Misconception Clarification in Online Graduate Courses

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Abstract

"Muddy Points" (MP) is a commonly used instructional reflection tool used to collect feedback about student learning issues and points of confusion. This feedback can be leveraged to enhance student learning and further optimize an instructor's course delivery. If used appropriately, this method can help students monitor their construction of knowledge and contribute to their self-regulation of learning. This then leads to deeper conceptual learning and improved achievement of their learning goals.

In a face-to-face classroom setting, Muddy Points are typically collected at the end of a class session. Feedback or response to comments are usually addressed at the beginning of the next class session. This paper investigates if a MP process can be effective in an online course setting. It also investigates and shares best practices that would be needed for a successful implementation.

The modified Muddy Points methodology includes four steps: 1) collection of student reflections of unclear concepts; 2) assessment of student reflections in order to identify misconceptions that can keep students from achieving learning outcomes; 3) generating formative feedback, and 4) selecting and using delivery tool that quickly provides formative feedback to students. This process was implemented and studied in two fully online Materials Science courses. In one course, all of the steps were used and in the other, only the first step was implemented. Mid-semester survey data supports the notion that this type of formative assessment can be performed effectively in an online setting if implemented with careful consideration and adherence to ALL of the four steps. This paper shares data from both classes, the technologies used, and recommendations for the implementation of this process in other online courses.

I. Introduction

Over the past three decades, new approaches to engineering course delivery and associated learning methods have been developed. A couple of the approaches such as active learning classrooms and online class delivery have become popular. Another effective development during this time has been the use of Classroom Assessment Technique (CATs) [1]. Muddy Points (MP) is one of these techniques. It is a tool used to collect feedback about student learning issues and points of confusion. Many times, it takes the form of a 'Minute Paper' where students are asked to spend the last minute or so of class anonymously writing their responses to a couple of questions. These questions help the instructor recognize any disconnects between what they said and what the students actually heard (*e.g.*, What was the main point of today's class? What did you find most confusing?) [2]. Instructors can then take this feedback and leverage it to enhance student learning by adapting future content delivery and course facilitation methods. Responding to this information at the beginning of the next class period also lets students know the instructor hears them and values their opinions. This can greatly enhance student motivation.

As of fall 2015, 29.7% of all higher education enrolments were taking at least one online course. This number represents an increase of 3.9% over the previous year and an 11% increase over

2012 [3]. With online enrollments increasing, instructors will need to rethink how they implement CATS such as Muddy Points.

Various aspects of online course delivery and learning research have been enabled by the recent rapid increase in the number of online courses. Most of the research in the literature addresses pedagogy and effective of online tools [4]. However, there is not much in the literature that provides course developers and instructors with a methodology for the implementation of these newly developed tools into online courses.

This paper looks at how to implement such a process in an online course. How does an instructor collect this information? How do they convey the information back to the students? This type of instructive process of feedback delivery and communication should be carefully chosen such that information is obtained quickly and responses are provided to students in a timely manner. Finding ways to accomplish these tasks can increase instructor presence in the course, which is a key factor to student success in online learning [5]. It can also build a sense of community as students communicate with their peers regarding their struggles and concerns, and provides instructors with timely informative feedback.

Another essential factor in online education is learner autonomy. Online learning necessitates that learners regulate and evaluate a good portion of their own learning [4]. If used appropriately, MP can help students monitor their construction of knowledge and contribute to their self-regulation of learning. This then leads to deeper conceptual learning and improved achievement of their learning goals.

II. Method and process

In general, a Muddy Points methodology includes at least these four steps [6]:

1. Collection of student reflections of unclear concepts
2. Assessment of student reflections in order to identify misconceptions that can keep students from achieving learning outcomes
3. Generating formative feedback
4. Selecting and using a delivery tool that quickly provides formative feedback to students

In a f2f setting, MP are generally collected at the end of a class session as students leave the room. The professor then reviews the submissions to sense themes and develops additional resources or materials based upon them. These additions are then usually addressed in person at the next class meeting. The process can be modified and applied to an online class environment. This is exactly what was done in two online graduate engineering courses in the Fall of 2017.

