Exploring self-regulated learning choices in a customisable learning pathway MOOC

Matt Crosslin
University of Texas, Arlington

Open online courses provide a unique opportunity to examine learner preferences in an environment that removes several pressures associated with traditional learning. This mixed methods study sought to examine the pathways that learners will create for themselves when given the choice between an instructor-directed modality and learner-directed modality. Study participants were first examined based on their levels of self-regulated learning. Follow-up qualitative interviews were conducted to examine the choices that participants made, the impact of the course design on those choices, and what role self-regulation played in the process. The resulting analysis revealed that participants desired an overall learning experience that was tailored to personal learning preferences, but that technical and design limitations can create barriers in the learning experience. The results from this research can help shape future instructional design efforts that wish to increase learner agency and choice in the educational process.

Massive open online courses, now known as MOOCs, have gained considerable attention in educational circles in recent years. While offering courses online for free is not a new idea, recent efforts in this area have attracted such large numbers of learners that a new term was coined to describe this phenomenon (Kovanović, Joksimović, Gašević, Siemens, & Hatala, 2015; Liyanagunawardena, Adams, & Williams, 2013). By 2012, several outlets had declared "MOOC" the educational buzzword of the year (Kovanović et al., 2015; Liyanagunawardena et al., 2013). Since MOOCs are typically offered as no cost or low cost courses that do not require learners to pass or complete the course, many questions remain as to what motivates such high numbers of registrations, as well as why some learners complete these courses and many others do not (Ferguson, et al., 2015; Jordan, 2015; Liyanagunawardena et al., 2013; Qiu, et al., 2016). Coming to an understanding of the reasons why some self-regulated learners engage with MOOCs and others do not could provide valuable insight into how learning designs for traditional courses could leverage customisable pathways and self-regulated learning. By investigating the reasons why learners choose various pathways in a flexible course format designed to let them choose their preferred epistemological modality (instructor-centric or learner-centric), this mixed-methods study sought to explore personalised learning choices in a customisable modality pathway course (defined as a course that allows learners to choose and change the power dynamic modality for their learning experience, thus creating their own personalised pathway) through the lens of self-regulated learning. This study was conducted as the main focus of a dissertation completed in pursuit of a PhD degree (Crosslin, 2016).

Background of self-regulated learning and MOOCs

The first course that was later labelled a MOOC was offered in 2008. This course, Connectivism and Connective Knowledge (CCK08), was initially designed as an open online course by George Siemens and Stephen Downes (Kovanović et al., 2015). The course grew beyond initial enrolment estimates to over 2000 participants; what was then considered a massive number. While much larger numbers were still to be attained, these initial surprising numbers led Dave Cormier to coin the term "massive open online course" (Dabbagh et al., 2016). However, the size of CCK08 was not intended to be the most interesting aspect of the course. Siemens and Downes had designed the course to be an experiment in a new learning theory that they had recently begun working out, called connectivism (Kovanović et al., 2015).

Theoretical framework of MOOCs

The beginnings of connectivism can be seen as an attempt to shift the power structure of courses away from relying on the instructor as the centre of the course and onto a more learner-centred design that leverages networking and social connections, as well as technology as a part of the sense-making process of learning (Siemens, 2005). Connectivism is a response to learning theories such as behaviourism, cognitivism, and constructivism, which Siemens and Downes felt did not address modern learning situations adequately

(Siemens, 2005). In Siemens' (2005) own words, connectivism addresses modern learning situations because:

> Connectivism is the integration of principles explored by chaos, network, and complexity and self-organization theories. Learning is a process that occurs within nebulous environments of shifting core elements – not entirely under the control of the individual. Learning (defined as actionable knowledge) can reside outside of ourselves (within an organization or a database), is focused on connecting specialized information sets, and the connections that enable us to learn more are more important than our current state of knowing. (p. 6)

The first MOOCs should be seen in this context: learning in a course where the control of power has shifted from a centralised instructor to a network of connections, and where content acquisition has shifted from a centralised expert to a nebulous connection of shifting elements and participants. This context did not last long, as a new format of MOOC arose a few years later. This new format of MOOC came about in 2011, when Peter Norvig and Sebastian Thrun created a course for Stanford University, Artificial Intelligence, that attracted over 160,000 students at its peak (Cabiria, 2012). This new form of MOOC was seen as very behaviourist in nature – with extensive use of instructor-created content, automatically graded tests, and very controlled avenues for learner interaction (Kovanović et al., 2015). This version of the MOOC gained the attention of the world at large, but the difference between the two versions was not lost on certain scholars.

In examining the differences between these two versions of MOOCs, Stephen Downes coined the terms *xMOOC* and *cMOOC*. The original form of MOOC was labelled a *connectivist MOOC* or cMOOC for short, while the newer form of MOOC was labelled *MOOC as eXtension of something else* or xMOOC for short (Downes, 2013a). Downes describes the difference between the two terms by saying that a "cMOOC is designed as a network … while an xMOOC is based on a central course site and content that will be followed by all students" (Downes, 2013b, para. 25). What the two terms basically highlight is a difference in the power dynamics of the two terms: xMOOCs rely on content and activities that are distributed from a centralised expert or experts, while cMOOCs rely on student-centred learning with a decentralised power structure. However, not all MOOCs fall into easy classifications. In 2014, an experimental format was created by Siemens and others that combined the xMOOC format with the cMOOC format as distinct pathways or layers in one course, allowing the learners to customise the epistemological modality they engaged the course activities with as need throughout the duration of the course. This format has been referred to as *dual-layer* (Dawson, Joksimović, Kovanović, Gašević, & Siemens, 2015; Rosé et al., 2015), *multiple pathways* (Crosslin & Dellinger, 2015), and *customisable modality* (Crosslin, Dellinger, Joksimović, & Kovanović, in press). Regardless of where the power may reside in any MOOC, there is one factor that has remained a constant for most MOOCs: the open nature of MOOCs means that due to either large numbers or de-centralised structure, learners are responsible for regulating their own learning (Kop & Fournier, 2011).

