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Students' patterns of engagement and course performance in a Massive Open Online Course

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ABSTRACT

A series of Massive Open Online Courses (MOOCs) in the Curriculum and Instruction (CUIN) Department at a university are collaboratively being designed and developed by a team of doctoral students with mentorship from two CUIN professors. The first two MOOCs, Powerful Tools for Teaching and Learning: Digital Storytelling MOOC (DS MOOC) and Powerful Tools for Teaching and Learning: Web 2.0 Tools, have been developed and offered multiple times on the Coursera platform. This paper reports on the relationships between learners' patterns and motives of engagement and their prior subject knowledge with their course performance in the Digital Storytelling MOOC. Results from this study indicate that learners who demonstrated active engagement in the MOOC tended to outperform other learners who did not practice this trait. Learners whose motives for participation involved earning the Continuing Professional Development certificate, gaining skills, ideas and inspirations, and improving their professional practice outperformed the students who valued these traits less. Learners who possessed moderate level of content knowledge seemed to benefit most from the course. This paper contributes insight into aspects of students' behaviors that possibly contributed to their success in a MOOC and invites discussion on how to reinforce these traits.

1. Introduction

Massive Open Online Courses are a unique form of online education due to an absence of admission criteria, a highly diverse student population and a variety of motives for taking the course. The term "Massive Open Online Course" (MOOC) was first used to describe a twelve-week online course, Connectivism and Connected Knowledge, designed by George Siemens and Stephen Downes, offered at the University of Manitoba, Canada, in fall semester 2008 (Cormier & Siemens, 2010). "Massive" regards the capacity for courses to enroll large numbers of students, as well as to track vast quantities of participant activity and performance data. "Open" refers to low to free cost to participate as learners see fit, and materials for the course that are accessible to all users with an adequate Internet connection. As online courses, MOOCs are available via the Internet on a variety of devices and thus expand access beyond the traditional campus. Labeled a "course," a MOOC is framed in a time period with a beginning and an end point; provides a coherent set of resources; and follows a sequence of activities organized by an instructor in order to address specific learning objectives. Current research on MOOCs highlights issues such as the influence of MOOCs on the future of higher education (Billington & Fronmuller, 2013), the effects of MOOCs on teaching

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and learning (Martin, 2012), what educational problems MOOCs might solve (Rivard, 2013), gaps in MOOC research (Liyanagunawardena, Adams, & Williams, 2013), and blending face-to-face classes with online MOOC classes (Bruff, Fisher, McEwen, & Smith, 2013).

Classifications of MOOCs may vary depending upon the pedagogical interactions, learning outcomes or the participant's experience (Haavind & Sistek-Chandler, 2015). Common in the literature are the two kinds of MOOCs: xMOOCs and cMOOCs. This classification is based on the course content structure, expectations of students' performance and assessment methods. The vast majority of existing MOOCs are content-based MOOCs, known as xMOOCs, which present the course content through different knowledge packages and methods that assess learners' mastery of the knowledge (Kim, 2015). Course content usually includes short lecture videos each week, often supported by supplementary readings, and assignments. Assessments that count towards the participant's final score are provided, usually weekly, in the form of multiple-choice or short answer quizzes that are auto-graded, and peer-graded assignments. Online discussion forums are also included to allow participants to engage with each other and exchange knowledge and ideas, or to create a sense of community (Hollands & Tirthali, 2014).

Connectivist MOOCs, known as cMOOCs, are more fluid in structure. They focus more on an overarching instructional goal and are less directive with respect to process. Learners in a cMOOC build their knowledge through co-creation assignments with peers. Instructors may pose initial or weekly questions and challenges together with a variety of text-based or media resources. Learners interact and cooperate with one another in carrying out the co-creation task. The success of a cMOOC is highly dependent on participant interaction via discussion forums. However, the challenges to make this interaction happen lie at the different starting point of the prior knowledge of the learners (Andersen & Ponti, 2014). Course outcomes are often unique products, such as blog posts, images, diagrams, or videos generated by participants using a variety of social media. The role of the instructor is to act as a facilitator by aggregating, reviewing, summarizing and reflecting on participant activity on a daily or weekly basis (Hollands & Tirthali, 2014).

