Student Study Behaviors on Problem Roulette

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Overview

Problem Roulette (PR) is a web-based study service at the University of Michigan that offers random-within-topic access to a large library of past exam problems in introductory courses. Our work was to analyze students study behavior on PR service.

- First we focused on some extremal behaviors, like high-skip rate and wanted to find the reasons of those behaviors. Depending on the data, we selected some students who had the extremal behaviors to do some interviews. We found that the main reason why students skipped questions was repetitiveness.
- Second, we focused on how the type of sessions influence students' performance in class. Using data from Stats 250, Chem 130 and Physics 140 from 2014 Winter semester to 2015 Fall semester, we found that students use PR more frequently and those who spend more time studying per session earn higher average grades.

Terms

- **Session**: a period of concentrated study defined by a series of attempted problems with a maximum of 30 minutes between problems.
- **Long and short session**: long and short session types are separated by median of mean session time (total study time/ session number).
- **Many and short sessions**: many and few session types are separated by median of session number.
- **Skip rate**: number of response/ number of views
- **GPAO**: GPA earned in all other courses at the end of the semester
- **GPE**: grade point earned in class

Questions

- Why students have some extremal behaviors:
  - High skip rate
  - Having extremely long sessions or having many short sessions
- How session types influence students performance?
  - Long session v.s. short session
  - Many sessions v.s. few sessions
  - Many and long sessions v.s. few and short sessions

Method

- Data Analysis:
  - Collect data from PR data base
    - Chem 130: 2013 Fall ~ 2017 Winter
    - Stats 250: 2014 Winter ~ 2015 Fall
    - Physics 140: 2014 Winter ~ 2015 Fall
  - Use Python to organize and visualize data
- Interviews: 3 participants

Reference

1. Evrard, A.E. et al. (2015), *Problem Roulette: Studying Introductory Physics in the Cloud,* Am. J. Physics, 83, 76.

Findings

Figure 1: Mean session time and sessions number are gathered around median

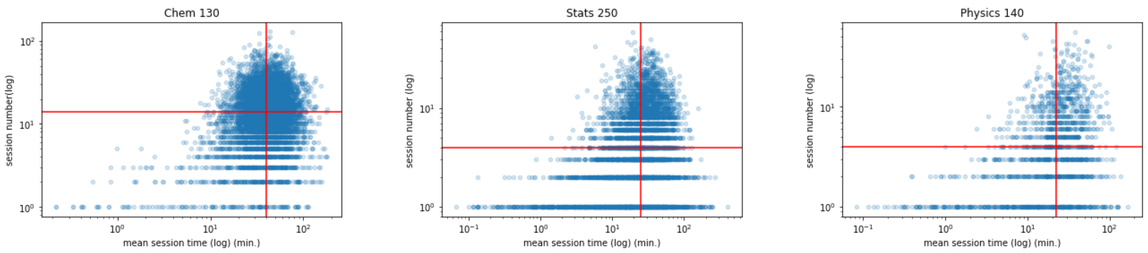


Figure 1: The relation of mean session time (log, in minutes) and number of sessions (log). Red lines are median values used to divide students into different session types. Long session is on the right side of vertical lines, while short session is on the left side. Upper side is many sessions and lower side is few sessions. Session behavior differs somewhat among subjects, with Chem 130 having the largest volume and Physics 140 the smallest. Extremal behaviors demonstrate a range of study habits. For example, a student in Stats 250 had one super long session of almost 400 minutes, and several students in Chem 130 had nearly 150 study sessions in a term.

