

Learning Science Areas of Research

KEY FINDINGS

Our research and development team has put forth a research agenda that studies learning from a holistic perspective and continually advances the learning sciences. Over the past year, we have published papers at highly reputable scholarly conferences on a range of topics to share our research findings with the larger educational community.

From our research, we have shown these core learning science findings:

- Doing practice causes better learning. [1]
- Adaptivity helps better prepare struggling learners. [2]
- Teachers are vital to the successful implementation of learning technology. [3]
- Artificial intelligence can create learning by doing at scale and engage students in the same way as human-authored questions. [4]

You can read our research studies in full [here](#).

TRANSFORMING TEXTBOOKS INTO LEARNING BY DOING ENVIRONMENTS:

An Evaluation of Textbook-Based Automatic Question Generation (AQG)

"The current advances in artificial intelligence, natural language processing, and machine learning make it possible to take high-quality textbook content and automatically transform it into learning by doing courseware designed to be more effective for student learning. AQG that is directly based on the textbook content is a practical solution to achieve this goal of combining content and learning science-based practices at large scale. However, the AG questions should be rigorously evaluated to ensure they meet certain standards, and a comparison of performance metrics to HA questions provides the first step to ensuring the quality of these questions.

Overall, the trends from this large-scale data analysis indicate that students in natural learning contexts do not treat the automatically generated questions differently than their human-authored counterparts." [2]

THE DOER EFFECT:

Replicating Findings that Doing Causes Learning

*“By engaging with a learning by doing design—formative practice questions integrated into the learning material—students activate the doer effect and increase their learning gains. This analysis confirms that even when controlling for an outside variable, doing the formative practice within the courseware caused better performance on an external final exam. **Doing practice causes better learning.**” [1]*

THE IMPACT OF ADAPTIVE ACTIVITIES IN ACROBATIQ COURSEWARE:

Investigating the Efficacy of Formative Adaptive Activities on Learning Estimates and Summative Assessment Scores

“This study was critical in helping to understand the efficacy of the adaptive activities in Acrobatiq’s courseware. The learning science and instructional design principles utilized to create the course content were intended to help students better learn the material and prepare them for high-stakes summative assessments. The findings, which show that not only do the adaptive activities help increase learning estimates for many students, but that learning estimates correlate to mean summative scores, validate the primary function of the adaptive activities.” [3]

AT THE INTERSECTION OF TECHNOLOGY AND TEACHING:

The Critical Role of Educators in Implementing Technology Solutions

“This data validates our belief that the instructor is critical to the success of technology in the classroom. While the courseware itself is proven to be effective in helping students learn, it can only do so if students engage with it. Instructors hold enormous sway over how students engage with the courseware and therefore benefit from the technology.” [4]

1. Van Campenhout, R. Johnson, B. G., & Olsen, J. A. (2021). The Doer Effect: Replicating Findings that Doing Causes Learning. Presented at eLmL 2021: The Thirteenth International Conference on Mobile, Hybrid, and On-line Learning. ISSN 2308-4367, pp. 1–6. Retrieved from: https://www.thinkmind.org/index.php?view=article&articleid=elmL2021_1_10_58001
2. 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: Sottolare 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
3. Van Campenhout, R. & Kimball, M. (2021). At the intersection of technology and teaching: The critical role of educators in implementing technology solutions. IICE 2021: The 6th IAFOR International Conference on Education. ISSN 2189-1036, pp. 151–161. Retrieved from: <https://papers.iafor.org/submission59028/>
4. Van Campenhout, R., Dittel, J. S., Jerome, B., & Johnson, B. G. (2021). Transforming textbooks into learning by doing environments: an evaluation of textbook-based automatic question generation. In: Third Workshop on Intelligent Textbooks at the 22nd International Conference on Artificial Intelligence in Education. CEUR Workshop Proceedings, ISSN 1613-0073, pp. 1–12. Retrieved from: <http://ceur-ws.org/Vol-2895/paper06.pdf>