How Can Learner Analytics Data Inform Language MOOC Design?

Suzi Lee, Robert S. Kadel, Amanda Madden and Yakut Gazi

Abstract

This study explores student engagement in a Massive Open Online Course (MOOC) designed to teach advanced-level speaking in English. The course, with over 200,000 students enrolled, was offered on the Coursera platform. Learners' engagement with course elements in relation to their performance in the course was analyzed with a view to improving course design and activities. The results point to positive effects of quiz completion, peer assessment as well as video watching on course performance.

Key Words: Massive open online course, speaking in a second language, student engagement

Literature Review

Massive Open Online Courses (MOOCs) continue to show promise for providing tens of thousands of students with free education irrespective of geography or ability to pay. Language MOOCs, which provide students with critical language skills in the global economy, are one particular area of potential. Although the number of MOOCs for teaching languages (LMOOCs) has increased since MOOCs became popular around 2012, second language (L2) instruction has not "so far been a major player in the MOOC space" (Goodwin-Jones, 2014, p. 5). A major concern is the suitability of MOOCs for L2 teaching (Bárcena, Read, Martin-Monje, & Castrillo, 2014). Potential issues include the role of the instructor, provision of feedback, student-teacher ratio, and heterogeneity of the learners. In addition to design issues, the issue of student engagement and success in language MOOCs is another major concern.

In order to find fixes for these issues, the authors of this study analyzed learners' engagement with course elements in relation to their performance in the course. This paper presents analyses of student engagement in an LMOOC entitled *Speak English Professionally: In Person, Online & On the Phone* designed by the Language Institute at Georgia Institute of Technology. This article examines how this data can be used to redesign the course to improve learner outcomes, student engagement and retention. After reviewing the data, the authors made recommendations to course designers for revisions to videos and other course materials that will improve the course for learners.

As a relatively new field, learning analytics (LA) is the "measurement, collection, analysis, and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs"

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(First International Conference on Learning Analytics and Knowledge, 2010, p.1) As Gelan, et al. have noted (2018), while LA has potential uses for language learning, as yet its application is relatively unexplored: "While the use of LA in language learning has received little attention to date, available research suggests that LA could provide valuable insights into task design for instructors and materials designers, as well as help students with effective learning strategies and personalised learning pathways" (p. 294). Based on the metrics of student preparation, use of available resources, and engagement patterns, Gelan et al. (2018) compared the learning strategies and patterns of successful and unsuccessful students. Successful students were found to spend more time on the platform and more actively engage online with the course materials and content applications. Rienties, Nguyen, Holmes and Reedy (2017) compared course design with online engagement and students' use of modules. The variance in online engagement was shown to be shaped by instructional design. Their results point the way forward to further collaboration between learning analytics specialists and instructional designers.

Many English-language MOOCs are taken by non-native speakers. Several studies (e.g., Uchidiuno, Koedinger, Hammer, Yarzebinski, & Ogan, 2017; Türkay et al., 2017) have investigated how English Language Learners (ELLs) or L2 learners enrolled in subject matter MOOCs (e.g. psychology, statistics) engage with course materials and whether their engagement patterns are related to retention and success in the course. A noted problem with Language MOOC instructional design is that MOOC platforms were not designed with language acquisition in mind. For example, speaking practice with other classmates is difficult in a MOOC (Gimeno-Sanz, Navarro-Laboulais, & Despujol-Zabala, 2017).

