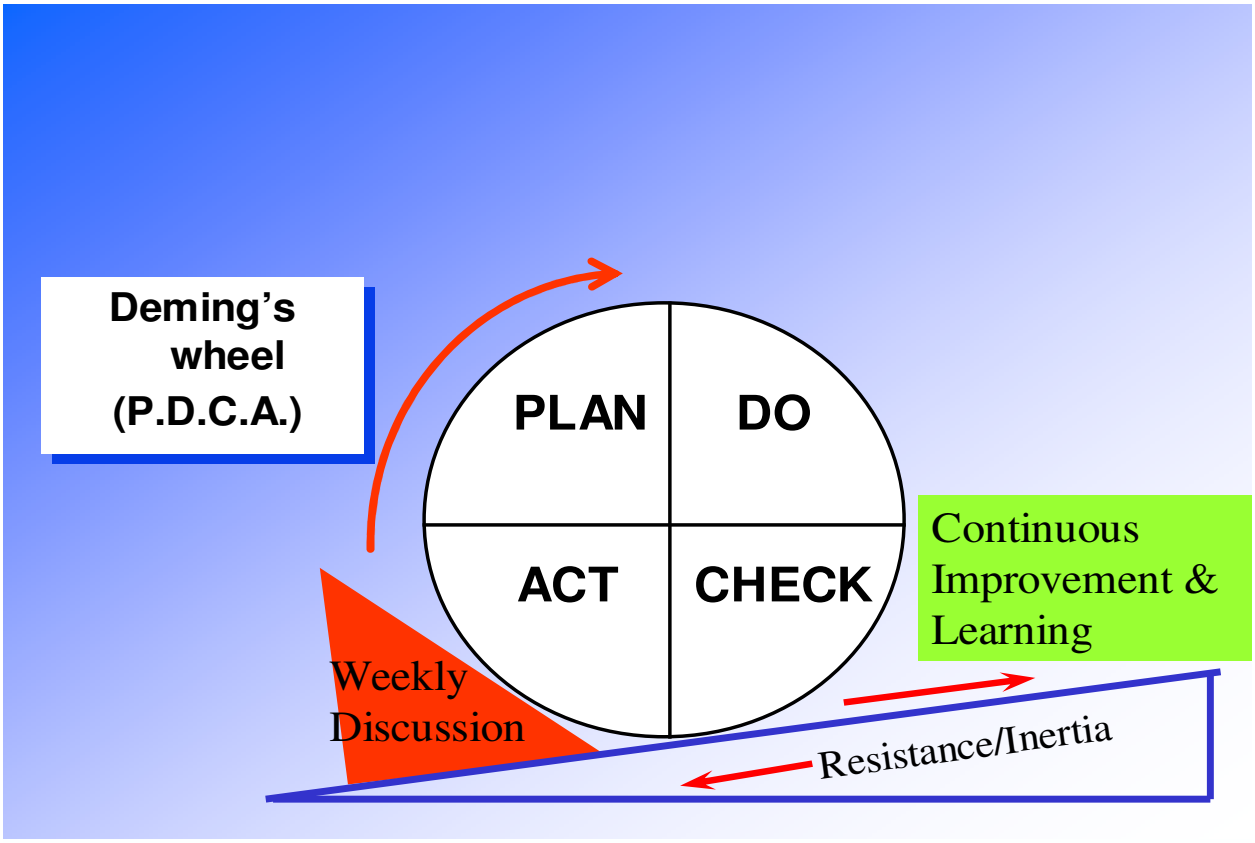

Figure 1: Process Approach to Design and Use of Weekly Discussion

This process approach will facilitate attainment of desired goals managing activities and related resources as a process. The "process approach" is a generic management principle, which can enhance an organization's effectiveness and efficiency in achieving defined goals. A popular continuous improvement process is characterized via the PDCA (Plan-Do-Check-Act) cycle. This PDCA cycle is recommended for design and administration of weekly discussions in this paper even though the process improvement method of the six-sigma approach or the eight-discipline (8-D) method commonly used by automotive industry may also be applied.

The PDCA cycle is an established and logical method that can be used to improve a process. This requires:

(P) Planning (what to do and how to do it),
(D) Executing the plan (do what was planned),
(C) Checking the results (did things happened according to plan) and
(A) Acting to improve the process (how to improve next time).

