# MOOC Research Initiative
# Final Report

## Project Title: Beyond and Between "Traditional" MOOCs: Agile and Just-in-Time Learning

## Project Details

Project Lead: Jennifer Campbell
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Project Budget: $25000

## Research Questions

We investigated the potential use of archived-MOOCs as learning resources for beyond and between live sessions. Live- and archived-MOOCs are distinguished by the presence or absence of instructional support, cohort presence, deadlines, and the potential for formal acknowledgement of completion.

To this end, we investigated live- and archived-learners' demographics, intent, and the relationship between intended and actual behaviour, including the amount and nature of interaction with the course materials. One of our focuses was an exploration of the value of archived-MOOCs as resources for self-directed learning, review, and remediation. In particular, what were the learners' goals and could they be met by an archived-MOOC? We also compared learners' activity patterns, learner outcomes, and satisfaction between the live- and archived-courses. This comparison was motivated by questions such as: How valuable is the instructor and cohort presence? Are deadlines and statements of accomplishment important motivators? Are there signs of self-organization and peer-support in the archived courses? Do learners use the archived course materials in sequence? Are there differences in demographics and intent? And are there differences in learner interactions with videos? Finally, we explored patterns of mobility across related MOOCs by examining whether learners in a sequel MOOC used the first course for remedial learning.

# Findings

The two MOOCs studied here are "Statistics: Making Sense of Data" (STATS) and "Learn to Program: The Fundamentals" (LTP1), both offered on Coursera, with live sessions in April-May 2013 and September-November 2012, respectively, and available afterwards as archived-MOOCs. We also looked at a sequel to LTP1, "Learn to Program: Crafting Quality Code" (LTP2), to understand how students transition among related live- and archived-MOOCs.

To better understand the characteristics of live- and archived-learners, we examined the results of pre-course surveys of learners in the live-courses and similar surveys of the archived-learners. Data from the course clickstreams were used to identify learners' patterns of use of the course components. For example, we modeled learners' transitions from video to video using a first-order Markov Chain. Additional evidence to corroborate and complement this analysis was provided by the database of each course, including records of videos accessed, assessments submitted, and posts to the discussion forums.

## Summary of results

***Why do learners enroll in an archived MOOC?*** Since the experience of archived-learners is of central focus to this research, the survey of archived-learners included a question about why they chose to enroll in the archived-courses. The most common responses indicated that learners were interested in the live-courses. The top responses were that learners enrolled in the live offering but were not able to complete the course (43.4% for STATS and 41.1% for LTP1), and that they arrived too late for the live offering (30.8% for STATS and 40.9% for LTP1).

***Learner Intent*** In order to consider whether courses were meeting learners' needs, all research questions were considered in the context of how much work learners intended to do for the course. See Table 1 for a summary of responses to learners' intent. The greatest proportion of survey respondents intended to complete all work, although more live-learners than archived-learners intended to complete all requirements.

Table 1: *Summary of work learners planned to complete*

| | STATS | | LTP1 | |
|---|---|---|---|---|
| | Live | Archived | Live | Archived |
| All required | 74.8% | 38.3% | 81.8% | 65.3% |
| Most | 11.4% | 25.9% | 7.0% | 12.7% |
| Not sure | 11.2% | 25.9% | 7.0% | 12.7% |
| Some | 2.5% | 25.8% | 1.1% | 9.6% |

***Learner Behaviour*** As can be seen in Table 2, on average live- and archived-learners accessed a similar number of videos, attempted a similar number of assessments, and actively watched videos for a similar length of time. However, in terms of the length of time over which they accessed videos, the top 10% of archived-learners did so over a longer period than the top 10% of live-learners.

Table 2: *Summary statistics of live- and archived-learner activity*

| | | STATS | | LTP1 | |
|---|---|---|---|---|---|
| | | Live | Archived | Live | Archived |
| Mean number of required videos accessed (maximum 41) | | 12.1 | 12.2 | 15.2 | 13.5 |
| Mean number of optional videos accessed (maximum 24) | | 2.7 | 3.5 | | |
| Mean number of required quizzes attempted (maximum 7) | | 2.5 | 2.1 | 2.2 | 2.0 |
| Mean number of required assignments attempted (maximum 3) | | | | 0.7 | 0.9 |
| Length of time between first and last video access (days) | Median | 11.1 | 12.0 | 12.4 | 9.6 |
| | 75th percentile | 41.9 | 52.5 | 40.1 | 50.0 |
| | 90th percentile | 55.2 | 149.4 | 49.5 | 171.6 |

Figure 1 gives visual representations of the likelihood that LTP1 learners transitioned from one video to another video. Hotter colours indicate larger probabilities, corresponding to more common video-to-video transitions. A hot spot immediately to the right of the diagonal indicates that watching a video in sequential order was a common transition. Both live- and archived-learners tended to watch videos in the intended sequence. There is some indication that archived-learners who intended to complete less than all of the course were more likely to watch videos out of sequence.