Martín-Monje, Castrillo and Mañana-Rodríguez (2017) investigated the role of the use of learning objects and online interaction in course success based on their research on an LMOOC, *How to Succeed in the English B1-Level Exam.* Data examined from 485 participants indicated that videos were the most frequently accessed materials. The study found a strong correlation between grade obtained and number of video accesses. The results also indicated that task submission and assessment submission were the strongest predictors of success whereas forum interaction and the submission of peer feedback did not contribute significantly to explaining student success. Analysis of participants' engagement styles revealed that *viewers* (i.e., those who accessed the learning objects but did not submit any tasks) and *all-rounders* (i.e., those who accessed at least two learning materials, submitted at least one task and posted at least one comment in the course forums) were the most prominent profiles. Shah et al. (2017) likewise divided learners in a language MOOC into three groups: overachievers (those who completed watching every video, completed each assignment, etc.), underachievers (those who did not complete watching videos and did not complete assignments), and normal learners (those who fell within one standard deviation of averages of video consumption and assignment completion). Successful completion of the MOOC was largely dependent on being classified as an overachiever.

Methodology

For this research, learner data of the *Speak English Professionally: In Person, Online & On the Phone* MOOC, offered by Georgia Institute of Technology on the Coursera platform was analyzed. This data set is available to the institution as a download from Coursera. Coursera makes each partner institution's data available to "Data Coordinators" at each school as well as course-specific data to each respective instructor and instructional designer. The data are generated on platform interaction ranging from quiz and course grades to discussion forum posts to clickstream data generated as each user interacts with videos and other content on the platform. Data Coordinators at each institution use a secure web page to request a data "dump" of all data generated on the platform for the institution and then parse it for specific courses and research questions.

Student Profile

Over 250,000 students enrolled in the *Speak English Professionally* course since its launch in 2016 on the *Coursera* MOOC platform. Table 1 provides information about the student enrollments and completion rates

Table 1. Student enrollment and completion

Enrolled	242,206
Actively enrolled	179,706
Self-paid enrollments	8,456
Coursera financial aid recipients	13,710
Completed course	6,914
Completion ratio	31.2%
Completion ratio (overall)	3.7%

Demographic information for all participants is not made available through the Coursera platform. However, a sample of participants in the *Speak English Professionally* course was surveyed in fall 2017, with the following characteristics ($n = 374$):

- Gender: female 52.7%, male 45.7%, other/chose not to disclose 1.6%
- Average age: 33.0 years
- Country in which currently residing: 7.3% China, 7.0% France, 6.8% India, 6.5% Egypt, 6.2% United States (every other nation was 5% or less of the sample)
- Highest level of schooling completed: Bachelor's/university degree 41.6%, Master's degree 25.4%, all others 33%
- Most common fields in which respondents received degree: business, management, marketing 15.7%, engineering 15.7%, computer and information sciences 8.8%, English language and literature 5.7% (every other degree field was 5% or less of the sample)
- Employment status: employed full-time 45.2%, student, 23.3%, unemployed/looking for work 12.8%, all others 18.7%

- Fields in which respondents work or are seeking work: engineering 12.4%, education/training/library 11.0%, business or financial 10.3%, information technology 10.0%, all others 56.3%
- Most common first languages: Arabic 21.8%, Spanish 15.8%, French 10.6%, Chinese (Mandarin) 7.6% (every other language was 5% or less of the sample)
- Majority of the learners indicated that they were comfortable with basic English communication, but few were comfortable with dealing with complex English communication.

Course Materials and Structure

Much of the course content is adapted from materials and practices created by the course instructors who have taught the materials in a face-to-face environment. In general, MOOCs on the Coursera platform follow a similar course structure. A course consists of a number of modules; a module consists of one or more lessons; and a lesson contains various items such as lecture videos, readings, discussion prompts, assessments, etc. Therefore, the overall structure of the course, *Speak English Professionally: In Person, On-line & On the phone,* was designed based on this model. There are other factors of the course structure design that were based on the instructional design practices and parameters emphasized by Coursera including guidelines on exercising the backward design approach, which focuses on what students should learn from the material, before considering how the instructor might approach teaching it (Wiggins and McTighe, 2005). Coursera also provides guidelines on determining the length of the course and appropriately utilizing the assessment tools available on the Coursera platform.