The PDCA cycle can be applied within an individual process, or across a group of processes. This paper recommends the design and development of discussions in the planning phase, monitoring discussions and checking the breadth and depth of discussions online in the subsequent phases, and finally taking corrective actions by actively participating is discussions when necessary. As shown in Figure 1, in every system and process there is sufficient inertia to let a status quo prevail and complacency to creep in. However, the PDCA cycle promotes continuous improvement of student learning in online courses. Weekly discussions ensure that students understand course material covered that week and are ready to build on that foundation in subsequent weeks.

Critical Thinking

The Center for Critical Thinking and Moral Critique and the Foundation for Critical Thinking, two sister educational non-profit organizations, work closely together to promote educational reform[1]. Critical thinking, as defined by these organizations "is that mode of thinking-about any subject, content, or problem-in which the thinker improves the quality of his or her thinking by skillfully analyzing, assessing, and reconstructing it. Critical thinking is self-directed, self-disciplined, self-monitored, and self-corrective thinking. It presupposes assent to rigorous standards of excellence and careful command of their use. It entails effective communication and problem-solving abilities, as well as a commitment to overcome our native egocentrism and socio-centrism[1]."

To apply critical thinking in weekly discussions, students must learn to 'identify its purpose, question, information, conclusion(s), assumptions, implications, main concept(s), and point of view[1].' These may be termed as "the elements of thought[2]." These tools may be applied to course topics or to each discussion forum. Students may assess thinking by checking it for "for clarity, accuracy, precision, relevance, depth, breadth, significance, logic, and fairness[1]." Ultimately students may become well-cultivated critical thinkers with the following intellectual traits: humility, autonomy, integrity, courage, perseverance, reason, empathy and fair-mindedness[1, 2]. Ability to apply the critical thinking tools and standards may be incorporated to the rubrics for evaluating discussions as shown in Table 1.

As per Gloria Rogers[3] "rubric is a set of categories developed from the performance criteria that define and describe progression toward meeting important components of work being completed, critiqued, or assessed." The development and application of rubrics allow faculty to assess student work in a way that quantifies the progress students are making toward achieving the performance criteria. The use of rubrics when scoring student work provides the

program and faculty with valuable information about how students are progressing and also points to specific areas where students need to improve [4, 5, 6.]

The rubrics for evaluating discussions comprise of four metrics or performance criteria shown in column #1 of Table 1. Each performance criterion has an associated weight (W) that varies from 1 to 3 on the basis of its importance. Student performance for each metric may be scored on a scale (S) of 0 to 3. The maximum possible score or total points (TP) is 27 for a discussion. The TP is used to characterize unacceptable, marginal, acceptable, and exceptional performances as shown at the bottom of Table 1.

Discussion Examples

1. MIE 7300 – Design of Experiments: Lesson #6, Discussion #6.

Select one journal paper dealing with an application of Design of Experiments (DOE) to improve/design a product or process. Send a copy of the paper the instructor. Read and understand the paper. If you have problems in understanding any topic in the paper, send your questions to the instructor at least 4 weeks before the due date for this discussion. Review the paper and post your responses at the course Website under the respective discussion #. State how the DOE guidelines in the textbook were applied in the paper. State assumptions that were used in modeling and analysis. State the factors, factor levels, nuisance factors, and the response variable(s). State whether full factorial, fractional factorial, or other DOE models were used. What was the resolution of the design? What were the aliases? Discuss how the statistical analysis compares with the topics covered in this course. Summarize what you leaned about practical application of DOE.

2. MIE 7300 – Design of Experiments: Lesson #7, Discussion #7.

In this discussion you are asked to be creative in applying full factorial design in your current work. Even if you do not have any experience with Design of Experiments (DOE), try to apply what you learned in this chapter in the course. If you do not wish to deal with products or processes in your current company, consider any product or process you may be familiar with in your previous jobs or at home.

(a) List factors and factor levels for two applications of the full factorial design in your current work, previous work, or at home. State also which application will benefit from the addition of center points to the design. State assumptions that may be necessary.

(b) List factors, factor levels, and blocking criterion for one application of blocking in a full factorial design in your current work, previous work, or at home. State also which application will benefit from the addition of center points to the design. State assumptions that may be necessary.

(c) Participate in the discussions by asking a question about a topic posted for this discussion by another student and then answering all the questions that are addressed to you by other students. This activity of discussion must be completed within one week from the due date.