The first modification implemented was to accomplish step one – collection of student reflections of unclear concepts. It involved the lecture videos. At the end of each video lecture, the students were presented with a survey question that asked them to evaluate the confidence they had in their understanding of the material.

Survey Question:

I feel confident in my understanding of the information presented in this lecture.

- Yes
- I think I will once I reflect upon it a little more.
- No, I could use some help.
  Feedback: Please reach out to one of the instructors or post something on the Muddy Points Board.

If the student selected 'No' (see Fig. 1), they were given the feedback to either contact the instructor or post to the Muddy Points Board. The instructors were then able to go to the survey responses within the LMS and quickly view how their students felt about the lecture and who might need additional communication and instructions.

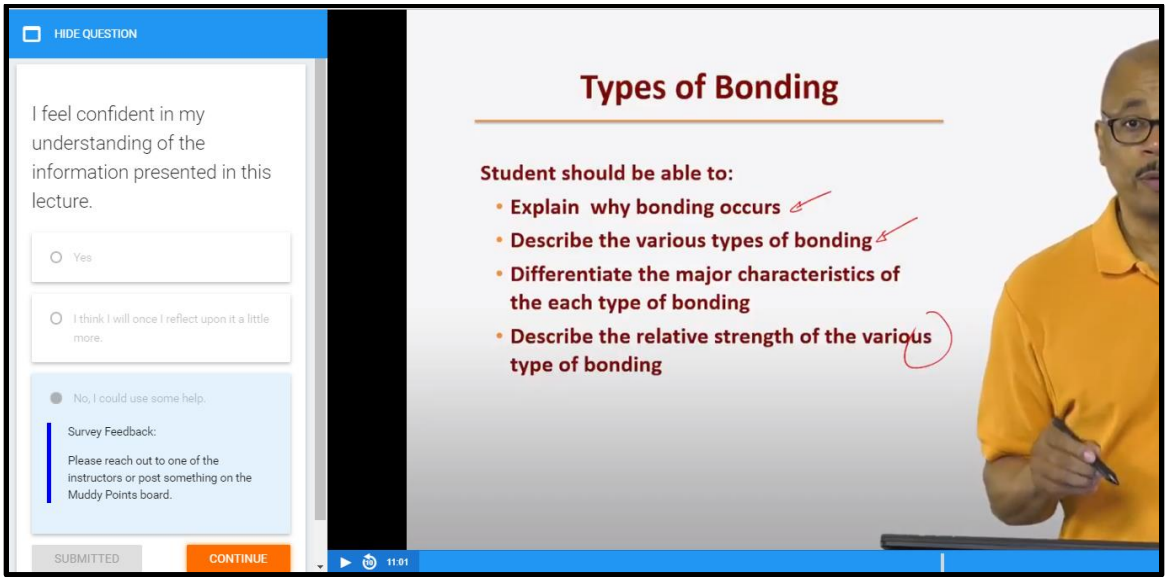

Figure 1. Feedback to survey question encouraging students to reach out to the instructor or post on muddy points bulletin board.

The second modification made helped accomplish step one as well. It was to create a digital space where students could post their reflections and questions. After review of available technology, the instructors chose to use Lino (http://en.linoit.com) to create digital bulletin boards that could be embedded or linked into the course. The instructor, to help ease any student confusion on how to use the tool provided posts and video tutorials.

The instructors would then complete the second step - assessment of student reflections in order to identify misconceptions that can keep students from achieving learning outcomes. One helpful feature of Lino is that the instructor can set up notifications so they can get an email when students post. This helped the instructors make sure to catch every comment and to recognize activity on the board. They could then review those comments to organize them around themes. Lino allows the instructor to drag comments around the bulletin board making the grouping of comments into themes easy.

The third step - generating good formative feedback - is a key component for MP. The professors spoke regularly and discussed what students were posting on the Muddy Points board. They would then generate answers and additional resources such as short videos or readings that could

alleviate student concerns. These items were then prepared to be shared during Step 4. In addition, during this timeframe students were encouraged to help answer one another's questions.