Thus, the boundaries between the MOOC types are not clear. There are some MOOCs that fit in between an xMOOC and a cMOOC. This third type of MOOC is called pMOOC (or project-based MOOC), which is a content-based, highly structured MOOC in terms of how the course content is organized and presented, but also blends a project-based model of assessment. In this type of MOOC, the task for the student is to design a project that is reviewed by peers using an articulated rubric, created by the instructor or teaching staff (Haavind & Sistek-Chandler, 2015). Course completion requirements in a pMOOC typically include submitting projects for peer grades and reviews of a number of mini-projects designed by peers (Haavind & Sistek-Chandler, 2015). The DS MOOC, the subject of this study, fits the description of a pMOOC. It is a five-week MOOC equivalent to five phases of producing a digital story. For each week, instructional materials including video lectures, readings, and examples of digital stories to watch are presented together with the week's assignment for the student to perform. The week's assignment can be seen as a mini project that builds on one another towards the final project, a complete digital story at the end. Students' submitted assignments at most phases of the course are assigned to be graded by peers using articulated rubrics created by the instructor. Students are also exemplified with sample grading for each assignment using the rubric.

This paper investigates possible factors for learners' success in the above mentioned DS MOOC, the pMOOC offered in September 2014. It examines potential relationships between students' course performance and their patterns and degree of involvement, their motives of participation as well as their subject matter knowledge prior joining the MOOC. Data on the students' course performance were retrieved from the data pool collected by Coursera and provided to the instructors. . Data on the students' patterns, degree and motives of participation as well as their subject knowledge of digital storytelling prior participating in the MOOC were collected through a post-course survey. Results of the study will allow the development team to reinforce and strengthen factors related to motivation and engagement in the design of the next MOOCs.

2. Theoretical framework

The design and development of the DS MOOC was an ongoing process which started in the beginning of the fall 2013 semester. The DS MOOC went through final development in spring and summer 2014 and was delivered for the first time via the Coursera platform in September, 2014. In terms of course design, the DS MOOC content was compressed and converted from a 15 week version of the digital storytelling course that was taught as a graduate course to registered students. Part of the job of converting a regular digital storytelling course to a MOOC involved re-defining the goals and objectives for the MOOC, given that it was to be offered to a group of diverse learners on an open public platform. This goal and objective redefinition entailed re-identification and re-determination of the amount of content, and number and level of difficulty of the MOOC assignments. Secondly, issues regarding implementation of peer assessment and online discussions into the course assignments were considered. Finally, the replacement of classroom student–teacher interaction by student–content interaction through content videos and tutorials in a MOOC environment (Anderson, 2013) in a MOOC directed the teaching staff to make informed moves in the design and development process.

The design and development process employs key principles of instructional design (Dick, Carey, & Carey, 2009), Connectivism theory (Siemens, 2005), and self-regulation learning strategies (Barnard, Lan, To, Paton, & Lai, 2009). Key instructional design principles ensured rigorous course design and supported revision. Connectivism promoted learner autonomy and encouraged interaction among students. The self-regulated learning framework facilitated learners in building

their self-directedness and time-management skills through learning activities. It was expected that these three key components of the design plan would closely guide learners in a MOOC to achieve their goals.

Milligan, Littlejohn, and Margaryan (2013) identified three types of student engagement in a Connectivist MOOC (cMOOC): active participation, passive participation, and lurking. Active participants represent the key group in a cMOOC who contribute most to the course content development and are the most successful learners. Passive participants and lurkers may gain all the benefits of the course but apparently contribute nothing in return and do not actively engage with other learners in the course. While student engagement can be mediated by a number of factors such as confidence, motivation, and learners' prior knowledge (Andersen & Ponti, 2014), it is critical to the student's success in the MOOC environment where there is higher expectation of self-regulation in learning than in other online educational environments.