Self-regulated learning in MOOCs

While some colleges offer credit for MOOC participants who pay tuition and complete certain MOOCs, the majority of MOOC learners sign-up and participate in MOOCs for personal reasons more than any other reason (Hew & Cheung, 2014). Because of the responsibility that is placed on MOOC learners to regulate their learning, MOOCs have become an interesting testing ground for self-regulated learning. Milligan, Littlejohn, and Margaryan (2013) used self-regulation as a lens to determine patterns of engagement in MOOCs, identifying how participants were active, passive, or lurking in the course. Haug, Wodzicki, Cress, and Moskaliuk (2014) found that open badges or certificates could serve as motivators for self-regulated MOOC participants. Chung (2015) explored how design issues affect self-regulation among non-English speakers in courses offered primarily in English. Gasevic, Kovanovic, Joksimovic, and Siemens (2014) identified self-regulated learning as one of "main research themes that could form a framework of the future MOOC research" (p. 135). Many of these studies touch on issues of how design affects self-regulation, but few seem to explore learner perceptions of instructional design overall.

According to Mikroyannidis, Connolly, and Berthold (2013), educational initiatives like MOOCs are related to self-regulated learning because:

> These initiatives may provide an abundant amount of learning resources for free, but it is up to the learner to find the right ones to meet her learning needs and aspirations. Today's learner is expected to be able to plan her learning journey, search for appropriate learning resources, use these resources for her learning and reflect on her progress. In other words, a self-regulation skill set is required that will enable someone to learn how to learn. (p. 3)

Therefore, this study focuses on self-regulated learning over factors related to learning. Several aspects of self-regulated learning in MOOCs are still not fully understood, including how the design of learning materials and activities can affect learner self-regulation. What is known about MOOCs is that the basic design of many MOOCs requires a shift in power dynamics and control that some course designers might not be ready for. Mackness, Mak, and Williams (2010) identified autonomy, connectiveness, and interactivity as important factors that influenced student success in the CCK08 MOOC. These factors would imply a shift away from the dependence on the instructor and more reliance on self-regulated learning. Kizilcec, Piech, and Schneider (2013) performed a cluster analysis of learner types in MOOCs and noted that "the clusters reveal a plurality of trajectories through a course that are not currently acknowledged in the design and discourse around MOOCs" (p. 177). In other words, what would learning look like if learners were given the option to create a personalised pathway through different course modalities? Current research acknowledges what MOOC learners do in the courses as well as what factors influence those choices, but whether or not a course design that allows personalisation influences or affects self-regulated learning is still not addressed in the literature.

Research design

Based upon this analysis of the literature, a general need for more research into the relationship between self-regulated learning and customisable pathways learning design in MOOCs was identified. While some literature does touch on the relationship between learner personality and self-regulated learning in MOOCs, these studies only look at part of the picture. Self-regulated learners tend to have a level of motivation and experience that can help them overcome obstacles to learning such as poor learning design (Wang, Shannon, & Ross, 2013). Therefore, the gap in knowledge that was identified is the lack of insight into learners' choices when given the learning design option of customisable modality pathways, as viewed through the lens of self-regulated learning in MOOCs.

The results of this study can help shape instructional design in traditional online courses by illuminating the factors identified by participants that encouraged them to stay engaged with self-regulated learning. Instructional designers can utilise this information to make better decisions about course design by basing those decisions on factors that are identified in participant responses as beneficial for self-regulated learning and personalised learning design. Policy makers in education could use this information to set quality standards for online course design. Learners could also use the information to help self-identify courses that would be better suited for their self-regulated and personalised learning goals.

Research questions

This study investigated two primary research questions and three sub-questions. These questions are:

1. What are the attributes of the MOOC learners' pathway choices through the course content and activities?
2. What are MOOC learners' experiences in the customisable learning pathways? To what extent are their pathways related to the course designs?
   - What are MOOC learners' patterns in choosing the customisable learning pathways?
   - Are there any relationships between learner modality patterns and the course design? If so, why?
   - Are there relationships between learner modality patterns and the course activity design? If so, why?

Methodology

As noted in the introduction, this study was conducted as the main focus of a dissertation completed in pursuit of a PhD degree. Due to the knowledge gap in understanding learners' choices when given pathway options, this study utilised the participant-selection variant of the explanatory sequential mixed methods design (Creswell & Clark, 2011). This design allowed the study to focus on the insights gained from the second qualitative phase once the results of the first quantitative phase have been analysed. Therefore, the results from the first quantitative stage would only be necessary a means to provide context for the qualitative results if they were found to not affect the selection of participants for the second round. The procedure for the study had two main stages. The first stage involved sending out the quantitative survey via course email to all adult participants in HumanMOOC. The quantitative instrument was the SRL in Massive Open Online Courses survey (Milligan, Margaryan, & Littlejohn, 2013). The SRL in Massive Open Online Courses survey was chosen because it combines elements of several self-regulated learning instruments to create one instrument focused on MOOC environments. Participants accessed the survey online after self-selecting to taking the survey. Demographic information was also collected for analysis. Participants who completed the self-regulated learning survey were contacted to participate in follow-up online interviews. Descriptive statistics were first analysed to determine if demographic variables reveal any correlating trends. Next, one-way ANOVA was conducted to compare various demographic variables to the results of the self-regulated learning scale. Certain factors found to have significant impact on self-regulated learning, were noted for the selection process.