The final and fourth step - selecting a delivery tool that quickly provides formative feedback to students – allows the instructor to show students that their comments have meaning and affect the instruction. Online, some ways to accomplish the delivery of feedback can be during virtual office hours or email. Another way the instructors in this case used to deliver feedback was to add sticky notes to the digital bulletin board. A system was created so that students knew that any sticky note that was pink belonged to the instructor and the information could be relied upon (see Fig. 2).

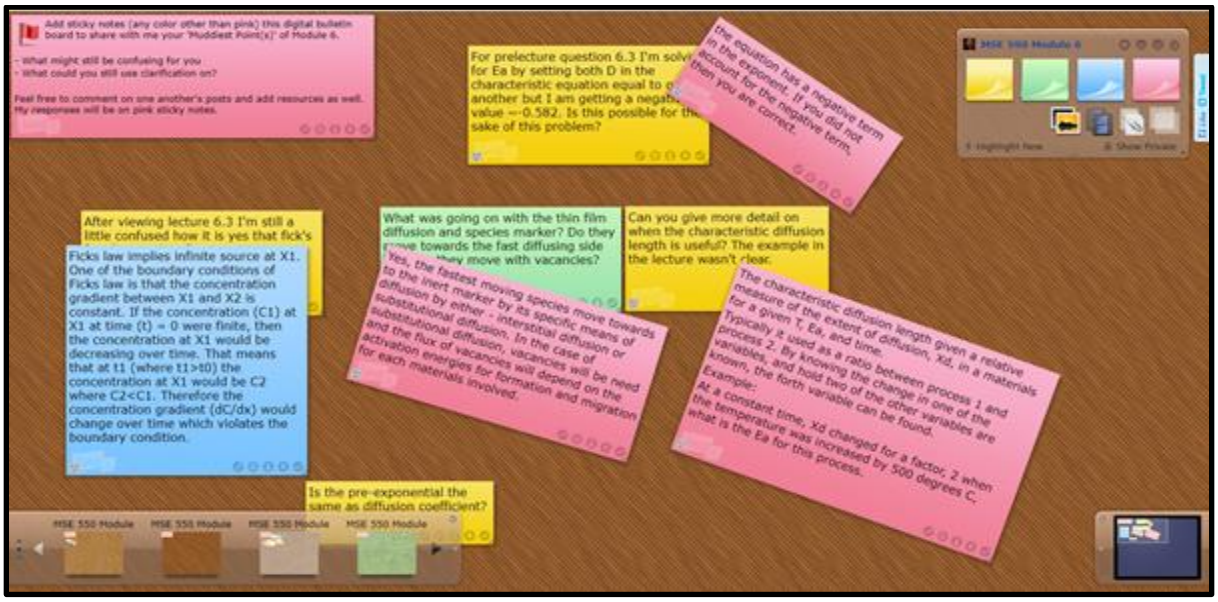

Figure 2. Example of one of the muddy points digital bulletin boards.

Another way the instructors chose to convey their responses to student feedback was to create short video clips or mini-lectures that would point out common misconceptions and clear them up with additional targeted instruction and examples. These were posted in the course LMS site as well as being sent out in announcements.

III. Results & student reactions

An aim of MP is to facilitate student self-monitoring of their desired learning goals [6]. The instructor has the responsibility to respond to MP in a timely manner through next lecture slides, email, LMS announcements, or conversations via the telephone or web-conferencing. In preparation for this paper, one course (MSE 598) the instructors monitored and responded to the Muddy Points board regularly. In another course (MSE 550) the instructors only occasionally reviewed the Muddy Points board during the first half of the semester.

Mid-semester surveys were launched in both courses to evaluate the effectiveness of the online MP process. The data received (see below) supports the notion that this type of formative assessment can be performed effectively in an online setting. The responses also verified what

many studies have shown – it is important to give prompt feedback and encourage contact between students and faculty [7] [8]. In MSE 598 where the board and comments were regularly monitored and responded to, students found value in Muddy Points. In MSE 550 where it was not monitored and responded to regularly, they did not find value in the MP process.

These elements (monitoring and communication) are vital in the success of Muddy Points or any type of assessment that is meant to be formative. The second half of the semester in MSE 550 had the elements for success added to its process.

