acrobatiq by VitalSource

# The Impact of Adaptive Activities in Acrobatiq Courseware:

## Investigating the efficacy of formative adaptive activities on learning estimates and summative assessment scores

**This is an overview of the adaptive activity efficacy research and findings by the VitalSource Research and Development team as published in July 2020 and presented at the 22nd International Conference on Human-Computer Interaction.**

## INTRODUCTION

The purpose of this paper is to evaluate the efficacy of the adaptive activities within Acrobatiq's courseware. It analyzes the adaptive activities from a Probability and Statistics course by using real course data to evaluate their impact on learning estimates and summative assessment scores. With roots in research, Acrobatiq by VitalSource is pleased to continue to share results and insights with the broader educational community.

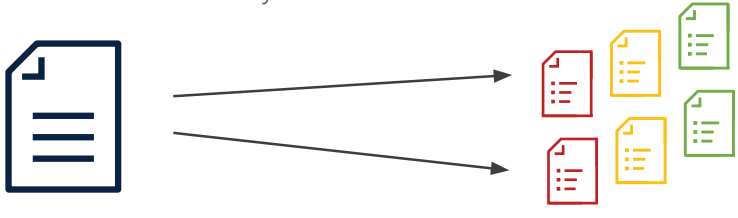
**The results of this research project proved the adaptive activities are an effective learning tool for students:**

- The adaptive activities had a **net positive effect** on learning estimates.
- Analysis also showed that not only did learning estimate states correlate to mean summative assessment scores but **improving learning estimates after completing the adaptive activity practice yielded higher mean summative assessment scores.**

### DEFINING THE KEY TERMINOLOGY

The ***adaptive activities*** are formative activities delivered after a module of learning content to help students prepare for a module quiz. They are designed with sets of scaffolded questions against each learning objective from the preceding lessons. The platform uses the student's learning estimate to determine the level of question scaffolding the student should receive within the activity.

Performance on lessons determines scaffolding in adaptive practice.



A ***learning estimate*** is a predictive measure generated by Acrobatiq's Analytics Engine for each student on each learning objective. It is primarily based on how well a student performs on the formative practice for each learning objective. The learning estimate is categorized as ***low, medium, and high.***

***Formative practice*** are questions integrated into the lesson content that provide immediate feedback and repeated attempts without producing a grade.

***Summative assessments*** are the end-of-module quizzes that produce a score in the gradebook.

## RESEARCH QUESTIONS

***1. Do the adaptive activities increase learning estimates for students?***

***2. Do the adaptive activities increase student scores on summative assessments?***

## THE DATA

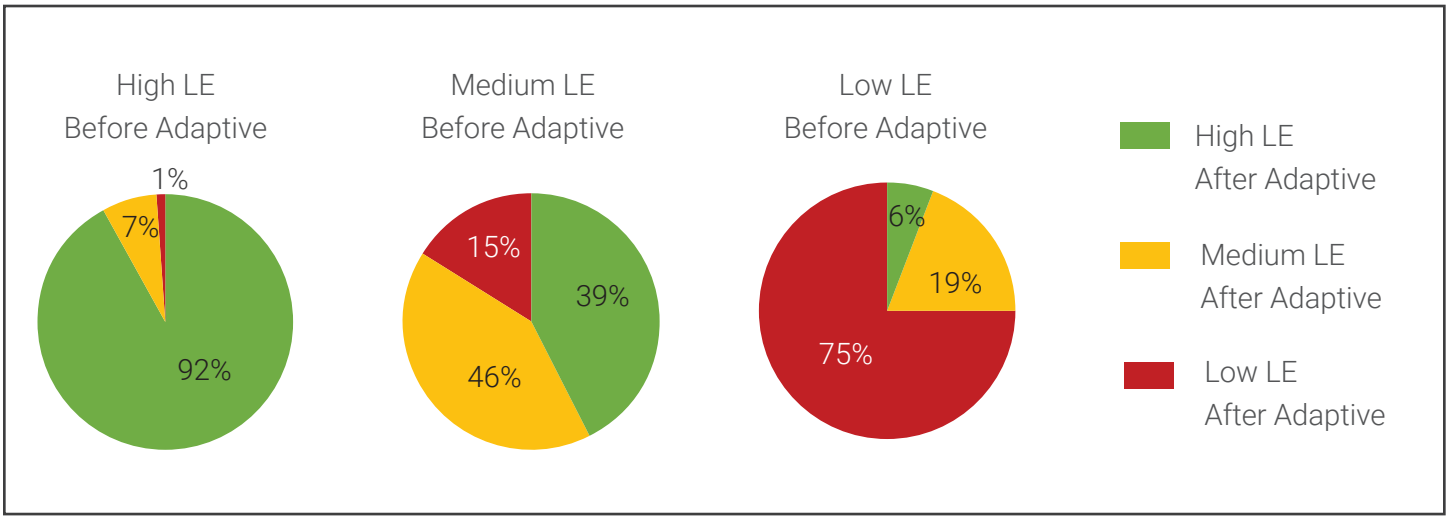
| | | |
|---|---|---|
| **300 Students** at a major 4-year institution | **21** learning objectives | **5,971** total data records |

The data used in this paper was from a real course with no experimental controls. While there are many benefits to a controlled experiment, we believe the value of this analysis is in the real-world context of the course usage. The full data set was reduced to include only learning objectives with formative, adaptive, and summative records. We also set parameters for the number of formative practice questions tagged against the learning objectives. Analysis was run on the full and reduced data set and conclusions were consistent between them.