The second phase involved online, text-based structured interviews designed to explore the qualities of learners' pathway choices and perceptions of self-regulated learning related to the customisable modality MOOC design. A pre-determined set of questions were presented to all participants in the same order via a text survey, with probing questions sent through course email as determined by the interviewer when the responses were unclear or incomplete. These responses were analysed through etic coding to produce categories by qualitative analysis. Thematic analysis was then conducted to identify themes within the responses. These themes were used to discuss the research questions.

Course design

The educational setting for this study was a MOOC offered in the winter of 2015: Humanizing Online Instruction: The #HumanMOOC (HumanMOOC). HumanMOOC was administered through the Instructure Canvas system in conjunction with faculty from various universities. The subject of HumanMOOC focused on helping online instructors learn how to improve their courses by increasing social, teaching, and cognitive presence. HumanMOOC course design was based on the unique customisable modality pathways format that contains two complete modality options for learners: one modality containing instructor-led content, and another modality designed for connectivist interactions. This design method has been referred to as a dual-layer MOOC (Dawson et al., 2015; Rosé et al., 2015), multiple pathways course (Crosslin & Dellinger, 2015), customisable modality course (Crosslin, Dellinger, Joksimović, & Kovanović, in press), and a self-mapped learning pathways course (Crosslin, 2017). The main goal of the design is to create two distinct modality options for learners to utilise as they progress through course content, while allowing learners the freedom to move between modalities or mix both as they need at any time in the course (Crosslin, 2016). This freedom of choice was accomplished in HumanMOOC through the use of a weekly Neutral Zone that explained both modality options for the week while encouraging learners to choose either or both as needed. Weekly competencies provided structure and scaffolding to help learners stay on track and connected with each other.

The instructor-led modality contained a complete set of instructor-designed content and activities that could be utilised as a specific pathway to complete the course: learning objectives, text content, video content, instructor-guided discussions, instructor-guided activities, and assessments in the form of badges. This content was placed in a linear fashion inside of the course utilising tools within Canvas. The goal was to showcase to learners an acceptable linear pathway through the course content. This modality was referred to as a "Stream" in the course explanation to the students because of its linear, flowing nature.

The connectivist modality contained a less structured collection of tools and suggestions for learners: Twitter hashtags, an activity bank (a list of activity ideas that could help self-guided learners gain ideas for completing badges if they needed scaffolding), and a connect area (a place that aggregated learner blogs to

aid in discovery of other distributed participants). This modality was intentionally left open and non-linear to encourage learners to form their own groups, ideas, and content connections. The utilised tools were suggested as a starting point. Learners used the Twitter hashtag (#humanmooc) to connect with other learners, ask questions, share content ideas, and form activity ideas (such as several spontaneous participant-initiated and led Google Hangout sessions). This modality was referred to as a "Garden" in the course explanation to the students because of its non-linear, self-guided nature.

The overarching goal of the customisable pathways design is to move learners to self-determine how they would map their own learning pathway. This goal would bring learners closer to the theoretical framework of self-determined learning known as heutagogy (Hase, Stewart, & Kenyon, 2007). According to Blaschke (2012), in a heutagogical course the instructor "facilitates the learning process by providing guidance and resources, but fully relinquishes ownership of the learning path and process to the learner, who negotiates learning and determines what will be learned and how it will be learned" (p. 59). However, since customisable pathway courses are not fully heutagogical in nature, they can be viewed as part of a process that points learners towards self-determined learning.

Ethical considerations

IRB approval was obtained before participants were initially contacted. The main ethical issues that were taken into consideration with this study were informed consent, confidentiality of the information, and anonymity of the participants. Informed consent was obtained by an explanation section in the recruitment email and the initial survey. Confidentiality for the participants that only complete the first stage survey was preserved in that no names or personally identifiable information was accessed until potential interviewees were identified. Those who chose to be interviewed were assigned a pseudonym by the researcher before the interview. All interview responses were assigned to this pseudonym, and any references or quotes in the discussion were attributed to this same pseudonym. Any quotations that use personally identifiable information such as job titles were not used. Storage of the study data was treated with the strictest of confidence. All data, recordings, or transcripts that are stored were stored on a secure device with password protection. The researcher and major professor are the only ones with access to these files. Paper records were not kept.

Participants

Participants were recruited from the winter 2015 offering of HumanMOOC. This offering attracted a total registration of 871. Of those numbers, 573 logged into the course at least once and 461 spent enough time in the course to register activity in the software activity analytics. The company that administrates the course registration for HumanMOOC does not collect learner statistics, so obtaining demographic records for the course was not possible. Therefore, this study utilised convenience sampling by collecting results from all participants that self-selected to participate.

Of the available population ($N = 461$), 98 started and 70 completed the SRL in Massive Open Online Courses survey. Of those 70, two responses used names that could not be found in the class rolls, and one was found to be from a participant that logged into the course but did not spend time with any of the materials and so these three were discarded. Of the remaining responses, 17 participated in the qualitative interview stage. Table 1 is a summary of some key demographics.