Figure 2: Many sessions help students earn better grades

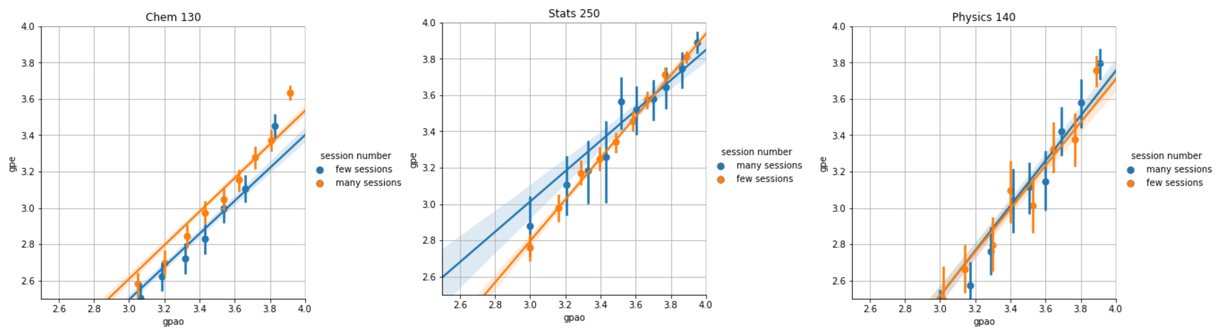


Figure 2: Performance difference between students who had few sessions and students who had many sessions.
The difference in Chem 130 is obviously that students having many sessions performed better. In Stats 250, the difference between students earned lower than 3.7 is significant, and when approach to high GPA, the difference is not big. In Physics 140, having many sessions is still better than few sessions. However, the influence of number of sessions is small. The differences between these three plots may be we have more data from Chem 130 or because of the sleep function, having many sessions helps us memory things better.

Figure 3: Long sessions help students earn better grades

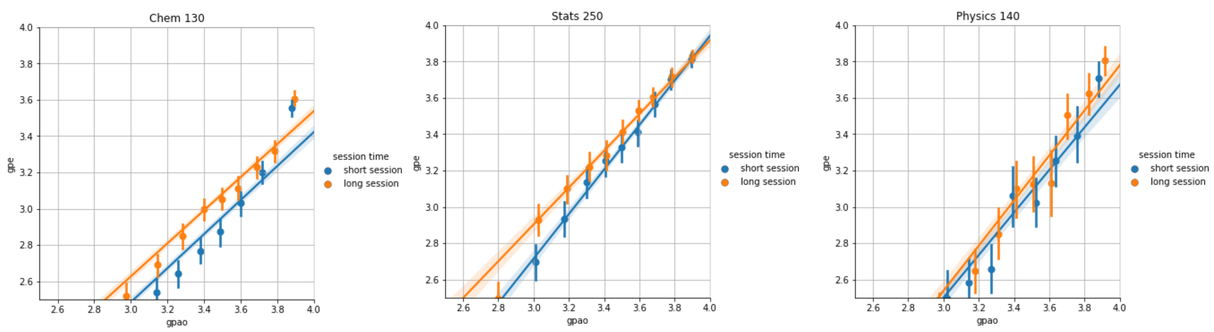
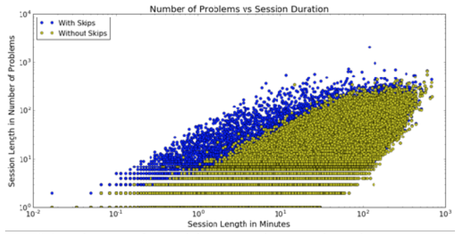


Figure 3: Performance difference between students who had long session and students who had short session.
The difference in Chem 130 is obviously that students having long session performed better. In Stats 250, the difference between students earned lower than 3.7 is significant, and when approach to high GPA, the difference is not big. In Physics 140, having many sessions is better than few sessions.



- Students often skip questions. The plot above, for Chem 130, shows that students who view problems without answering (blue) produce the longest session lengths by number of problems, but not by time.

Results from interviews

- The main reason why students skip questions appears to be that the questions were repeated again and again and students thought it was wasting time to do them (⅔ participants mentioned it). Not knowing how to answer and wanting to learn later is another reason mentioned.
  - "A lot of the problems that I've skipped, I do it because I've seen it before, or I don't know how to approach it and I want to figure that out first. I try to use time frames - because in a test I know I won't have infinite time to do something, so I move on very quickly, and plan to come back to those later. I would try it again later once I feel like I know it."

Conclusions

- As a practice tool, PR plays a role helping students figure out what topics they have not yet understood. Students can focus more energy on those topics.
- Statistical behaviors of session types across subjects are similar, but the overall volume of study is different.
- Students who expend more energy studying gain better grades in classes; more sessions and/or longer average study sessions lead to better grade performance.
- Students do not want to waste energy on answering repetitive questions.

Next

- Expand the study to include recent data from the new PR service (2017 onward), which would include data from EECS 183.
- Build interventions into the service, giving students advice and encouragement aimed at improving their self-efficacy.
- Perform more interviews to probe student attitudes and rationales for certain types of behaviors.
- Modify the algorithm to avoid serving students repetitive problems.