Understanding lived experiences of students in a blended-learning neuroscience MOOC

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Abstract

This study is part of a larger research project that aims to understand the lived experiences of students enrolled in a Massive Open Online Course (MOOC) on neuroscience, offered by Harvard University in the Fall of 2013. The course provided 185 students with physical lab kits to conduct electrical engineering experiments. Our previous descriptive analyses of the online survey, clickstream, and grade data show that students' engagement with certain activities affected their overall grades[1]. However, these findings do not fully reflect students' lived experiences or their unobserved behaviors. This paper will discuss students' perceptions of using the online and offline components of the course through thematic analysis performed on the interviews of students who received lab kits. Understanding students' lived experiences may allow STEM MOOC educators to design online and offline activities and materials that reflect the interactive nature of STEM topics.

Keywords

MOOC, Blended Learning, Student Lived Experiences, MOOC Perceptions and Behaviors

Introduction

Although quantitative analysis of clickstream data creates a picture of each student's website presence, it fails to capture students' reasoning or their experiences and emotions in an online course. Student perceptions captured in qualitative data can reveal the hidden reasons that influence what activities students chose to spend their time on within the course and their overall course experience. This paper is a part of a larger ongoing study of HarvardX's "MCB80x: Fundamentals of Neuroscience", an innovative MOOC containing interactive online and offline learning components, including an at-home lab kit. As MOOC courses become continuously more availible, adding STEM courses with lab components has been deemed both a necessity[2] and an expensive proposal[3]. Student perceptions within this course, especially of the lab-kit, provide a starting point to improve and implement similar STEM activities and offline components in other courses. This ongoing study utilizes thematic analysis to analyze interviews that were conducted to determine students' perceptions of the utility of the materials. This paper focuses on the research question: *What are students' perceptions of interacting with the online and offline components of the course?*

Background

MOOCs have large, diverse, global enrollment[5], which creates challenges not typically found in traditional classrooms[6]. One challenge is the lack of hands-on lab activities for MOOC students.

Although inquiry-based lab activities have been shown to be an important part of science learning[2], they are difficult to facilitate and expensive to replicate in a MOOC environment[3]. The large amount of clickstream data that MOOCs generate makes it challenging to quickly analyze and to provide feedback to the instructors or MOOC developers[3]. Several studies of MOOCs have already focused on understanding student behavior by analyzing clickstream data. Coffrin[7] analyzed clickstream data collected from two MOOCs to find that similar patterns emerged in student behavior and engagement from both MOOCs, but noted the limitations of the data in revealing the intentions behind these behaviors[7]. Commonalities in student MOOC behavior were also noted between students in live and archived courses. Students' behaviors were strongly connected to their pre-course survey responses of their intentions[8]. Thus, studying student perceptions that impact their behaviors will allow for a more nuanced understanding of student experiences in STEM MOOCs and the capacity to create a course that better suits their needs.

This paper explores the lived experiences of students in MCB80x. This course was "live" from October 31, 2013 until January 25, 2014 during which it was taken by over 24,000 students from 143 countries. This course offered interactive videos, virtual labs, traditional lecture videos, a discussion forum, and links to other offsite sources. The Fall 2013 offering of this course was unique because it included an at-home lab kit to create a hands-on learning experience to supplement the online content. At-home experiments included extensive electrical engineering activities related to basic neuroscience (e.g., measuring electrical potential of neurons). Out of a self-selected group of over 5,000 students who participated in a Randomized Control Trial (RCT), 185 students were randomly selected and received a lab-kit to complete the at-home lab component of the course. Students not in this group could opt to purchase a lab kit.

Methods

Sampling, Recruitment, Interview Procedure

Of the 185 students who received the lab kit, which constituted the treatment group, participants in interviews were recruited through a stratified sample of eight groups. This stratification sought to categorize students by *outcome*, which relates to their perceptions (whether they thought the course was useful enough to complete it), and *on-website behaviors* (whether they chose to engage in sustained use of the website). This stratification, thus, allowed patterns to emerge related to the perceptions and resulting behaviors, dividing students by persistence (passed, failed, or stopped out), performance (high grades or low grades), and engagement (high pageviews or low pageviews). The team hypothesized that students' realized persistence, performance, and engagement would likely relate to different student perceptions of the utility of the learning materials.

Twelve students from five of these strata self-selected to be interviewed via recruitment emails sent to all 185 students. The demographic information on these students is listed in Table 1 (names are pseudonyms). A semi-structured interview protocol was developed and piloted by the research team. Interviews conducted via online conferencing were audio recorded and transcribed verbatim.