Table 1
Study demographics

Characteristic		*n*	*%*
Gender	Female	41	71.2
	Male	19	28.8
Age	26-34	13	19.7
	35-54	38	57.6
	55-64	11	16.7
	65-older	4	6.1
Ethnicity	Caucasian	52	78.8
	Other	7	10.6
	African American	3	4.5
	Hispanic	2	3.0
	Asian	2	3.0
Education Level	High School or Equivalent	1	1.5
	Four-year College Graduate	8	12.1
	Master's Degree	41	62.1
	Doctoral Degree	12	18.2
	Professional Degree (MD, JD, etc.)	3	4.5
	Other (DC Degree)	1	1.15
Location	United States of America	46	69.7
	Europe	9	13.6
	Oceania (Australia, New Zealand, etc.)	6	9.1
	Africa	2	3.0
	South America	1	1.5
	Canada	1	1.5
	Asia	1	1.5

Results

Scores on the SRL in Massive Open Online Courses survey can potentially range between 32 and 128. The range for this study was 73 to 122, therefore the data is skewed towards the higher end of the self-regulated learning spectrum for this instrument. Most of the participants had graduate or professional degrees, so this factor probably accounted for the skew in the results. However, none of the studies that have used this survey so far (Milligan & Littlejohn, 2014; Milligan, Littlejohn, & Margaryan, 2013) used the results in a quantitative analysis manner; thus, comparison to other studies with regards to quantitative findings is currently lacking. However, two recent studies by Hood, Littlejohn, and Milligan (2015) and Littlejohn, Hood, Milligan, and Mustain (2016) took place where the researchers created modified versions of the survey by adding questions in order to perform quantitative analysis on the survey results. This modified version of the survey was not available during the time period that this study was under IRB review. The SRL in Massive Open Online Courses survey is typically utilised as a method to develop qualitative learner profiles, as is also the case in this study.

ANOVA correlations were used to compare total SRL scores with four demographic factors (age, education, gender, and ethnicity). No significant correlations were found between any demographic grouping and the SRL scores. This indicates that there is no significant correlation between self-regulated learning and any specific demographic group. If there had been a correlation, this correlation would have to have been considered when selecting participants for the secondary interview stage. However, since no correlation was indicated after analysis, all participants were contacted for the secondary interview stage. The results of the first quantitative analysis phase are provided here to add context to the qualitative results.

Reliability

Reliability for the SRL in Massive Open Online Courses survey was calculated using data from this study. Cronbach's alpha for the 32-item survey ($\alpha = .90$) indicated that this instrument has high reliability. This reliability score aligns with other recent studies that utilised modified versions of the same survey, which ranged from .72 – .945 (Hood et al., 2015; Littlejohn et al., 2016).

Interview question coding

The qualitative interview process involved asking a series of 10 questions, with follow-up questions as needed. The responses to these questions were investigated through content analysis to code for categories and themes. The categories that emerged are explained in Table 2.

Table 2
Open-ended question coding results

Categories	Supporting statements
Question 1: Can you tell me about your overall experience in HumanMOOC?	
The course was a positive experience that was beneficial in many ways	"It was a great experience overall. It was fun." (Avery) "I really enjoyed participating in this MOOC." (Emery)
Interactive social media aspects of the course were productive	"I found the discussions and assignments done by others very helpful to my learning." (Carter) "enjoyed the Garden approach much more than I expected." (Reese)
Learners encountered design and technical difficulties	"The content I found overly simple and poor." (Carter) "I have found it a little difficult at times." (Casey)
Learners were looking for practical application to work	"I have been looking for ways to beef up ideas for online course development." (Emery) "it offered new knowledge that will help enhance my skills." (Jessie)
Question 2: At several points in the course, you were given a choice of the learning modality to participate in (instructor-led Stream or student-centred Garden). How would you describe your overall pathway through those choices over the duration of the course?	
Learners wanted customisable, social options to mix pathways	"I swam in the Stream and I picked and chose from the Garden." (Alex) "I went back and forth between the Garden and the Stream." (Landry)
Learners wanted linear, time manageable guidance through a pathway	"I was seeking a linear sequence so I chose the Stream." (Blake) "Due to time constraints I followed the instructor led Stream for all of my assignments." (Emery)
Technical or design difficulties affected pathway choice	"After a while, I quit Stream path and continued to Garden path ... it was too static." (Taylor) "I crossed into the Garden just a bit when I got a little confused with the Stream." (Parker)
Question 3: What was your rationale for using the pathway(s) that you choose?	
Participants wanted specific types of	"I was in the Garden because of the mutual communications, actively changing conversations, fast knowledge flow and interesting people." (Taylor)

interactions with other learners	"Lots of conversations and public engagement." (Reese)
The Stream offered easier, more manageable path	"I feel that the Stream is a good way to learn the basics." (Hayden) "It fit with the time I had to be in the course." (Reagan)
Learners appreciated customisable ownership choices	"I went through the course like I was shopping at a grocery store ... choosing what products appealed to me to meet the needs of the projects I needed to complete." (Alex)

Question 4: What was your rationale for not utilising a different pathway?