Self-regulation		15 week	5 week	Description
Domains	Indicators	Digital storytelling		
Self-Evaluation	Summarize learning; peer evaluations; asking questions	Instructor evaluation of the three assignments; Guidelines how to complete assignments; peer questions for feedback on assignments	Peer Assessment; Self-assessment	Peer assessment of final project using rubric; self-assessment every week on componential weekly assignments using rubrics
Time Management	Time allocated for various course content; course schedule	Assignment due dates in each module	Detailed course schedule with time and due dates; approximate time for specific content, assignments and assessments	Expected time spent on an assignment, assessment and other content is estimated to help students gauge the amount of time they need to spend each week
Help Seeking	Find knowledgeable someone; share problems, meetings; instructor contact	Direct email to professor; meet via appointment	Questions to Teaching staff in discussion forums, questions to the professors; synchronous meeting on 2nd and 4th week	For technical support and other related questions a discussion forum is set where teaching staff will reply; a specific forum for questions for professors is also set with estimated time of reply; online synchronous meetings to ask problem questions related to course concepts/content

Many students engage with their peers both inside a MOOC through the discussion forums and outside the MOOC through social media (Veletsianos, Collier, & Schneider, 2015). Online discussion forums allow participants to engage with each other and exchange knowledge and ideas, or to create a sense of community that bond them to the course (Hollands & Tirthali, 2014). Goldberg et al. (2015) found a positive correlation between MOOC student's engagement and their course performance and completion regardless of their educational level and background: participants who completed the MOOC engaged in significantly more discussion board posts than participants who did not complete the course. In examining learners' participation in social networks outside of MOOCs, Veletsianos et al. (2015) found that some learners tend to share and discuss the course with individuals who are part of their broader social network.

Thus, the design below sheds light on the findings on student engagement and presents utilization of selected domains of a self-regulated framework with clear indicators that support student learning at a practical level. It also presents a comparison of design strategies between the 15-week course and the 5-week DS MOOC.

3. Material and methods

3.1. Data sources

Data sources for this study included archival data of learners' course grades and the post-course survey responses of participants in the DS MOOC. These data exist on the Coursera platform and are accessible by the MOOC instructors and teaching staff who are also the authors of the paper. An Institutional Review Board application for collecting the data on human subjects in the MOOC was approved before the data were downloaded and analyzed. Connecting data on learners' course grades and post-course survey responses were determined by using the Coursera seven-digit ID for each individual learner. Only data on learners who submitted an assignment and responded to the post-course survey were used for the analysis.

3.1.1. Learners' course grades

Data on learners' course grades were available on the Coursera platform for each week and for the overall course. The data included learners' submission records on the five course assignments and the grades for each assignment.

3.1.2. Post-course survey

The post-course survey was a 26-item questionnaire used to collect information on different aspects of students' participation and engagement; their opinion on aspects of the course content and peer assessment; and their suggestions for changes for the next DS MOOC. In this paper, items on students' patterns and motives of participation, and their subject knowledge before taking the course are examined.

3.2. Research questions

To examine possible relationships between the learners' course performance in the DS MOOC with their patterns, motives of participation and their subject matter knowledge prior joining the course, the following questions were asked:

- Is there a relationship between the learners' course performance in the DS MOOC with their patterns and motives of participation in this MOOC?
- Is there a relationship between the learners' course performance in the DS MOOC with their subject matter knowledge prior to joining this MOOC?

3.3. Research design

3.3.1. Participants

Participants in this study were the learners who signed up for the DS MOOC on Coursera in September 2014. Below is the learning analytics data on the learners from Coursera (Fig. 1):

3.3.2. Type of research design

A correlational research design was used to explore possible relationships between learners' performance in the course with aspects of their participation and their prior subject knowledge of digital storytelling on the DS MOOC. The dependent variable was the learners' performance in the MOOC, which was calculated based on the final grade for the course and consisted of five assignments that contributed a percentage to the final grade. Three of the assignments were peer assessed, and two were self-assessed. Learners who achieved a grade of 70% or more passed the course and thus received a Statement of Accomplishment. Further categorization of passing learners included: learners who achieved a grade of 90% or more passed the course with distinction and thus received a Statement of Accomplishment with Distinction; learners who achieved a grade between 70% and 89.99% were considered a normal pass. Learners who achieved a grade of less than 70% were considered to have failed the course. The componential assignments and their percentage grades were as follows:

Week	Assignment	% Grade
Week 1	Peer assessment	15%
Week 2	Peer assessment	15%
Week 3	Self-assessment	15%
Week 4	Peer assessment	40%
Week 1	Final digital story assessment	15%

The independent variables were learners' patterns and motives of participation in the DS MOOC. The purpose of using a correlational research design was to focus on describing existing relationships between the variables without manipulating them. A Pearson Correlation (O'Rourke, Psych, & Hatcher, 2013) coefficient was calculated to determine whether there were such correlations.