MSE 598 – Mid-semester survey (8 students surveyed, 6 responses)

I have found the Muddy Points (Lino) to increase my learning.
Strongly Agree – 17%
Agree – 67%
Neither Agree or Disagree – 16%

Free Responses:

- "Muddy points are a good way to interact with the professor outside the office hours."
- "Although I have not used Muddy Points a lot, it has given some vital information about some topics and questions I did not think of. It is useful in that manner."

MSE 550 – Mid-semester survey (9 students surveyed, 8 responses)

I have found the muddy Points (Lino) to increase my learning.
Strongly Agree – 0%
Agree – 0%
Neither Agree or Disagree – 50%
Disagree – 25%
Strongly Disagree – 12.5%
Not Applicable – 12.5%

Free responses:

- "Muddy Points are great but our questions are not answered in a timely manner."
- "Not much use of Muddy Points by whole class thus far. However, if questions are asked it would be good if the responses from professors were done within that week's deadline."
- "It is a good idea, but we should get responses to questions quicker."
- I think the muddy points are a great way for students to casually and anonymously post questions, and in that I think it's a great platform. However, in recent weeks, there have been questions posted with no instructor response, which dissuades further interaction. If there was some sort of notification which brings a posted question to the attention of the instructor/weekly reminder to check the activity, this would be effective."

Assessment of tool (Lino) use

Lino served the purpose of Muddy Points very well for these two courses. The only possible drawback noted might be that sometimes boards can get a little unruly. Luckily, users can always have a bird's eye view of the entire board and pan around to view portions of it better. The strengths of the platform definitely facilitated richer discussions in the course (MSE 598) where the instructor set up notifications and regularly monitored and participated in the postings.

Some particular strengths that help enforce MP best practices are:

- *Easy to link or embed* – Instructors can easily link to or embed the actual board(s) within their online courses to help ensure students see it within the context of the content. This helps increase participation as they are less likely to forget to post and also less likely to get lost on other places on the web while navigating to the site.
- *Notifications* – Instructors AND students can set up notifications so they receive an email when new content is posted. This helps keep the participants in the loop.
- Students do not need to create an account – Students can just click on a board and participate.
- *Ease of use* – The interface is intuitive to use. There are resources to help with any questions.
- *Attachments* – Users can add files as attachments to sticky notes. The instructor in MSE 598 did this to share additional references with students.
- *Mobile accessible* – Users can take notes, post pictures and videos with their mobile devices. They can also zoom in and out by pinch gestures.
- *Searchable* – It is possible to search the text of the sticky notes by keywords.

IV. Summary

Successful implementation of f2f tools used to interact with online students' needs to be simple and constant. In this paper, an approach is described regarding how to incorporate MP into online course delivery for informative student feedback and course reassessment/revising. The approach provides course developers and instructors with a methodology for the direct implementation of these newly developed or previously developed f2f tools effectively into online courses. However, there are several important aspects associated with the implementation:

- *Create a system* – To help with the management of the boards, make sure to set up some standard operating procedures at the very beginning. For example, in this instance, the instructor made sure to let students know that they could use any color sticky note but pink. That way they always knew the final word on topics.
- *Monitor regularly* – Student experiences are more likely to be positive if the instructors monitor boards frequently and involve themselves in the posting. This is shown by the data between MSE 598 and MSE 550.
- *Show impact* – To truly leverage the benefits of Muddy Points, instructors should use the feedback to shape future instruction. Show students that you are listening and responding to them as their questions are answered and their voices shape future coursework.

- *Develop Resources* – It is important for instructors need to create supports around the digital tool(s) used. It is also helpful to archive past Muddy Point boards and make them available to current/figure students. This not only models the process but also helps uncover questions and resources current students might not have realize they also possessed.

This experience helped to crystalize some best practices and given ideas for future iterations of the courses involved. Inquiries will be made to enable a direct link to the boards to be embedded in the feedback of the lecture videos. This way students are more likely to navigate there at that exact moment. All courses will have notifications set and will be monitored regularly by the instructor. Instructors will also refer back to the Muddy Points boards regularly in announcements and update videos. In addition, boards will be embedded within the Learning Management System (LMS) along with the link that can be opened outside of the LMS. Resources about this Muddy Points process will also be created and shared with additional faculty to help encourage these types of interactions in additional engineering courses.

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