Learners did not understand or have interest in other pathway	"I did not entirely understand the concept of the Garden." (Parker) "I wasn't interested in a lot of interaction." (Reagan)
Learners just preferred chosen pathway	"I enjoy structure." (Blake) "I felt that I needed what was offered in the instructor-led Stream." (Jordan)
Learners encountered technical or design difficulties	"I tried to use Canvas but it was impossible for me to use it to meet my goal of meeting new people." (Jamie) "I do not like too many choices for learning." (Blake)

Question 5: Did the course content design factor into the pathway(s) you choose? Why is that so?

Pathway choice was based on factors external to design	"For my particular situation, I choose the pathway regardless of the design. My pathway choice is entirely based on my knowledge on the subject at hand, not because of the pathway design." (Hayden)
Technical or design problems affected pathways choice	"I wonder if the design of having things due weekly impacted my ability to perhaps explore more of the Garden path." (Emery)
The design of content helped pathway choices	"Yes, it was easiest for me to just go through the course page by page." (Reagan) "I would say 'yes' because I felt I needed to have guidance and criteria." (Parker)

Question 6: Did the course activity design factor into the pathway(s) you choose? Why is that so?

Perceived positive design benefits encouraged choice	"Of course, that is also because both pathways were equally well designed." (Hayden) "By offering certain information the course made me read or think more about different things." (Charlie)
Personal preferences and choices affected pathway	"For my particular situation, I choose the pathway regardless of the design. My pathway choice is entirely based on my knowledge on the subject at hand, not because of the pathway design." (Hayden)
Negative design or technical factors affected choice	"The fact that those doing the Stream were using the forums as a way to share their work, made it difficult for me to interact with, because the format of forums makes it difficult for me to 'converse.'" (Cameron)

Question 7: Considering your responses to the Self-Regulated Learning (SRL) survey, how would you describe your experiences with SRL in this course?

The course/pathways design encouraged self-regulation	"I would say that I was strongly self-regulated my way through the course, and felt like I could (which does speak to the course design)." (Cameron) "I was motivated by excellent content provided in the course." (Alex)
Learners' self-regulation was independent of design	"I sometimes watched the great view in the Garden, rested and enjoyed the moment in some cases, I was the gardener, planting seeds, watering trees and tasting apples." (Taylor) "I think I stayed true to my own learning style and needs throughout the course." (Emery)
Learners demonstrated non-self-regulation attributes independent of design	"I am a procrastinator at heart ... I work better under pressure." (Landry) "Being the holiday time I actually struggled with it a little this time round." (Casey)
Design and technical issues affected self-regulation	"I felt there were a lot of tasks to complete in a short time frame." (Casey) "I did have a few accessibility issues in the middle of the course which did NOT help." (Landry)

Question 8: How would you describe the relationship between your pathway choice, the course content design, and self-regulation?

Content/pathways design affected SRL positively	"I liked the flexibility of being able to adapt the pathway to the content, which made it easier to complete the assignments." (Landry) "My self-regulation was affected because the Stream made it easy and efficient to be self-regulated." (Blake)
External factors influenced pathway choice and SRL	"I would say that my pathway choice was a result of pursuing my own goal (meeting people)." (Jamie) "I chose to just go straight through the content as outlined and it worked very well." (Reagan)
Design factors negatively impacted SRL	"I would say that there were lots of mini hurdles trying to complete all of the takes in different areas was tricky." (Casey)

Question 9: How would you describe the relationship between your pathway choice, the course activity design, and self-regulation?

Activity/pathways design affected SRL positively	"The flexibility was helpful." (Landry) "I was able to quickly self-regulate due to the design and ease of the pathway." (Blake)
Non-design factors influenced pathway choice and SRL	"The activities were not really relevant to my goals so I did not pursue them." (Jamie) "For the Stream I chose to pay attention because the activities were interesting." (Avery)
Learner sees content and activities as same	"I don't think I see the content that separate from the activity design. The course topics and the activities are intertwined for me." (Parker)

Question 10: What else would you like to share that would be related to these questions?

Learners had a positive course/design experience	"Thanks for a great MOOC experience." (Avery) "I felt like it was design-theory, learning styles, and differentiated learning and online education coming to life." (Alex)

Different tool/design choices would have improved experience	"I would suggest having a drop down menu labelled Stream and one for Garden." (Blake) "I would like to see the course offered over six (6) weeks rather than four (4)." (Casey)
Problems or lack of awareness of tools affected experience	"I ran in to a few snags with submission of assignments if I chose the Garden path." (Landry) "In the Garden path, I found the 'friending' or 'following' people confusing." (Cameron)
Personal preferences factored into learning experience	"I skimmed the articles, watched the videos, but was more anxious to 'create' and 'engage' than to read the content in detail." (Parker)

Interview themes

The preceding categories were analysed for similarities and synthesised into emerging themes. The two themes that were identified were: (1) participants desired an overall learning experience that was tailored to personal learning preferences; and (2) technical and design limitations can create barriers in the learning experience. A few categories did not fit into either of these themes, but did not form a cohesive theme of their own.

The first theme encompassed learners who both enjoyed the ability to choose their own modality as well as those who did not care about the modality choice option, but still benefitted from having their preferred modality present. Some participants also expressed suggestions for ways to improve choices. This theme would support the idea that learners enjoy the ability to personalise their own customisable pathway, even if they are not aware of their ability to make that choice. However, the suggestions that many made, as well as some comments about the design choices not helping their choices, would indicate that the customisable pathways design model still needs research and improvement, an idea that is supported in the second theme.

