How do MOOC Learners' Intentions Relate to Their Behaviors and Overall Outcomes?

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Abstract

The match between learners' intentions and their learning behaviors is missing from the majority of discussion on learning outcomes in MOOCs. The present study tackles this challenge by investigating the relationship among intentions, behaviors and outcomes in four Coursera MOOCs offered by the University of Toronto (U of T). These MOOCs were from various disciplines, including computer science (2 courses), psychology, and statistics. Grounded in a rich MOOC dataset that included pre-course surveys, learners' dick logs, and course completion data, we integrated statistical analysis and data mining techniques to address research questions from different angles. Results from cross tabulation and a chi-square test of independence implied an impact of learning intentions on behaviors. Frequent Sequence Mining showed promise in detecting different frequent sequences in varied learner groups defined by intentions and outcomes.

Research Questions

In the context of four U of T Coursera MOOCs:

- Q1. What are the underlying components of MOOC learner intentions?
- Q2. How do MOOC learner intentions vary across disciplines?
- Q3. How can MOOC learner behaviors be characterized based on the analysis of clickstream data?
- Q4. How are MOOC learner intentions related to MOOC learner behaviors?
- Q5. How are MOOC learner intentions & learner behaviors related to learning outcome measures?

Context

Course (Code)	# Learners	Duration	# SOA*
Introduction to Psychology (IntroPsych)	79,173	8 weeks	3,681
Learn to Program: The Fundamentals (Programming1)	80,000 (2 Offerings)	7 weeks	8,240
Learn to Program: Crafting Quality Code (Programming2)	53,974	5 weeks	3,352
Statistics: Making Sense of Data (IntroStats)	62,488	8 weeks	3,352

Table 1: Context of the study (*SOA: Statement of Accomplishment)

Data Sources

- Learner intentions: pre-course survey (n = 48,837)
  - Academic relevance **(Aca)**; Job skills **(Job)**; Enhancing CV **(CV)**; Prestigious university **(Uni)**; Fun & enjoyable **(Fun)**
- Learner behaviors: Clickstream events (n = 10,475) for IntroPsych
  - Pageview & Video views
- Learning outcome: SOA earned or not **(cert/nocert)**

Data Analysis

- **Data preparation**
  - Parse clickstream events; partition events by learner & session; engineer event features (e.g., out-of-sequence, seeking)
  - Link survey, clickstream, & achievement data by student ID

Question	Data Sources	Analysis
Q1 & Q2	Pre-course survey	• Principal component analysis • Descriptive analysis
Q3	Clickstream	• Frequency statistics • Clustering Analysis
Q4 & Q5	• Pre-course survey • Clickstream • Learning outcome	• Frequent Sequence Mining • Descriptive analysis

Findings

Q1& Q2: Learner Intentions

Two principal components of learner intentions:

- Betterment: Aca, Job, CV, Uni (Loadings above .7)
- Enjoyment: Fun (Loading of .83)

		Enjoyment	
		Hi	Lo
Betterment	Hi	9,586 (29.4%)	9,586 (21.5%)
	Lo	9,148 (28.0%)	6,903 (21.1%)

Table 2: Distribution of learners in 4 quadrants defined by intentions

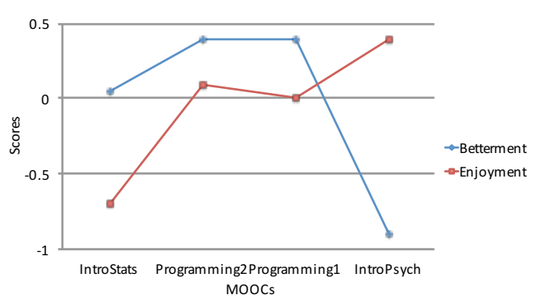

Figure 1. Distribution of intentions scores across four MOOCs

Q3: Learner Behaviors

- All-round high intensity (n=603)
- All-round medium intensity (n=1,891)
- All-round low intensity (n=3,969)
- Quiz-takers (n=1,078)
- Casual (n=2,934) (Visited lectures, forum, & wiki but not quizzes)