The course is composed of modules, which have several lessons embedded in them. Lessons contain items that can be videos, quizzes, discussions, and resources. The structure of the course components is illustrated in Figure 1. The curriculum development process resulted in a five-module course with fourteen lessons. Each module contains at least two lessons, and each lesson consists of one lecture video, a practice quiz, and at least one page of additional resources. In addition, two discussion forums are available with specific prompts to encourage learner interaction. At the end of every module, learners are required to complete a graded project, which in this course are all set up as graded peer-review assignments. Details of each course item are outlined below.

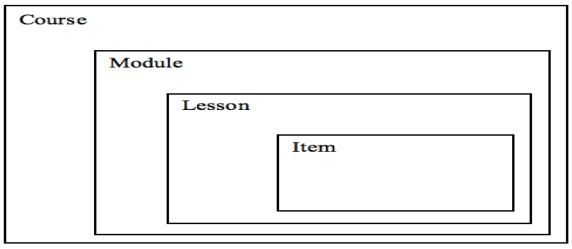

Figure 1. *Structure of Course Components*

Lecture Videos

In this course, the lecture videos are the main source of content delivery. Based on the study by Guo, Kim, and Robin (2014), for MOOCs where videos are central to the learning experience, the median video engagement time for learners is six minutes. Therefore, in order to increase student retention, most of the lecture videos in this course were designed and produced to be less than six minutes long with an average length of 5.57 minutes. To enhance student retention, one to three in-video prompts were added to all videos. These in-video prompts automatically stop the video and appear as a pop-up window on the screen. They are located in the video where the lecturer would want to check for comprehension or ask learners to reflect on their own experience. These prompts can be in the form of a multiple-choice question, simple text submission question, or a reflective question. Students would need to answer the prompt in order to continue watching the lecture.

Practice Quizzes

The practice quizzes in each lesson consist of one to five multiple choice comprehension questions. The questions mainly focus on the main points from the lecture. Each correct and incorrect response is followed with detailed feedback based on lesson content. Learners get three attempts at achieving a score of 80% or higher. However, because these quizzes are not included in a learner's overall grade, it is not necessary for learners to pass the quizzes in order to complete the course.

Discussion Forums

It is well known that interaction between instructor and learners as well as interaction between and amongst learners are considered a fundamental requirement of second language acquisition, so we included opportunities for learners to interact through the discussion forums. The two discussion forums are found in the first and fourth module of the course. These interactions are essential for receiving feedback on one's progress. On Coursera's platform, although there are interactive discussion forums, the only graded assessment tool that allows for getting meaningful feedback is the peer-review assignment. Therefore, this assessment tool was chosen for the graded items of this course, which is discussed next.

Peer-review Assignments

The peer-review assignments are the only graded assessment pieces in this course and are found at the end of each module. Each assignment gives learners the opportunity to practice and show evidence of reaching a certain level of mastery of the designated learning outcomes. For this assignment process to work, a learner is provided with the details of the assignment which includes a pre-determined outline of how the assignment would be graded by their peers. Once the learner submits their work, they are randomly grouped with three other peers from their cohort. The learner will need to

give feedback to these three other peers before receiving feedback on their own submission. Feedback is usually given through a rubric which aligns with the assignment requirements, and reviewers will be given a series of yes/no questions to evaluate the submission. Answers can be Yes (full mark), Somewhat (half mark), or No (no marks). A comments section is also provided with a prompt encouraging reviewers to leave suggestions for improvement. Because a learner is grouped with peers within a cohort, if feedback is not provided in a timely manner, their grade may be compromised.

Results

Data on course performance, the completion of quizzes, and video-watching were collected on 1,202 learners from January 1, 2017 to April 30, 2018. This total represents 15.5% of all paid/financial-aid learners who have participated in the course over the time period from January 2016 (the launch of the course on Coursera's new platform) to July 2018 (when data were pulled for this study). This particular group was selected because paid/financial-aid learners are the only learners who get access to the graded peer-review assignments. The variables studied and their descriptive characteristics are shown in Table 2 below.