4. Findings and discussion

4.1. Descriptive statistics

There were 573 respondents to the post-course survey. 568 of the survey respondents were active participants in the DS MOOC. Active learners were defined as the students who submitted an assignment and earned points in the course. The response rate among the active learners of the DS MOOC was 28% (i.e. the number of survey respondents (573) as a percentage of the number who submitted an exercise (2033) on the learning analytics). Among the survey respondents, 472 passed the

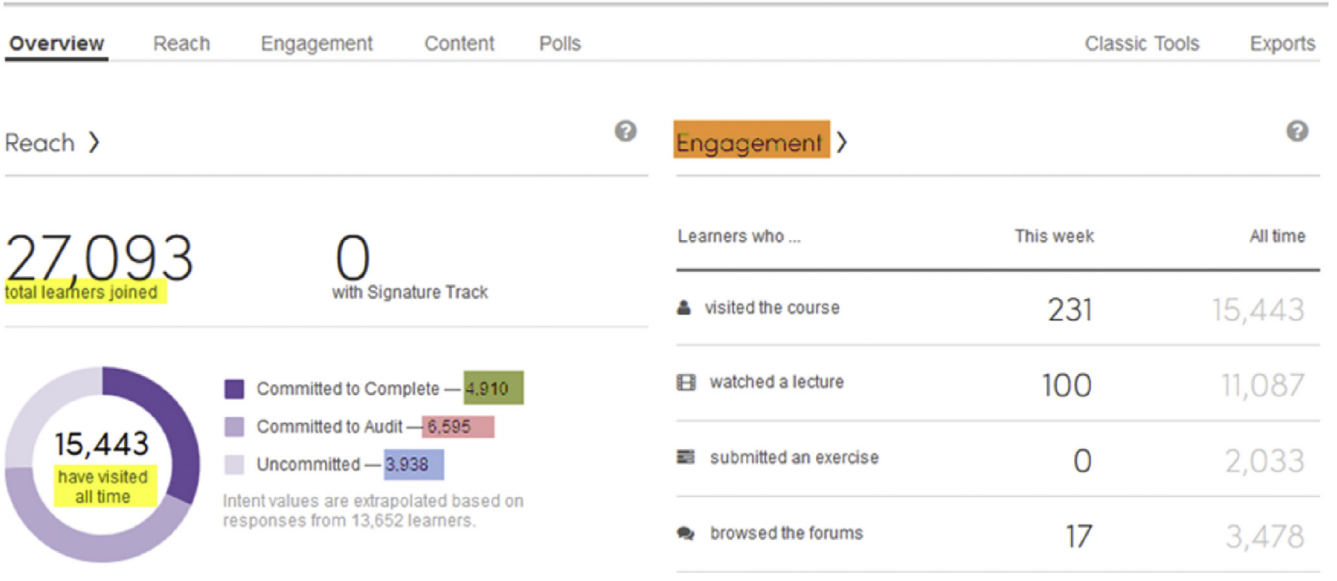

Fig. 1. Powerful Tools for Teaching and Learning: Digital Storytelling MOOC (DS MOOC) (picture goes here).

course with distinction (i.e. those who scored 90% or above the total grade), 54 passed (i.e. those who scored 70%–89.99% the total grade) and 46 failed the course (i.e. those who scored below 70% the total grade).