## RESEARCH QUESTION 1:

**Do the adaptive activities increase learning estimates for students? Yes.**

Of the cases in which a learning estimate was available immediately before and after adaptive practice, the learning estimate was increased by adaptive practice in 64.2%, and the median learning estimate change was statistically significantly ($p <<< 0.001$). We investigated these results further by separating out each learning estimate (LE) category to see how the adaptive practice changed each group.

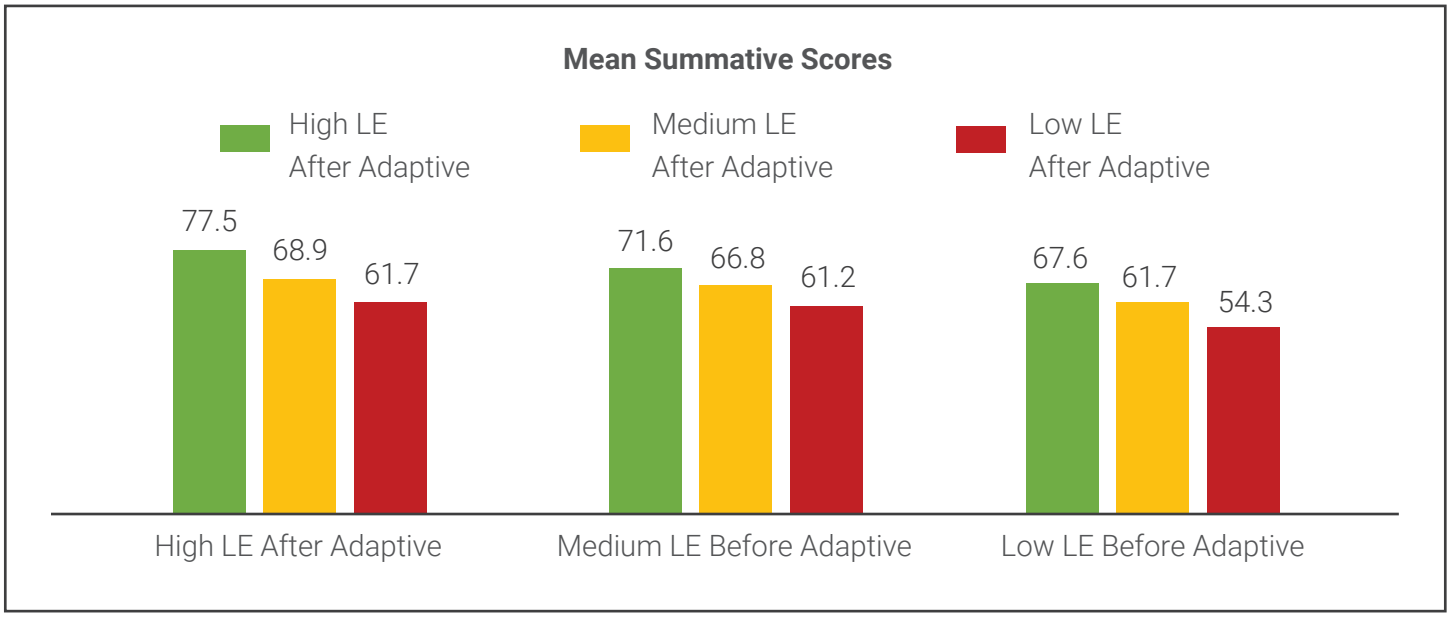


This breakdown of changes within learning estimate categories shows us that students who did well in the formative practice continued to do well in adaptive practice. However, there was considerably more change in the low and medium categories, with **25% of low learning estimates increased to medium or high, and nearly 40% of medium learning estimates increased to high. This is a sizable percentage of struggling students for whom the adaptive activities helped to increase mastery.**

## RESEARCH QUESTION 2:

**Do the adaptive activities increase student scores on summative assessments? Yes.**

Students with higher learning estimates generally had higher mean summative scores. Within original learning estimate categories, students who improved their learning estimates after the adaptive questions did better on summative questions than students who maintained their learning estimate category, and students who lowered their learning estimate category after the adaptive questions did worse than their counterparts who maintained their category. A comparison of these within-category changes found that were all statistically significant. The following graphs show mean summative scores per category.




## CONCLUSION:

The study demonstrated that adaptive activities help to increase the student learning estimates as well as correlate to higher summative assessment scores. Given these findings, we will encourage our partners to incorporate adaptivity into courseware as a proven means to positively impact student performance.

Acrobatiq by VitalSource will continue to partner with instructors and institutions on future research as we work toward the shared goal of improving learning experiences for all students.

Van Campenhout, R., Jerome, B., Johnson, B. G. (2020). The impact of adaptive activities in Acrobatiq courseware: Investigating the efficacy of formative adaptive activities on learning estimates and summative assessment scores. In: Sottilare R., Schwarz J. (eds) Adaptive Instructional Systems. HCII 2020. LNCS, vol 12214. Springer. pp 543–554. https://doi.org/10.1007/978-3-030-50788-6_40