Table 2. Descriptive statistics for course engagement variables

	N	Mean	Median	SD	Min.	Max.
Course grade	2748	0.62	0.70	0.328	0.02	1.00
Quiz grade	2748	0.98	1.00	0.034	0.60	1.00
Number of videos started	3039	24.84	21.00	21.880	1	392[2]
Number of videos completed	2911	13.24	14.00	8.845	1	203
Video completion rate	3006	0.56	0.58	0.235	0	1.00
Minutes of video watched	3003	77.72	76.00	71.569	0.08	1505.08
Peer submission score	3041	26.57	30	11.030	0	60
Number of peer assignments completed	3048	3.30	4.00	1.65	0	5

[2] While there are only 15 total videos in the course, it is possible for a learner to watch any video more than once. Each time a video is viewed, it registers a new "start" event in the data; each time a video is completed, it registers a new "end" event.

In order to determine which behaviors had an impact on learner performance, the variable Course Grade was regressed on three independent variables: average quiz grade, peer assignment score, and the number of videos the learner started watching.[3] One model (see Table 3) was run using all learners and scores on all peer assignments. As shown in Table 3, the model was then disaggregated to measure the effects of each of the peer assignments separately on course grade. These assignments are noted along the left-most column in Table 3 and are in the order in which the learner encounters them in the course: Do an Elevator Speech, Use Group Discussion Language, Participate in a Phone Conversation, Do a Mock Interview, and Deliver Your Pitch/Presentation. Average quiz grade showed a statistically significant, positive effect on course grade in all models except the last (Deliver Your Pitch/Presentation). The learner's score on the peer assignments showed statistically significant, positive effects on course grade in all the models. The number of videos the learner watched showed a statistically significant, positive effect on course grade for three peer assignments: Do an Elevator Speech, Use Group Discussion Language, and Participate in a Phone Conversation. However, there was no statistically significant effect of video watching on course grade when analyzing the Do a Mock Interview and Deliver Your Pitch/Presentation peer assignments.[4]

[3] Four different measures of video consumption were modeled: the number of videos the learner started watching (which includes restarting a video previously watched), the number of videos the learner completed watching, the number of minutes spent watching videos, and the video completion rate (which was the number of videos completed divided by the number of videos started). Each showed statistically significant effects on course grade in most models, but the models were strongest (as indicated by R^2 and F-tests) when using the number of videos started.

[4] Consistent with Shah et al. (2017), the same models were also run using a subset of learner engagement. Using the measure of video completion rate, we filtered out those students whose video completion rates were either zero (indicating they watched no videos) or one (indicating they completed watching every video they started). This left us with a subset of learners who were not considered either underachievers or overachievers, but rather gave a normal distribution of video watching behavior. The regression results for this subset were unchanged from the results of the larger population of learners shown in Table 3.

Table 3. Results of regression model showing effects of quiz grades, peer submission scores, and video watching on final course grade