4.2. Students' patterns of participation and their DS MOOC performance

Survey question 2, "*In what ways did you participate in this course (Please check all that apply)*," addressed learners' patterns of participation in the DS MOOC. Table 1 shows statistically correlational significance between the students' course performance with four patterns of participation of the students (P3: posted to the discussion forum, P4: tried an assignment, P5: submitted an assignment, and P6: responded to discussion posts of other people) ($p < .05$). These items characterized the active group of MOOC learners who submitted an assignment, participated in the discussion forums, etc. This suggests that students who demonstrated active learning characteristics tended to perform better in the DS MOOCs than the students who did not.

4.3. Students' motives of participation and their DS MOOC performance

Questions 7 through 12, "*Please rate the importance of the following factors on your participation and enrollment in this course*" in the survey identified learners' motives of participation in the DS MOOC. These questions asked students to rate their motives in enrolling in the DS MOOC on a "*very important-not important*" scale. Table 2 shows statistically correlational significance between the students' course performance with their motive to earn Continuing Professional Education (CPE) credits (available to Texas K-12 teachers) ($p < .05$). This suggests that learners who signed up for the course with such a purpose in mind tended to outperform those who did not. The correlation also yielded a statistical significance among the learners who did not prioritize earning the CPE credits. It can be inferred that earning the certificate was one, but not the only, driving force for learners to perform well in this MOOC.

Table 3 shows statistically correlational significance among the students whose motive was to gain knowledge and skills from the course ($p < .05$). Intriguingly, there is a big difference in responses among the subgroups who selected this motive. The subgroup who stated "*quite important*" seemed to perform far behind (Pearson Correlation is below zero) the group that chose "*very important*."

Similarly intriguing, Table 4 shows directional correlational significance in course performance among the learners whose priority was to gain ideas and inspiration from the course ($p < .05$). Students who stated "*very important*" tended to outperform overall than those who stated "*quite important*" (Pearson Correlation is below zero) (see Table 5).

Table 6 also shows negative correlational significance (Pearson Correlation is below zero) between the students' course performance and their priority to exchange ideas and get feedback from peers in the course ($p < .05$). These data may characterize a passive group of learners who did not seem to be concerned about interacting with other learners, giving and receiving feedback from peers, or participating in the discussion forums.

Similarly, Table 7 shows negative correlational significance (Pearson Correlation is below zero) with the course performance for the group of learners who were less likely to demonstrate the need to connect with other learners of the same interests ($p < .05$).

4.4. Students' prior subject knowledge of digital storytelling and their DS MOOC performance

In this regard, Table 8 presents a strong statistical correlation with the course performance among the learner group whose subject knowledge of digital storytelling prior to their enrollment in the DS MOOC was good ($p < .05$). It can be inferred that the way the DS MOOC content was designed seemed to be very appropriate for learners with a good/average level of understanding of the subject, appeared to be a bit too challenging for the novice learners, and probably not challenging enough for those who already had more advanced digital storytelling knowledge and skills.

5. Conclusions

The results reveal three intriguing patterns of the learners' participation, motives, and subject knowledge in comparison to their performance in the MOOC. First, there was a correlational relationship between learners' patterns of participation with their MOOC performance: learners who demonstrated active engagement tended to outperform the ones who did not prioritize a similar trait. Active engagement was evidenced by learners submitting at least one course assignment, and their participation in the discussion forum by posting and responding to others. Active engagement has been proposed to be a strong indicator of MOOC quality and student satisfaction (Ho et al., 2014; Jordan, 2014; Koller, Ng, Do, & Chen, 2013) and thus, the success of a MOOC. In order to encourage more learner participation, the design team plans to make pedagogical modifications for the next DS MOOC launch by making the discussion forums a more responsive and user-friendly place. This may be achieved by using strategies such as increasing the human interaction through synchronous sessions, creating/encouraging forum discussions among subgroups by geographical locations or language background. It can also be achieved by increasing managerial skills including the management of the Teaching Staff: assigning course teaching staff to monitor and respond to students' questions by hours so that the level of responsiveness is assured on a global time scale (Haavind, Chandler, 2015). As for students' participation in an assignment, from the design perspective, there should be further

investigation on the level of complexity, difficulty or time-consuming nature of the assignments to determine whether this might be a reason for the decreasing participation in the MOOC. However, the mystery of the decreasing participation and perhaps the pass/fail rate could be attributed to peer assessment, which presents natural pitfalls and provides challenges for MOOC design (Kulkarni et al., 2015). For the DS MOOC, learners' performance on each assignment was highly dependent on

Table 1
Students' patterns of participation and their DS MOOC performance.