Table 1. *Participant's Demographic Information*

Student Pseudonym	*Gender*	*Age*	*Country*	*Stratum*
Alex	Male	47	India	Passed, High Grade, High Pageviews
Ana	Female	28	Poland	Passed, High Grade, High Pageviews
Andrew	Male	51	Brazil	Passed, High Grade, High Pageviews
Kurisu	Female	54	France	Passed, High Grade, High Pageviews
Alice	Female	-	Mexico	Passed, Low Grade, Low Pageviews
Emily	Female	30	India	Passed, Low Grade, Low Pageviews
Jasmine	Female	34	Kuwait	Passed, Low Grade, Low Pageviews
Steve	Male	31	Ghana	Passed, Low Grade, Low Pageviews
Max	Male	51	Morocco	Failed, Low Pageviews
Bob	Male	42	USA	Stopout, High Pageviews
Wuki	Male	35	China	Stopout, High Pageviews
Carl	Male	35	Kyrgyzstan	Stopout, Low Pageviews

Thematic Analysis

The twelve student interviews were then analyzed using thematic analysis. Thematic analysis is an adaptable tool used to analyze qualitative data[9]. The research team studied the thematic analysis process from established practice[9 - 11] and came up with an adapted version of the process, encompassing the six most relevant steps from each paper (Table 2).

Table 2. *Thematic Analysis Process Steps (adapted from Braun & Clarke, 2006)*

Stage	**Process**
Step 1	Reading and re-reading the data, get comfortable with data, outline initial patterns.
Step 2	Generating initial codes and connect these (codes/labels/patterns) with research question(s) / theoretical framework.
Step 3	Introduce themes and categorize codes into themes.
Step 4	Research deeper into the themes generated; match themes with research question; refine themes.
Step 5	Condense themes, define and organize (clean up analysis); create thematic map (figure/visual).
Step 6	Describe thematic analysis results and write up thematic report.

Two researchers of the team were responsible for analyzing the data. Steps 1 through 4 of the thematic analysis process were independently completed by them. The first researcher (first author) was involved with the project from the design phase, whereas the second researcher (second author) joined the team just before the data analysis phase. This provided an opportunity to analyze the data from two different perspectives. After completing step 4, the researchers came together to compare their themes and decide on a final organization of themes. For the subsequent steps, both researchers worked together to come up with the results and to write the thematic report. The thematic report is a written account of the thematic analysis, which tells the story emerging from the data and is meant to convince the reader of the validity of the analysis[9].

Results

For step five of the thematic analysis process, specific themes were developed from the interview transcripts. These fifteen final themes were grouped into thematic topics, which included Utility of Engagement (students' explicit articulations of value judgments of learning materials), Lab Kits (the main offline behavior expected from the treatment group), and Learning Behaviors (non lab kit online and offline behaviors), in order to better understand the relation between the themes and the research within this ongoing study. For this paper, three themes from two of thematic topics that directly related to and informed the research question were selected to be examined in greater detail.

Utility of Engagement

Within the topic of Utility of Engagement, two themes emerged as unique answers to how students perceive the course: Course Expectations and Resource Impact. Course Expectations were the views that students brought into the course of what makes a course "good". These views are influenced by culture, prior experience, and learning preferences. For example:

> **"***...when it comes to fundamentals of neuroscience, it was a cool course. I, I attended it to make sure that I had all the bases of the neuroscience covered. But it turned out to be more fun than I had ever expected. It was really cool in terms of how it was prepared, how, how the knowledge was distributed to students and how we interacted, it really was.***"** - Ana

These views encompassed two main sub-themes: students who liked the interactive nature of the course and found it engaging and students who had the need for a more conventional lecture style course. Students who fell into the group who liked the interactive nature of the course were likely to also fall into the discovery theme of learning behaviors (see below). Students who fell into the group who wanted a more conventional course often felt that the material other than strict lecture videos was not a good use of their time and so were less likely to utilize these materials, including the discussion forum and "field trip" videos. For example:

> **"***...maybe i am wrong. but i would prefer if the videos are more conventional. I mean show the cell and the potassium going in and the sodium going out or explain both ways, in my personal point of view. The cartoon is very cool but as well is distracting so if the point is to show what is happening in the cell, then show the cell and the elements going in and going out. I think the best is to show both videos the cartoon of the bar/party and the cell and its process.***"** - Wuki