	Model	B	SE	Beta	*t* (*p*-value)	Adj. R^2	*F(df)* (*p*-value)
All peer assignments	(Constant)	-0.161	0.085		-1.889 (.059)	0.134	495.77 (3, 9617) (.000)
	AQG	0.68	0.087	0.075	7.856 (.000)		
	PSS	0.005	0.00	0.306	32.071 (.000)		
	NVS	0.002	0.00	0.152	15.933 (.000)		
Do an elevator speech	(Constant)	-0.641	0.176		-3.646 (.000)	0.161	163.27 (3, 2531) (.000)
	AQG	0.692	0.178	0.071	3.89 (.000)		
	PSS	0.045	0.003	0.265	14.529 (.000)		
	NVS	0.004	0.00	0.271	14.847 (.000)		
Use group discussion language	(Constant)	-0.563	0.179		-3.149 (.002)	0.110	92.465 (3, 2216) (.000)
	AQG	0.609	0.18	0.068	3.392 (.001)		
	PSS	0.021	0.002	0.252	12.498 (.000)		
	NVS	0.002	0.00	0.18	8.939 (.000)		
Participate in a phone conversation	(Constant)	-0.221	0.181		-1.222 (.222)	0.079	55.943 (3, 1909) (.000)
	AQG	0.432	0.183	0.052	2.355 (.019)		
	PSS	0.015	0.001	0.249	11.268 (.000)		
	NVS	0.001	0.00	0.115	5.219 (.000)		
Do a mock interview	(Constant)	-0.16	0.185		-0.867 (.386)	0.082	48.345 (3, 1577) (.000)
	AQG	0.51	0.186	0.066	2.738 (.006)		
	PSS	0.01	0.001	0.273	11.31 (.000)		
	NVS	0.00	0.00	0.044	1.837 (.066)		
Deliver your pitch/ presentation	(Constant)	0.266	0.203		1.313 (.189)	0.030	15.231 (3, 1368) (.000)
	AQG	0.297	0.201	0.039	1.479 (.139)		
	PSS	0.005	0.001	0.174	6.56 (.000)		
	NVS	0.00	0.00	0.02	0.757 (.449)		

Note. AQG = average quize grade, PSS = peer submission score, NVS = number of videos started

Discussion

The results point to significant effects of quiz grade and peer assignment grades on course grade. This is consistent with Martín-Monje et al. (2017), who have shown that task submission, including completion of quizzes is strongly related to both course completion and success in the course. Central to the current analysis, however, is the effect of video consumption on course performance, which was significant in four of the models but not the last two shown in Table 3. Recognizing that there is some attrition over the length of the course, we hypothesize that by the time learners have reached the last two peer assignments, they are finding less need to watch the videos relevant to those assignments. The results also point to the effect of watching the course videos when working on the first three peer assignments, indicating that those who both watch the videos and engage in the peer assignments perform better on overall course grade.

The implications of this analysis are twofold: on the one hand, it behooves course designers to provide additional encouragement for learners to watch the videos. On the other hand, when analyzing course performance specific to Do a Mock Interview and Deliver Your Pitch/Presentation, course designers should consider what might be changed in the corresponding modules or specific lessons that might make the videos more relevant to course performance. Does something about the videos in those modules need to be changed? Does something in the corresponding course materials need to be changed to make the current videos more relevant. The authors find that an additional analysis of video and other content consumption in the final modules of the course is warranted.

Conclusion

The findings point to the significance of watching videos and completing peer assignments for success in the course. Quizzes act as self-check activities which help learners confirm their understanding of basic concepts (Sokolik, 2014). Consistent with a meta-analysis conducted by Montero, Van Den Noortgate, and Desmet (2013), watching course videos is generally related to course performance, though this effect waned as learners moved through to the end of *Speak English Professionally*. Additionally, research has shown that ELLs show distinct behaviors when they are struggling in a MOOC (Uchidiuno et al., 2017); they download video transcripts, watch videos for a greater length of time and pause them for longer compared to non-ELL users (Türkay et al., 2017). Videos for language learning need to be carefully designed. For instance, Sokolik (2014) suggests that talking head videos should be avoided and learners should be immersed in a rich environment that encourages reflection and discussion so as to engage them both in culture and the language. Additionally, Uchidino et al. (2017) have shown that ELLs benefit more from video narration when it is accompanied by text displayed on the screen.

The findings of the current study suggest that learning analytics data can be used to make inferences about the learning process, predict learner behavior and improve learning environment. Further research should include interventions in relation to course design and testing those interventions by collecting further learning

analytics data. Thus, MOOC design should involve a sustained effort so that we have a better understanding of learning in such virtual environments.

References

Bárcena, E., Read, T., Martín-Monje, E., & Castrillo, M. (2014). Analysing student participation in foreign language MOOCs: A case study. In U. Cress & C. Delgado Kloos (Eds.), *Proceedings of the European MOOC Stakeholder Summit 2014* (pp. 11-17).