		Patterns of participation			
		P3	P4	P5	P6
Course performance	Pearson Correlation	.149**	.110**	.465**	.128**
	Sig. (2-tailed)	.000	.008	.000	.002
	N	573	573	573	573

Any p value less than 0.05 is designated with one asterisk (*). Any p value less than ≤0.01 is designated with two asterisks (**).

Table 2
Students' motives to earn CPU credits in the DS MOOC with their course performance.

		Continuing Professional Unit (CPU) credits				
		Very important	Quite important	Neutral	Slightly important	Not important
Course performance	Pearson Correlation	.151**				−.233**
	Sig. (2-tailed)	.000				.000
	N	573				573

Any p value less than 0.05 is designated with one asterisk (*). Any p value less than ≤0.01 is designated with two asterisks (**).

Table 3
Students' motives to gain new knowledge and skills and their DS MOOC performance.
Any p value less than 0.05 is designated with one asterisk (*). Any p value less than ≤0.01 is designated with two asterisks (**).

		New knowledge and skills				
		Very important	Quite important	Neutral	Slightly important	Not important
Course performance	Pearson Correlation	.128**	−.136**			
	Sig. (2-tailed)	.002	.001			
	N	573	573			

Any p value less than 0.05 is designated with one asterisk (*). Any p value less than ≤0.01 is designated with two asterisks (**).

Table 4
Students' motives to gain ideas and inspiration and their DS MOOC performance.

		Ideas and inspiration				
		Very important	Quite important	Neutral	Slightly important	Not important
Course performance	Pearson Correlation	.130**	−.136**			
	Sig. (2-tailed)	.002	.001			
	N	573	573			

Statistical correlations were also found among those who claimed to value "*professional practice take-aways*" for their daily practice ($p < .05$). The group who stated "*very important*" outperformed the participants who stated "*quite important*" or "*neutral*" (Pearson Correlations are below zero).
Any p value less than 0.05 is designated with one asterisk (*). Any p value less than ≤0.01 is designated with two asterisks (**).

Table 5
Students' motives to gain professional practice take-aways and their DS MOOC performance.

		Professional practice take-aways				
		Very important	Quite important	Neutral	Slightly important	Not important
Course performance	Pearson Correlation	.138**	−.102**	−.142**		
	Sig. (2-tailed)	.001	.015	.001		
	N	573	573	573		

Any p value less than 0.05 is designated with one asterisk (*). Any p value less than ≤0.01 is designated with two asterisks (**).

Table 6
Students' motives to exchange ideas and get feedback and their DS MOOC performance.

		Exchange ideas and get feedback				
		Very important	Quite important	Neutral	Slightly important	Not important
Course performance	Pearson Correlation					−.202**
	Sig. (2-tailed)					.000
	N					573

Any p value less than 0.05 is designated with one asterisk (*). Any p value less than ≤0.01 is designated with two asterisks (**).

Table 7
Students' motives to connect to others with similar interests and their DS MOOC performance.

		Connect to others with similar interests				
		Very important	Quite important	Neutral	Slightly important	Not important
Course performance	Pearson Correlation					−.115**
	Sig. (2-tailed)					.006
	N					573

Any p value less than 0.05 is designated with one asterisk (*). Any p value less than ≤0.01 is designated with two asterisks (**).

Table 8
Students' prior subject knowledge and their DS MOOC performance.

		Students' prior subject knowledge				
		Poor	Fair	Good	Very good	Excellent
Course performance	Pearson Correlation			.145**		
	Sig. (2-tailed)			.001		
	N			573		

Any p value less than 0.05 is designated with one asterisk (*). Any p value less than ≤0.01 is designated with two asterisks (**).

the assessment of their peers using a rubric. The final score of one assignment is the median of the four assessment outcomes (three peer assessments and one self-assessment). The quality of the peer feedback is unknown and needs further examination. The Coursera platform offers a mathematical solution for peer assessment with the random assignment of three peers for assignment grading instead of one. In order to enable more accurate assessment, the course design team created a rubric for the peer assessors to us and provided self-assessment by the learner to further level out the learners' performance grade. After the first DS MOOC launch, the design team decided to provide examples of peer assessment through sample grading by the instructor and course teaching staff of learners' digital story submissions of different quality.