The second theme was Resource Impact. Since this course offers no institutional credit, the usefulness of the course was defined by each student and related directly to each student's life. Thus, students often found unique ways of using course resources to meet needs they were not originally designed to meet. For example:

> **"***I thought interesting, interesting visuals there. Professor was nice. He was knowledgeable and I guess I used them both and just refresher for my own knowledge and I kind of, I used even some material in classes I teach.***"** - Bob

Students did this in two ways: by using this course as a guide for how to teach neuroscience or by using it as a way to fill in details missing from current or previous education. Since this course was designed as an introduction to neuroscience to students who were generally uninformed concerning neuroscience concepts, it was not designed to meet either of these two needs. Students who looked to this as a guide to teach neuroscience were teachers who often used some of the class resources in their own classes or used the examples presented in the class lectures to better explain neuroscience concepts to their own classes. Students who sought to fill in missing details were taking the course as a review or as a way to gain details necessary for research projects. For example:

> **"***I had just, uh, started a research project studying multiple sclerosis and I wanted a little bit more background because I do know the pathology part but I wanted to know the theological neuroscience of, you know, just the general central nervous system. So I thought that might give me a little bit more of a command over the nomenclature used, certain assays that are used, when I'm reading, you know, journal articles and stuff like that. So I, that's basically why I signed up to that course, to gain more information, more basic information that wouldn't make me sound stupid when I'm talking about the diseases that I'm studying.***"** - Jasmine

Lab Kits

The at-home lab kits produced an enriching array of responses from those students that received and used them. However, several students received the kits too late or not at all. Those that did work with the lab kits and conducted experiments revealed their perceptions of the usefulness of the lab-kit through the theme of Amplifying Behaviours that emerged, where students used the lab kits in connection with others, demonstrating to the class they taught or to their own children. For example:

> **"***...actually I feel kind of pity with the cockroaches, so (laughs) I rather opted out of experimenting on cockroaches. But ah, I demonstrated the instrument in my class, in the lecture class and I, and I summoned my students and pop leads on electrode, electrode sub leads on my students and let them see how it was spiking and let them measure and show them that these are the action, these are what you see and these are the peaks so in magnitude and, and these are the times, these are timescales highs on the skills. We can measure how much is the, ah, duration, degree in the spikes et cetera, so they also enjoyed.***"** - Alex

Conclusions and Implications

Student behaviors within the MOOC environment were influenced by the perceptions they brought into and developed within the course. Although this research team categorized themes into topics that were intended to split them by behavior and intention, it was discovered that each were highly intertwined. Interviewees in one sentence would jump from perceptions to intentions and back again. Their initial course perceptions influenced what behaviors they engaged in. Students either limited or embraced their engagement in various course activities. Students also took the resources provided in the course and utilized them in new ways to better meet their needs, bringing these resources into their class as teaching materials or using them as review materials for exams. Students also took the lab-kit beyond its intended purposes by improvising to use it on other animals or even humans and by amplifying its use through bringing it into classrooms and collaborating with others. Students used self-motivation techniques of excitement through new discovery to inspire learning behaviors necessary to completing the course. Overall, this shows that MOOCs create a highly adaptable environment that many students use as a foundation on which to build for their own unique purposes.

This study was limited in its ability to draw from each strata, as students self-selected for the interview process. Despite encouragement by the researchers, no students were able to be recruited from three stratas due to this self-imposed exclusion. Some students also found it hard to give specifics due a two-year gap between when they participated in the course and when they were interviewed. Despite this, many students were able to give detailed responses to the interview questions.

Future research will focus on interviewing the control group of the RCT in order to understand how their experiences compared to those of the treatment group who received the lab kit. This research may reveal how the additional activities, interactions, and amplifying behaviors from the lab kit influenced student behavior and perception of the course. Additional recruitment from the missing treatment group strata may also be done to provide a more complete view of student experiences in the class. Given the importance of student intentions that we found in this study, further research may also explore grouping students based on their motivations within the course, such as those who gathered resources in order to teach their own classes and those who focused on the discovery of new information about neuroscience.

As MOOCs continue to be used by a diverse and worldwide group of students, it is important to create a more nuanced view of students' lived experiences in these environments to meet their needs. These experiences can inform MOOC developers, allowing them to create courses that better meet students' needs and are thus more student-centered learning environments. This information can then in turn be used to improve traditional learning environments.

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