The second theme encompassed both technical problems with the Stream and Garden user interfaces, as well as problems with design choices made by the instructors. Several learners found the Canvas user interface to be confusing. This probably indicates that learners needed an easier to navigate learning management system for the Stream modality, as the course discussion forums were crowded with questions asking where to find certain resources. Future offerings of this course design methodology should look for simpler, more user-friendly content or learning management systems for offering the Stream modality. Additionally, the scaffolding into the Garden could be more extensive to help the learners that expressed confusion with that modality.

Research question results

What are the attributes of the MOOC learners' pathway choices through the course content and activities?
The learners' pathway choices tended to be specific to several individual learner factors. These factors related to attributes of the pathway choices based on qualitative analysis include personal preferences, time constraints, confusion with the design and/or tools, desire for a specific learning experience for the specific course, well-designed pathway choices, personal desires for specific social interactions (or lack thereof), or an ever-changing mixture of any of these factors on any specific day. The idea that less regulated or experienced learners will choose an instructor-guided path and that more regulated or experienced learners will choose a student-centred path was not well supported by the analysis. Therefore, the main attributes of the MOOC learners' pathway choices seemed to be individualised, not conforming too many recognisable patterns, and connected to many factors internal and external to the course design and purpose.

What are MOOC learners' experiences in the customisable learning pathways? To what extent are their pathways related to the course designs?
Many learners appeared to have a positive experience in the customisable modality pathways design, though many were also confused by the design and tools utilised. The general learning pathway patterns (research question 2, sub-question 1) seemed to be that learners: (a) chose one modality and stuck with that

modality through the entire course, (b) created a linear mixture of both pathways for the entire course, (c) created a nonlinear mix of both modalities for the entire course, (d) chose one modality at the beginning and then switched to the other when the original choice became difficult, confusing, or boring, or (e) utilised both pathways interchangeably through the entire course. With regards to learner modality patterns (research question 2, sub-questions 2 and 3), learner patterns appeared to sometimes have a relationship to course design and activities, and sometimes not. Many learners seemed to choose modality patterns based on personal reasons. Others indicated that the design of the course helped in the modality choices they made. Still others found the design confusing and felt this hindered their choices. Sometimes, this confusion was connected to problems with the tools or tool interface, but for a few learners, the course design did seem to affect modality patterns. All of these scenarios connected to both themes that emerged from the analysis, in that learners preferred making choices but had issues that affected choices. Those who were affected negatively by design issues seemed to desire having the course designed in manner that would have been more to their personal learning preferences. In general, the ability to choose modality patterns in relation to the course design seemed to either not affect pathways choices at all, or tended to help learners chose an individualised pathway.

Discussion

Some of the comments from participants highlighted the contradictory nature of offering choices to all learners. Many participants indicated appreciation for the fact that they could focus on the linear Stream pathway without interruptions from social interaction in the Garden. Others indicated that they wished the Stream and Garden were more "permeable", allowing learners to see both options at the same time. The question becomes: which learners gets their desires in the final course design? These ideas cannot really coexist at the same time for all learners. Perhaps new technology needs to be developed to make this possible? This need for flexibility has been noted in earlier research into multiple pathways design (Crosslin & Dellinger, 2015; Crosslin et al., in press; Dawson et al., 2015).

This leads to one other interesting finding to discuss, which is how some participants felt hindered by the interface and or design of the technology, most notably the learning management system utilised in HumanMOOC. Some of the technology in the course was very inflexible. The fact that many participants noted this could be a sign that the flexibility of the tools is more important than coherence or lack of coherence between content and activities. A case could be made for using more flexible technology tools where they exist, or, where they don't exist, inventing new ones. Previous studies into new technologies implemented in dual-layer courses indicates that new tools can be beneficial (Dawson et al., 2015; Rosé et al., 2015). However, the relatively high SRL scores from all participants seemed to indicate that most learners could overcome those limitations. SRL tends to be studied in courses that have one pathway choice for the entire course, so it may be the case that a new paradigm of SRL needs to be applied to contexts like HumanMOOC where learners are in more control of power dynamics. In general, these issues lent support to the second theme of design and technically difficulties affecting learners in various ways.

Implications for education

Assuming that the findings and discussion from this study are plausible, the task ahead for those working on customisable modality pathways design is complex. Creating customisable learning experiences is no small task. Technology currently exists to support many of the ideas discussed in this study, but pulling these technologies together in a manner that maximises power dynamics control for individual learners will take a massive amount of research, investigation of options, user interface design, and end-user testing. Additionally, once a good system for supporting customisable layer design is in place, the hard work begins.

This hard work is the paradigm shift that would be necessary in untold numbers of practitioners that are used to controlling the decisions in designing a single pathway, one-size-fits-all-or-else course. So many courses are designed by the instructor in charge with clear objectives, clear steps to achieve those objectives, and clear content to consume as part of those steps. Those aspects can still stay in place as one of the pathway choices in a pathways course. The charge is really not to change people's chosen epistemology, but to expand their willingness to embrace others within the same course.

However, special note should be made of how these results could be utilised in other contexts. Not all learning systems allow for the type of openness required in MOOCs, therefore customisable pathway course

structures will need to be adjusted within these systems. For example, traditional online courses typically require more easily gradable artefacts. Within traditional online courses, the results of this study could be utilised to implement greater student choice over which artefacts are produced. Traditional online courses could also be divided into sections, with each section allowing learners to self-map their learning pathway to some degree. Then, all learners could come together at the end of each section for a standardised assessment required by the degree program. Instructors could also create a bank of assignments to facilitate self-mapping while keeping assignments within institutionally-mandated parameters. The goal of these design adjustments would be to foster self-regulation and determination as much as possible within contextual restraints.

