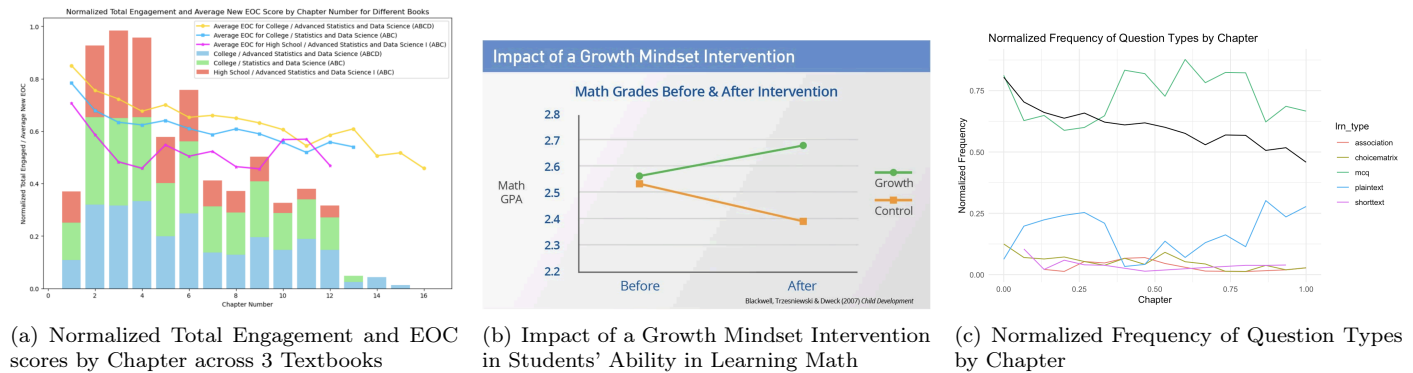


## Problem Statement: How to improve the student experience of learning statistics on CourseKata?

Before addressing the problem statement, we explored broader influences on student engagement in statistics and discovered that out-of-school factors impact learning four to eight times more than school-based factors like teachers and textbooks, suggesting that enhancing CourseKata textbooks will only improve 20% of the student experience.

Then, to start answering the problem statement we built [a tool](#) that visualizes student engagement levels within each chapter of the latest version of three distinct textbooks, and [another tool](#) that visualizes each student’s engagement trend across chapters and how it compares to their EOC score trends. Note that we define higher EOC scores being indicative of students having a better experience in learning statistics. Our first suggestion was to let teachers use these tools to track student engagement in the textbooks over time and revise their lesson plans accordingly.



Following that, we hypothesized that student’s engagement with statistics is correlated with their intrinsic interest and practical applications within course content. To test this hypothesis, we ran a multiple linear regression model to predict the average EOC score for a student given their total engagement time with CourseKata textbooks and their average reported Intrinsic and Utility values. Within the summary of our linear model, the p-values of all three predictors we chose are smaller than our significance level,  $\alpha = 0.05$ , indicating that all three are significant in predicting a student’s EOC score, disproving the null hypothesis of  $\beta_1 = \beta_2 = \beta_3 = 0$ .

Next, we were interested in how student participation measured by ratio of questions completed influenced their EOC scores. We found that even though most students only complete less than 25% of the textbook questions, they are still able to obtain high EOC scores. This may point to some students enrolling into the course with more experience than others. Therefore, we suggest CourseKata introduce a diagnostic test to assess student understanding at the outset to ensure that they are placed in a class that would best suit their level of experience. This could similar to the University of Washington’s Self-Guided Placements for Mathematics, Programming, and Foreign Languages.

Additionally, having teachers that ask the right questions and model how to approach statistics is essential for facilitating a student’s experience on CourseKata. In the Learning Zone model, teachers should aim to place their students in the growth zone instead of the stress or comfort zone. Additionally, they should emphasize that ability in STEM is malleable and can be improved. To promote a growth-based approach to statistics wherein students are challenged appropriately and taught to embrace a growth mindset, CourseKata should include optional “excursion” topics to encourage curiosity among students. Success of a growth-based approach is shown in graph (b), where math grades of students after a growth mindset intervention increased whereas the grades of the control group decreased.

Finally, we looked into the influence of question types on EOC scores to further examine the type of questions that teachers should be asking. As visualized by graph (c), approximately 70% of questions asked within CourseKata textbooks were multiple choice questions. Additionally, running a linear regression predicting EOC scores of students on each chapter revealed that the various question types all have large p-values, indicating that asking a multiple choice question is no different from asking any other type of question. Therefore, we suggested CourseKata to remove 50% of their questions and within the 50% that they keep, increase the ratio number of implementation-based questions such as coding to understanding-based questions such as multiple choice and association.

Additionally, to ensure that students feel supported in their learning journey, we suggest that CourseKata implement a discussion board at the end of each section that allows students to post their question, similar to Ed discussion and Stack Exchange. Through this, the discussion board can act as a dictionary for students reading the textbook as more and more people post their questions onto the board.