First International Conference on Learning Analytics and Knowledge (22 July 2010). Retrieved from https://tekri.athabascau.ca/analytics/

Gelan, A., Fastré, G., Verjans, M., Martin, N., Janssenswillen, G., Creemers, M., Lieben, J, Depaire, B., & Thomas, M. (2018). Affordances and limitations of learning analytics for computer-assisted language learning: A case study of the VITAL project. *Computer Assisted Language Learning*, *31*(3), 1-26.

Gimeno-Sanz, A., Navarro-Laboulais, C., & Despujol-Zabala, I. (2017). Additional functionalities to convert an xMOOC into an xLMOOC. In *European Conference on Massive Open Online Courses* (pp. 48-57). Springer, Cham.

Godwin-Jones, R. (2014). Global reach and local practice: The promise of MOOCs. *Language Learning & Technology, 18*, 5–15.

Guo P. J., Kim J., & Robin R. (2014). How video production affects student engagement: An empirical study of MOOC videos. *ACM Conference on Learning at Scale (L@S 2014).*

Martín-Monje, E., Castrillo, M. D., & Mañana-Rodríguez, J. (2017). Understanding online interaction in language MOOCs through learning analytics. *Computer Assisted Language Learning, 31*(3), 251-272.

Montero P. M., Van Den Noortgate, W., & Desmet, P. (2013). Captioned video for L2 listening and vocabulary learning: A meta-analysis. *System, 41*, 720-739.

Rienties, B., Nguyen, Q., Holmes, W., & Reedy, K. (2017). A review of ten years of implementation and research in aligning learning design with learning analytics at the Open University UK. *Interaction Design and Architecture(s)*, *33*, 134-154.

Shah, K., Bach, M., Qin, N., Liu, A., Hussen, H., Lee, J.Y., & Kadel, R. (2017). *Inferring student success predictors for CS1301x online course at Georgia Tech.* Poster session presented at the American Society of Engineering Education STEM Education Expo, Atlanta, GA.

Sokolik, M. (2014). What constitutes an effective language MOOC? In E. Martin Monje & E. Bárcena (Eds.), *Language MOOCs: Providing learning, transcending boundaries* (pp. 17-32). Berlin: De Gruyter Open.

Türkay, S., Eidelman, H., Rosen, Y., Seaton, D., Lopez, G., & Whitehill, J. (2017). Getting to know English language learners in MOOCs: Their motivations, behaviors, and outcomes. In *Proceedings of the Fourth (2017) ACM Conference on Learning@ Scale* (pp. 209-212). Cambridge, Massachusetts.

Uchidiuno, J., Koedinger, K., Hammer, J., Yarzebinski, E., & Ogan, A. (2017). How do English language learners interact with different content types in MOOC videos? *International Journal of Artificial Intelligence in Education*. https://doi.org/10.1007/s40593-017-0156-x

Wiggins, G., & McTighe, J. (2005). *Understanding by design* (2nd ed.). Alexandria, VA: ASCD.

Öğrencilerin Analitik Verileri KAÇK Tasarımını Nasıl Geliştirebilir?

Öz

Bu çalışma, ileri düzey İngilizce konuşma becerisini öğretmeyi hedefleyen bir Kitlesel Açık Çevrimiçi Kursta (KAÇK) öğrenci katılımını araştırmaktadır. 200,000'in üzerinde öğrencinin kayıtlı olduğu ders, Coursera platformunda sunulmuştur. Dersin tasarımını ve etkinliklerini geliştirmek amacıyla, öğrencilerin edim göstergesi olarak derse katılımları analiz edilmiştir. Sonuçlar, kısa sınavların, akran değerlendirmesinin ve videoları seyretmenin dersteki edimi olumlu etkilediğini ortaya koymuştur.

Anahtar sözcükler: Kitlesel açık çevrimiçi kurs, ikinci dilde konuşma, öğrenci katılımı