Limitations

Due to the mixed methods nature of the study, the main limitation of this study is that the results are not quantifiably generalisable to the larger education population. The design of this study utilises a methodology that focuses on the qualitative results, with the quantitative analysis only necessary to formulate selections for the second phase. Additionally, the primary researcher also served as instructor and lead instructional designer for HumanMOOC. This could have introduced a bias towards certain design structures in the data collection of the qualitative feedback. Perceptual misrepresentations are also a limitation in any qualitative research study, as well the ability of the quantitative instruments to accurately record complex ideas such as pathway choices and self-regulated learning. Additionally, the inconsistent participation rates as well as high drop-out rates that many MOOCs experience make a consistent scope difficult to conceptualise.

Suggestions for further research

Based upon the findings discussed in this study, several recommendations for further research are proposed. These recommendations include: investigating different tools, developing new instruments, and exploring how to improve interface design. When investigating other tools, future research could look into other learning management systems, or even content management systems like WordPress or Drupal, to see if systems like those work better for more learners in customisable pathways courses. Additionally, researchers could also examine the effects of other social media tools beyond Twitter and blogs on the customisable pathways experience. In developing new instruments, new scales need to be developed in order to rate levels of connectivism versus instructivism, or instructor-centred versus learner centred preferences of learners in customisable pathways courses more fully. Finally, as new tools are developed to support customisable learning pathways, experiences, and validation, these tools will be accompanied by various interface choices that also need to be researched.

Conclusion

The findings reported in this study are often contradictory and vague. Such is the nature of looking into true individualised learning. Individual learners are diverse, unique, and difficult to fit into boxes. In many ways, the scattered results presented here are an indication that the customisable modality pathways design is on the right track. If too many learners lined up on too many factors, there would be no need for customisation. However, the results of this study appear to support the idea that learners need the ability to customise their learning experiences. Ultimately, the goal of customisable modality pathway design is to humanise online education more, by returning power back to individual learners so they can self-regulate through their own personalised pathway. Instead of losing learners in a sea of data, computer algorithms, learning at massive scale, and dehumanising tools, courses could become places where each person becomes a unique individual fully able to control their own learning experiences.

References

Blaschke, L. M. (2012). Heutagogy and lifelong learning: A review of heutagogical practice and self-determined learning. *The International Review of Research in Open and Distance Learning, 13*(1), 56-71. https://doi.org/10.19173/irrodl.v13i1.1076

Cabiria, J. (2012). Connectivist learning environments: Massive open online courses. *Proceedings of The 2012 World Congress in Computer Science Computer Engineering and Applied Computing, Las Vegas, NV*, 16-19.

Chung, L. Y. (2015). Exploring the effectiveness of self-regulated learning in massive open online courses on non-native English speakers. *International Journal of Distance Education Technologies (IJDET), 13*(3), 61-73. https://doi.org/10.4018/IJDET.2015070105

Creswell, J. W., & Clark, V. L. P. (2011). *Designing and conducting mixed methods research* (2nd ed.). Thousand Oaks, CA: Sage Publications.

Crosslin, M. (2016). *Customizable modality pathway learning design: Exploring personalized learning choices through a lens of self-regulated learning* (Doctoral dissertation). University of North Texas, Denton, TX. Retrieved from http://digital.library.unt.edu/ark:/67531/metadc849703/m1/1/

Crosslin, M. (2017, March 28). Creating a self-mapped learning pathway [Blog post]. Retrieved from http://www.edugeekjournal.com/2017/03/28/creating-a-self-mapped-learning-pathway/

Crosslin, M., & Dellinger, J. T. (2015). Lessons learned while designing and implementing a multiple pathways xMOOC + cMOOC. In D. Slykhuis, & G. Marks (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference 2015* (pp. 250-255). Chesapeake, VA: Association for the Advancement of Computing in Education.

Crosslin, M., Dellinger, J. T., Joksimović, S., & Kovanović, V. (in press). Customizable modalities for individualized learning: Examining patterns of engagement in dual-layer MOOCs. *Online Learning Journal*.

Dabbagh, N., Benson, A. D., Denham, A., Joseph, R., Al-Freih, M., Zgheib, G., Fake, H., & Guo, Z. (2016). Massive open online courses. In *Learning Technologies and Globalization* (pp. 9-13). Cham: Springer. https://doi.org/10.1007/978-3-319-22963-8_2

Dawson, S., Joksimović, S., Kovanović, V., Gašević, D., & Siemens, G. (2015) Recognising learner autonomy: Lessons and reflections from a joint x/c MOOC. *Proceedings of Higher Education Research and Development Society of Australasia 2015, Melbourne,* 117-129.