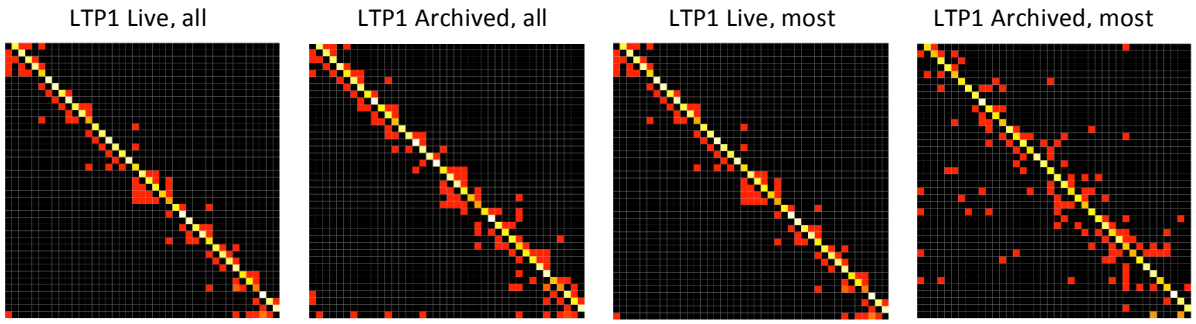


Figure 1: *Video transition matrices for LTP1 for intent categories "all required" and "most".*

For those who intended to complete all of the required work, were the archived-learners as successful as the live-learners? Because earning a Statement of Accomplishment was not possible for the archived-learners, we examined quiz completion as a surrogate measure of course completion. For both live- and archived-learners, learners more commonly completed either zero or all seven quizzes. For example, for STATS learners who intended to complete all work, 27.3% of live-learners attempted zero quizzes and 21.3% completed all seven, and 40.4% and 35.7% of archived-learners completed zero and seven quizzes, respectively.

We also investigated discussion forum activity for live- and archived-learners. More of the live-learners viewed threads than archived-learners. For STATS, 44.6% of live-learners and 31.3% of archived-learners viewed threads; for LTP1, the corresponding percentages were 41.8% and 37.3%. As expected, fewer learners posted than viewed and more live-learners posted than archived-learners. For STATS, 12.1% of live-learners and 9.3% of archived-learners posted on the forums; for LTP1, the corresponding percentages were 14.5% and 9.3%. It is interesting to note that archived-learners did post to the forums, even though the courses were not active.

LTP2 was a sequel to LTP1, with the content from LTP1 a presumed prerequisite. Having this sequence of courses, with LTP1 available as an archived-MOOC during the period when LTP2 was live, allowed us to investigate whether the LTP2 users made use of the archived LTP1 as a remedial resource. Of the active live-learners in LTP2, 13.0% were active in the archived LTP1, watching on average 22.9% of the LTP1 videos. Only 26.3% completed any of the quizzes.

## Conclusions

The advent of MOOCs has created opportunities for learning that are clearly in high demand, but the direction in which MOOCs should evolve to best meet the interests and needs of learners is less apparent. Despite the lack of a defined cohort, deadlines, strong instructor-presence, and the ability to earn a Statement of Accomplishment, archived-learners indicate similar intent and exhibit similar behaviour to live-learners. And this behaviour extends

beyond watching videos to completion of assessments and interaction on the discussion forums. In addition, we also found evidence of the use of an archived-MOOC as a remedial resource. These findings may have an impact on the future development of MOOCs as resources for self-study, and will be of interest to those considering materials for supporting learner success in other courses.

**Limitations**

The nature of the available data made it very difficult to assess learners' goals, and whether or not the courses were successful in meeting these goals. Learners were surveyed at the end of the courses, but responses to the survey were predominantly from learners who completed all of the course, resulting in a lack of variety in the feedback. These respondents typically found that the course materials were an excellent match for their needs and interests.

**Dissemination**

- "Beyond and Between 'Traditional' MOOCs: A Comparison of Learner Intent and Behaviour in Live and Archived MOOCs". Presented at the University of Toronto MOOC Research Symposium. April 28, 2014.
- J. Campbell, A.L. Gibbs, H. Najafi, and C. Severinksi. A Comparison of Learner Intent and Behaviour in Live and Archived MOOCs. Submitted to *The International Review of Research in Open and Distance Learning*.
- "Beyond and Between Traditional MOOCs: Agile and Just-in-Time Learning." Presented at the MOOC Research Conference, December 5-6, 2013, University of Texas, Arlington.

## Future Work

In the work accomplished to date, we have identified and investigated a number of features that describe the demographics, intent, and activity of learners in live- and archived-MOOCs. We hope to carry out further work with the goal of illuminating which attributes are the most predictive between the two groups of learners.

As a next step, supervised and unsupervised learning methods could be used to classify or cluster the learners. The resulting models could then be studied to show which attributes are the most predictive between archived- and live-learner groups and whether some of the attributes are systematically different between learners who are classified correctly and those who are incorrectly classified.

We are also interested in extending our identified features of learner activity to further investigate the behaviour of live- and archived-learners. For example, we are interested in analyzing learner behavioural trajectories as they develop over time. In addition, events from the clickstream could be organized into common categories or sequences of activities, producing a series of actions for each learner. Transitions between these actions could be modeled with latent state models.