The Doer Effect:
Replicating Findings that Doing Causes Learning

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About the Authors

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Rachel Van Campenhout, Learning Science Specialist, Research and Development at VitalSource combines a background in learning engineering with a goal to better student learning environments through a wide range of research-based methods.

Benny G. Johnson, Director, Research and Development at VitalSource has spent 15 years working in the field of artificial intelligence for education, including developing intelligent tutoring systems, and now works to scale effective learning science practices using artificial intelligence.

The Goal of this Study

This paper aims to replicate previous causal doer effect research to:
- Identify if a similar learning environment using the same learning by doing methods can produce similar results
- Extend the external validity of these learning methods
- Provide additional evidence that this learning science principle should be scaled

The Doer Effect

The doer effect is the learning science principle that the amount of interactive practice a student does (such as answering practice questions) is much more predictive of learning than the amount of passive reading or video watching the student does. [1]

Doing **practice** has **6x** the effect size than **reading** alone.

The Doer Effect

The doer effect was investigated at Carnegie Mellon University by Koedinger et al. and was shown to be causal. [2, 3]

Doing more practice caused better learning.

The regression model controls for the amount of reading, watching, and doing in outside units, to control for a third variable [2].

Within Reading	Outside Reading
Within Watching	Outside Watching
Within Doing	Outside Doing

Methods

- 3,120 students included from a Macroeconomics course from March 2017 to April 2019
- 6 course competencies are used as the unit, with 47 learning objectives mapped to the competencies
- Final exam questions were similarly mapped to the 6 competencies

Results

Mixed effects linear regression model

TABLE 1. DOER EFFECT REGRESSION ANALYSIS RESULTS.

Learning Method	Location	Normalized Estimate	Std. Error	t-Value	Pr(>|t|)
	(intercept)	0.0000	0.1256	0.000	1.0000
Doing	within-unit	0.1146	0.0099	11.613	< 2.2e-16 ***
	outside-unit	0.1556	0.0132	11.773	< 2.2e-16 ***
Reading	within-unit	-0.0125	0.0091	-1.367	0.1729
	outside-unit	-0.0604	0.0130	-4.645	3.432e-06 ***

- **Both within-unit doing and outside-unit doing were strongly, positively significant.**
- **We would likely expect outside-unit doing to almost always be significant (regardless of whether the doer effect is causal), as it is well known that students who do more practice tend to get better outcomes.**
- **What matters is that within-unit doing is additionally significant, which means the relationship of within-unit doing to its own unit's assessment score cannot be accounted for by the amount of outside-unit doing, indicating that relationship is causal in nature.**

Conclusion

- 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.

References

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2. K. Koedinger, E. McLaughlin, J. Jia, and N. Bier, "Is the doer effect a causal relationship? How can we tell and why it's important." Proceedings of the Sixth International Conference on Learning Analytics and Knowledge, LAK 2016, pp. 388-397. http://dx.doi.org/10.1145/2883851.2883957
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Thank You!