Downes, S. (2013a, April 9). What the 'x' in 'xMOOC' stands for [Google+ post]. Retrieved from https://plus.google.com/+StephenDownes/posts/LEwaKxL2MaM

Downes, S. (2013b, October). Connective knowledge and open resources [Web log entry]. Retrieved from http://halfanhour.blogspot.co.uk/2013/10/connective-knowledge-and-open-resources.html

Ferguson, R., Clow, D., Beale, R., Cooper, A. J., Morris, N., Bayne, S., & Woodgate, A. (2015). Moving through MOOCS: Pedagogy, learning design and patterns of engagement. In G. Conole, T. Klobučar, C. Rensing, J. Konert, & É. Lavoué (Eds.), *Design for teaching and learning in a networked world* (pp. 70-84). Toledo: Springer International Publishing. https://doi.org/10.1007/978-3-319-24258-3_6

Gasevic, D., Kovanovic, V., Joksimovic, S., & Siemens, G. (2014). Where is research on massive open online courses headed? A data analysis of the MOOC research initiative. *The International Review of Research in Open and Distributed Learning, 15*(5), 134-176. https://doi.org/10.19173/irrodl.v15i5.1954

Hase, S., & Kenyon, C. (2007). Heutagogy: A child of complexity theory. *Complicity: An International Journal of Complexity and Education, 4*(1), 111-118.

Haug, S., Wodzicki, K., Cress, U., & Moskaliuk, J. (2014). Self-regulated learning in MOOCs: Do open badges and certificates of attendance motivate learners to invest more? *Proceedings of the European MOOC Stakeholder Summit 2014*, *Graz, Austria*, 66-72.

Hew, K. F., & Cheung, W. S. (2014). Students' and instructors' use of massive open online courses (MOOCs): Motivations and challenges. *Educational Research Review, 12*, 45–58. https://doi.org/10.1016/j.edurev.2014.05.001

Hood, N., Littlejohn, A., & Milligan, C. (2015). Context counts: How learners' contexts influence learning in a MOOC. *Computers & Education, 91*, 83-91. https://doi.org/10.1016/j.compedu.2015.10.019

Jordan, K. (2015). Massive open online course completion rates revisited: Assessment, length and attrition. *The International Review of Research in Open and Distributed Learning, 16*(3), 341-358. https://doi.org/10.19173/irrodl.v16i3.2112

Kizilcec, R. F., Piech, C., & Schneider, E. (2013). Deconstructing disengagement: analyzing learner subpopulations in massive open online courses. *Proceedings of the third international conference on learning analytics and knowledge, Leuven, Belgium* , 170-179. https://doi.org/10.1145/2460296.2460330

Kop, R., & Fournier, H. (2011). New dimensions to self-directed learning in an open networked learning environment. *International Journal of Self-Directed Learning, 7*(2), 2-20.

Kovanović, V., Joksimović, S., Gašević, D., Siemens, G., & Hatala, M. (2015). What public media reveals about MOOCs: A systematic analysis of news reports. *British Journal of Educational Technology. 46*(3), 510–527. https://doi.org/10.1111/bjet.12277

Littlejohn, A., Hood, N., Milligan, C., & Mustain, P. (2016). Learning in MOOCs: Motivations and self-regulated learning in MOOCs. *The Internet and Higher Education, 29*, 40-48. https://doi.org/10.1016/j.iheduc.2015.12.003

Liyanagunawardena, T. R., Adams, A. A., & Williams, S. A. (2013). MOOCs: A systematic study of the published literature 2008-2012. *The International Review of Research in Open and Distributed Learning, 14*(3), 202-227. https://doi.org/10.19173/irrodl.v14i3.1455

Mackness, J., Mak, S., & Williams, R. (2010). The ideals and reality of participating in a MOOC. In L. Dirckinck-Holmfeld, V. Hodgson, C. Jones, M. de Laat, D. McConnell, & T. Ryberg (Eds.), *Proceedings of the 7th International Conference on Networked Learning 2010* (pp. 266-275). Lancaster, UK: University of Portsmouth . Retrieved from http://eprints.port.ac.uk/5605/1/The_Ideals_and_Realilty_of_Participating_in_a_MOOC.pdf

Mikroyannidis, A., Connolly, T., & Berthold, M. (2013). *Self-regulated learning*. Milton Keynes: The Open University.

Milligan, C., & Littlejohn, A. (2014). Supporting professional learning in a massive open online course. *The International Review of Research in Open and Distributed Learning, 15*(5). https://doi.org/10.19173/irrodl.v15i5.1855

Milligan, C., Littlejohn, A., & Margaryan, A. (2013). Patterns of engagement in connectivist MOOCs. *MERLOT Journal of Online Learning and Teaching, 9*(2), 149-159.

Milligan, C., Margaryan, A., & Littlejohn, A. (2013): Survey instrument: SRL in massive open online courses. Retreived from: http://dx.doi.org/10.6084/m9.figshare.767291

Qiu, J., Tang, J., Liu, T. X., Gong, J., Zhang, C., Zhang, Q., & Xue, Y. (2016). Modeling and predicting learning behavior in MOOCs. *Science, 45*(50), 55-64. https://doi.org/10.1145/2835776.2835842

Rosé, C. P., Ferschke, O., Tomar, G., Yang, D., Howley, I., Aleven, V., … Baker, R. (2015). Challenges and opportunities of dual-layer MOOCs: Reflections from an edX deployment study. *Proceedings of the 11th International Conference on Computer Supported Collaborative Learning, Gothenburg, Sweden*, 848-851.

Siemens, G. (2005). Connectivism: A learning theory for the digital age. *International Journal of Instructional Technology and Distance Learning, 2*(1), 3-10.

Wang, C., Shannon, D. M., & Ross, M. E. (2013). Students' characteristics, self-regulated learning, technology self-efficacy, and course outcomes in online learning. *Distance Education, 34*(3), 302-323. https://doi.org/10.1080/01587919.2013.835779

Corresponding author: Matt Crosslin, matt@mattcrosslin.com