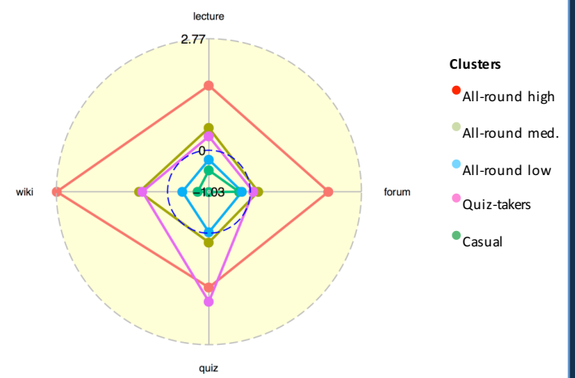

Figure 2: Five clusters of MOOC learners. Each axis shows a specific activity type & is scaled for representation purposes. The position of a dot can only be compared within an axis.

Q4: Learner Intentions & Behaviors

- Significant Relationship, χ^2 (12, 10475) = 32.24, p = .001
- Cross tabulation:
  - High Betterment (HiLo/HiHi) → Quiz-takers
  - Low Betterment, High Enjoyment (LoHi) → All-round high and medium intensity
  - Low Betterment, Low Enjoyment (LoLo) → All-round low intensity & Casual

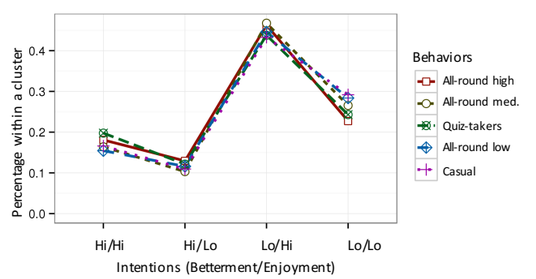

Figure 3. Distribution of learner behaviors clusters among 4 categories of learner intentions

Q5: Intentions, Behaviors, & Outcomes

- When logging in, the most frequently accessed course components were lecture videos and course pages (syllabus, logistics, assignments)
- High-enjoyment learners were more likely to access social features as their first action after logging in, regardless of MOOC completion status
- SOA earners were less likely to attempt quizzes or access discussion forums as their first actions following authentication

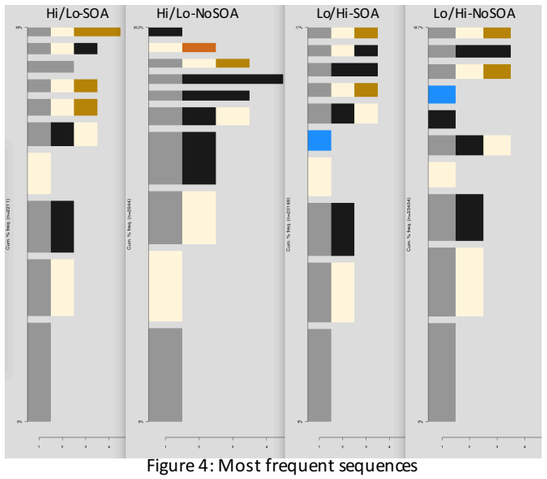

Figure 4: Most frequent sequences

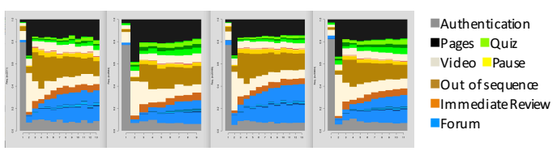

Figure 5: Event distributions by time points (top)

Conclusions & Future Research

- "Non-significant" yet noticeable interactions were identified between intentions & behaviors as characterized by counts
- Frequent Sequence Mining showed sequential differences among different clusters of students as defined by intentions and outcomes
- Further study underway
  - Analyzing course designs in-depth, to contextualize the data
  - Instructor interviews about design intent & beliefs about learning & teaching
  - Analyzing the growth of discussion forums as course artifacts; access & reading-patterns of individuals