Analyzing Learning Patterns and Potential Interventions in First-Year Compulsory Course at an Online University

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Abstract: Online universities are becoming increasingly popular for their flexibility, especially for adult learners. However, the autonomy of online learning can lead to challenges in maintaining motivation and engagement. This study at Tokyo Online University examines the learning patterns of first-year students in a mandatory academic literacy course. It analyzes the relationship between students' learning history and grades to identify patterns of success and failure in order to develop targeted intervention strategies. The literature review discusses MOOC attrition rates, self-regulated learning strategies, and the relationship between learning patterns and academic performance. The analysis clusters students based on engagement and performance, reveals distinct patterns between successful and unsuccessful students, and highlights early course engagement as critical. The study recommends introducing information on successful study strategies during new student orientation and sending targeted messages to disengaged students.

Keywords: Online universities, Learning patterns, Intervention strategies

1. Introduction

Online universities offer flexible, on-demand courses that are ideal for adult learners who want to retrain or upgrade their skills, freeing them from the constraints of time and place. As higher education increasingly moves online, it is important to understand the challenges and opportunities involved. A key challenge in online learning is the need for individual autonomy, self-regulation, and sustained motivation, without which learners may abandon their studies, a prominent issue in MOOCs (Hone & El Said, 2016).

Previous research highlights key factors for online student success, including time management and social presence (Kizilcec, Pérez-Sanagustín, & Maldonado, 2017; Richardson et al., 2017). This study aims to build on these findings to develop targeted intervention strategies for online students, inspired by Furukawa's (2022) analysis of MOOC student data. Despite advances in MOOC research, studies of learning behaviors in four-year online undergraduate programs are limited. Online students tend to be more intrinsically motivated and less socially connected than traditional college students (Kato, 2021; Kato, 2022b). Early engagement in courses correlates with higher final grades, as shown in a first-year course at an online university (Kato, 2022a). This paper focuses on analyzing learning patterns and exploring potential interventions for students, rather than detailing specific intervention implementations.

2. Literature Review

Studies of learning progress and attrition in online learning, particularly in MOOCs, are extensive. The average MOOC enrolls approximately 43,000 students and has a completion rate of 6.5% (Jordan 2014). Literature reviews indicate that the rigid structure of MOOCs may not be appropriate for students with diverse needs, and those who take courses selectively or slowly may be considered dropouts (Onah et al., 2014). Learning analytics

have been used to identify successful and unsuccessful learning patterns in blended environments (Tempelaar et al., 2015). A systematic review highlighted the importance of understanding different learning patterns in online higher education and suggested that factors that contribute to success in traditional settings may be less effective online (Broadbent and Poon, 2015). Kizilcec et al. (2017) explored the relationship between self-regulated learning strategies, learner behavior, and goal attainment in MOOCs. Furukawa (2022) analyzed MOOC programming learning logs and identified clusters of early learners to support based on characteristics such as number of video views and programming skills. Kato (2022a) found that early course completion has a significant impact on final grades, suggesting that early intervention for students who are falling behind could potentially reduce dropout rates.

3. Research Questions

The research questions are as follows:
　・What learning patterns are associated with successful completion of a course during the first half of the quarter?
　・What learning patterns are associated with failure during the first half of the quarter?

4. Analysis of Learning Patterns

Figure 1 displays a scatterplot comparing students' first and eighth class completion dates with final scores, where a score of 60 or above, marked by a red line, signifies success. The graph indicates some early starters dropped out, while most who completed eighth class passed.

Figure 2 shows students clustered by first class completion date and final score: Group A started early, scored high, and did not need intervention. Group B started late, scored high, and benefited from the intervention. Group C started on time but failed and appeared to need time management intervention. Group D is a group that started slowly and lost credits, and how to intervene is an issue for the future.
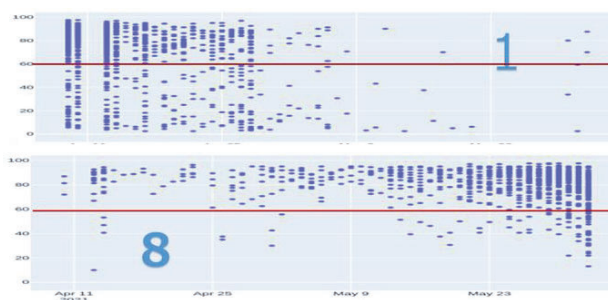

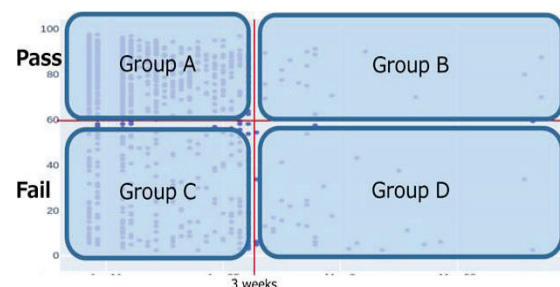Figure 1. Final scores and completion dates of the 1st and 8th classes.

Figure 2. Grouping of Students by Date of First-Class Completion and Final Score.

Figures 3 and 4 show the full periodic learning histories for Groups A and C, who completed their first study within three weeks. The axes represent a quarter's schedule and progress percentage, with 100% representing completion of all 8 classes. Due to similar trends, the analysis divides the students into two groups: those who passed (A and B) and those who failed (C and D). Clustering was done using the Python module "sklearn".

5. Future Discussion

398

In the future, the following information should be presented at new student orientation prior to the start of classes to help students understand their learning options and consider their own learning styles:

  1. Take your first class as soon as possible

  2. There are several ways to take classes. There are several ways to proceed with the class, either regularly or all at once in the first half of the class.

  3. It is possible to catch up in the second half even if you fall behind in the first half.

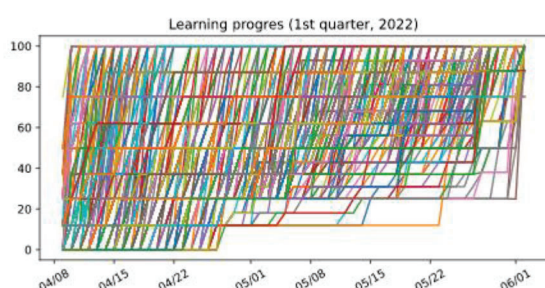 4. If you don't start at the very beginning, you may not be able to finish.
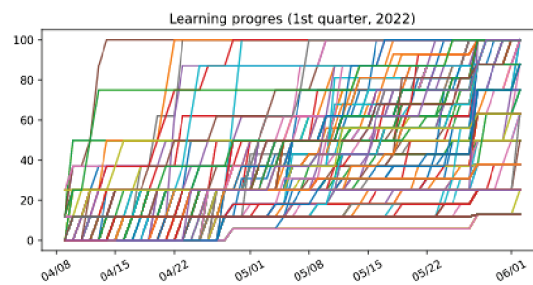

Figure 3. Learning progress of Group A.

Figure 4. Learning progress of Group C.

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