Table 1: Rubrics for Assessing and Evaluating Discussion in Online Courses

Metric & Weight (W)	Unacceptable (Score, S=0)	Marginal (Score, S=1)	Acceptable (Score, S=2)	Exceptional (Score, S=3)	Points (P) P = W*S
Demonstrate Ability to Use Tools of Critical Thinking (W=3)	Identify at most 3 of the 8 tools.	Identify 4 to 5 of the 8 tools.	Identify 6 to 7 of the 8 tools.	Identify its purpose, question, information, conclusion(s), assumptions, implications, main concept(s), and point of view	
Ability to Check Standards of Critical Thinking (W=3)	Ability to check for at most 4 of the 9 standards	Ability to check for all 5 to 6 standards	Ability to check for all 7 to 8 standards	Ability to check for all 9 standards: clarity, accuracy, precision, relevance, depth, breadth, significance, logic, and fairness	
Writing Skills (W=2)	Message or point of view is lost due to errors in syntax, spelling, and grammar.	Many errors in syntax, spelling, and grammar, but conveys point of view.	A few errors in syntax and wording. Correct word choice, spelling, and grammar most of the time. Adequate in conveying point of view and in presenting argument.	Clear syntax and unambiguous wording. Correct word choice, spelling, and grammar. Excellent in conveying point of view and persuasive in presenting argument.	
Participation (W=1)	Contribution is not relevant to discussion or there is no response to discussion or others questions.	Contribution is not thoughtful and is copied from textbook. Questions and responses are trivial. Does not meet timeline.	Contribution to discussion is adequate, is not substantive. Questions do not enhance the scope. Posts good response to questions or comments.	Makes significant and original contribution to discussion and enhances the scope by raising relevant questions. Always posts excellent response to questions or comments and makes discussion interesting. Very prompt in responding to questions.	
Total Points (TP=ΣP)					

Overall Performance

Overall Performance Criterion: TP≥14	Unacceptable 0≤TP≤8	Marginal 9≤TP≤13	Acceptable 14≤TP≤20	Exceptional 21≤TP≤27

3. MIE 7430 – Quality Engineering and Management: Lesson #7, Discussion #7.

Consider a product that you use or a product made by your company. Assume that this product has to be improved through comparative analysis of at least 2 competing products. State your assumptions and develop a house of quality or quality function deployment (QFD) chart. Explain each region of chart and respective numbers or weights in those regions as in the example in the textbook. Develop a design specification from the QFD chart for the product. Study the QFD chart posted by another student for this discussion and ask at least two questions about it within one week after the deadline for this assignment. Respond to questions about you QFD chart and analysis within one after the question is posted online.

4. MIE 7430 – Quality Engineering and Management: Lesson #8, Discussion #8.

Consider a process in your company or a product made by your company. Develop process failure modes and effects analysis (PFMEA) or design failure modes and effects analysis (DFMEA) chart as shown in the textbook. Determine the overall risk priority number (RPN) for the analysis. Explain how the RPN was computed. State how the RPN may be used in improving a design. List all your assumptions. Study the PFMEA or DFRMEA developed by another and ask at least 2 questions about it and also suggest one way to improve it. Post your questions and suggestion within one week after the deadline for this discussion.

5. MIE 7440 – Taguchi Methods of Robust Design: Lesson #5, Discussion #5.

Consider chapter 1 and 2 in textbook #2 and the respective lecture notes. The lecture notes clearly identify the places in chapters 1 & 2 where the instructor disagreed with the authors of this textbook. List the topics where you disagreed with the authors in these chapters and explain the reasons for your difference of opinion. List any errors or difficulties you had in these chapters. Respond to the points raised by at least two classmates in their postings for this discussion. Make sure that your response is online within one week after the initial posting online by classmates.

6. MIE 7440 – Taguchi Methods of Robust Design: Lesson #7, Discussion #7.

This chapter covers processes that must be analyzed using attribute data. Four models and associated signal-to-noise ratios are covered in this chapter. Create an example from your work for each of these 4 models. Clearly define all aspects of the model, especially assumptions, the signal factors, the model for output, and noise factors. Respond to the points raised by at least two classmates in their postings for this discussion. Make sure that your response is online within one week after the initial posting online by classmates.

Conclusions

The purpose of weekly discussion sessions in online courses is to motivate students to first learn the course topics for that week and then spur critical thinking about those topics through probing questions and activities. To achieve these goals, instructors must spend sufficient time to design and develop discussion sessions in online courses. This task is more difficult in online courses

because of lack of direct and one-to-one communication with students. This paper provided ideas for creatively designing discussions that promote exchange of ideas among students in a course. Finally, it suggested rubrics to grade the discussions and these rubrics covered basic elements of thought and reasoning.

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