Second, students' motives for participation in the MOOC show a dynamic effect on their performance, including negative effects, given the distant managed nature of the MOOC format. Positive correlations between the learners' motives to participate in a MOOC (i.e. to earn CPU credits, to gain new knowledge, to gain ideas and inspiration, to get professional takeaway) seemed to align well with Klobas, Mackintosh and Murphy's findings (2014) in their analysis of demographic information and motivations of different groups of learners. Their study revealed that the most strongly held reason for learner participation in MOOCs is to gain knowledge, although learner expectations about the course can be met without completing the MOOC (Klobas, Mackintosh & Murphy, 2014). Earning Continuing Professional Education credit and participating in MOOCs for utilitarian purposes seemed to be the most significant impetus for professional educators and teachers, particularly in the information and communication field (Klobas et al., 2014; Liu, Kang, & McKelroy, 2015). Yet, despite the aforementioned analysis of groups together with their various motivation of participation, the MOOC retention rate appeared to be decreasing and the reason is little known. It could be related tolearner dissatisfaction, decrease of curiosity, or the way the course is designed, developed and run. It is also important to investigate whether the open nature of MOOCs might play a role in determining the MOOC retention rates by allowing scattered and uncontrollable patterns of learning behaviors throughout the course to happen. Open in MOOC means both open entry and open exit. This means learners can have the freedom to decide to complete the course, to go half way, to window shop, or to never participate after sign up. It might be helpful during the modification stage to look into the students' feedback on the survey, their communication on the forums and the quality of the submissions to adjust the course goals and objectives, if needed. For example, what kind of support can be given besides what has already been given? To what extent should technical support be given to the learners in such a technologically oriented course as the DS MOOC? How soon should the students' questions be responded to on the forums by the teaching staff? In terms of content, the course offers instruction in the technical aspects and storytelling skills so that the learners can tell the story somewhat drafted in their mind. The primary question for further research is how to inspire the participants with the expectation that they should have a story to tell and will have a story to tell by the end of the course?

Third, even though the course was designed for a variety of learners and required no background knowledge, the statistical analysis implied that learners who were already equipped with moderate subject knowledge seemed to be at a more advantageous position and thus more likely to benefit from the course than the novice group. This finding yields some possible pedagogical modifications on the design of the next DS MOOC, such as: 1) promoting active engagement and facilitating the students with methods to achieve it, and 2) while everyone is invited to participate in the MOOC despite their background, it might be important to encourage the students to decide on the effort they can put in the MOOC based on the amount of prior subject knowledge they possess before entering the course. The potential impact on the MOOC design or revision based on the findings on the learner's prior digital storytelling knowledge would involve identifying or defining the primary target audience in terms of prior digital storytelling knowledge, which entails possible change of the assignment design, which in turn alters the design of the rubrics. For instance, basic design of the MOOC (i.e. structure, sequence and level of difficulty of the assignments) can be kept with little revision if it targets the audience with basic knowledge of digital storytelling.

Otherwise, the assignments could be made simpler and requirements can be reduced so that less investment from the learners is expected should the course be a basic DS MOOC for novice learners. Otherwise, more demand on details can be added assignments, or an upgrade of grading criteria for higher quality submissions can be implemented to make the MOOC more challenging.

Although the study results are subject to the post-course survey data of the MOOC, which in turn is likely skewed toward the active learners' side, the findings have vividly depicted dynamic relationships between course performance and patterns and motives of engagement by certain groups of learners in the MOOC. Importantly, these findings provide valuable insights into modifying the MOOC for the next launch. Future research work on our MOOCs will include examination of the learners' engagement data on a deeper level such as examining records of students' engagement with the course content, and matching these results with their demographic data and their survey responses through their user IDs provided by Coursera.

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