



WWC Single Study Review

A review of the design and summary of findings for an individual study



March 2016

WWC Review of the Report “The Open Learning Initiative: Measuring the Effectiveness of OLI Statistics Courses in Accelerating Student Learning”¹

The findings from this review do not reflect the full body of research evidence on the *Open Learning Initiative*.

What is this study about?²

The *Open Learning Initiative (OLI)* is a Carnegie Mellon University accelerated-learning program. The study authors assessed the program’s effectiveness in teaching an introductory statistics course. The intervention consisted of an online learning environment as the main instructional platform for the course, two weekly face-to-face meetings with an instructor to review more challenging material, and accelerated pacing to complete the course curriculum in 8 weeks instead of 15.

The authors invited all students enrolling in an introductory statistics course to participate in *OLI*. Of the 68 volunteer students, 22 were randomly selected to participate, with the 46 remaining students assigned to the comparison condition. The number of students for whom outcome data were collected was 21 intervention and 40 comparison students.

The intervention group received instruction through a comprehensive online learning platform, but were also given the opportunity to discuss the more challenging material with an instructor twice a week. The comparison group was enrolled in Carnegie Mellon’s regular Introductory Statistics course.

The study assessed students’ academic achievement by testing their statistical knowledge using the Comprehensive Assessment of Outcomes in a first Statistics course (CAOS).³

Features of the *Open Learning Initiative (OLI)*

In the *OLI-Statistics* course examined in this study, students received accelerated instruction through an online portal with fast and frequent feedback on their progress, and two weekly face-to-face sessions with an instructor to review the more challenging material. The course was designed so that students could complete the material for the entire semester in about half of the usual time (8 weeks vs 15).

WWC Rating

The research described in this report meets WWC group design standards without reservations

This study is a randomized controlled trial with low attrition.

What did the study find?

The study authors reported that the intervention group had an average of 73% correct answers on the CAOS test, compared to an average of 53% correct for the comparison group. The authors do not report statistical significance for this finding, but the WWC determined that the effect was positive and statistically significant.

Appendix A: Study details

Lovett, M., Meyer, O., & Thille, C. (2008). The Open Learning Initiative: Measuring the effectiveness of the OLI statistics course in accelerating student learning. *Journal of Interactive Media in Education*, 14, 1–16. doi:10.5334/2008-14

Setting	The study was conducted in 2007 at Carnegie Mellon University, Pittsburgh, PA.
Study sample	The researchers invited all 200 students enrolling in an introductory statistics course at Carnegie Mellon University to participate in an <i>Open Learning Initiative (OLI)</i> Statistics course. Of the 68 volunteer students, 22 were randomly selected to participate in the intervention, with the 46 remaining students assigned to the comparison condition. There were 21 intervention students and 40 comparison students for whom outcome data were collected. The students were undergraduates at Carnegie Mellon University; no other information about demographics or grade level was provided.
Intervention group	The intervention group was comprised of students who volunteered to participate in the <i>OLI</i> course and were randomly selected to receive the intervention. The <i>OLI</i> -Statistics course provided instruction through an online learning environment, two weekly group sessions with an instructor to address the most challenging material, and was paced to complete the introductory statistics curriculum in 8 weeks instead of 15. The group sessions were tailored by the instructor using reports of student performance generated by the online system.
Comparison group	The comparison group volunteered to participate in the intervention but were not selected. Instead, they received treatment as usual in the form of the regular instructor-led Introductory Statistics course at Carnegie Mellon. This course involved three 50-minute lectures per week plus one 50-minute lab session.
Outcomes and measurement	This study reported one eligible outcome—academic achievement, measured by performance on the Comprehensive Assessment of Outcomes in a first Statistics course (CAOS). For a more detailed description of this outcome measure, see Appendix B.
Support for implementation	No information was provided about training and support for implementation of the intervention, which is delivered primarily in an online format. The authors did not mention special training or support for the faculty who conducted the in-person meetings.
Reason for review	Several federal grant funding programs require that funding applications be supported by evidence of effectiveness based on WWC standards. This study was identified for review by the WWC because it was cited by a grant applicant.

Appendix B: Outcome measure for the academic achievement domain

Academic achievement

Percentage of correct answers on the Comprehensive Assessment of Outcomes in a first Statistics course (CAOS)

The CAOS is a standardized assessment of statistical knowledge.

Table Notes: There were two earlier quasi-experimental studies reported in the manuscript whose outcomes are not described in this WWC report. The two earlier pilot studies reported findings on mid-term exams and a final exam. These outcomes are not eligible for review because they do not meet the requirements for academic achievement outcomes specified in the Postsecondary Education review protocol. One of the earlier pilot studies also reported results on the CAOS for the intervention group compared to a national sample of students who took the CAOS. This comparison did not meet WWC group design standards.

Appendix C: Study findings for the academic achievement domain

Domain and outcome measure	Study sample	Sample size	Mean (standard deviation)		WWC calculations			p-value
			Intervention group	Comparison group	Mean difference	Effect size	Improvement index	
Academic achievement								
<i>Percentage of correct answers on the Comprehensive Assessment of Outcomes in a first Statistics course (CAOS)</i>	2007	61 students	68 (18.9)	53 (30)	15	0.55	+21	nr
Domain average for academic achievement						0.55	+21	Statistically significant

Table Notes: For mean difference, effect size, and improvement index values reported in the table, a positive number favors the intervention group and a negative number favors the comparison group. The effect size is a standardized measure of the effect of an intervention on individual outcomes, representing the average change expected for all individuals who are given the intervention (measured in standard deviations of the outcome measure). The improvement index is an alternate presentation of the effect size, reflecting the change in an average individual's percentile rank that can be expected if the individual is given the intervention. The statistical significance of the study's domain average was determined by the WWC. Some statistics may not sum as expected due to rounding. nr = not reported.

Study Notes: The WWC did not need to make corrections for clustering or multiple comparisons. The p-value was not reported in the original study. The WWC calculated the program group mean using a difference-in-differences approach by adding the impact of the program (i.e., difference in mean gains between the intervention and comparison groups) to the unadjusted comparison group posttest means. Please see the WWC Procedures and Standards Handbook (version 3.0) for more information. This study is characterized as having a statistically significant positive effect because the effect for at least one measure within the domain is positive and statistically significant, and no effects are negative and statistically significant, accounting for multiple comparisons. For more information, please refer to the WWC Standards and Procedures Handbook (version 3.0), p. 26.

Endnotes

¹ Single study reviews examine evidence published in a study (supplemented, if necessary, by information obtained directly from the authors) to assess whether the study design meets WWC group design standards. The review reports the WWC's assessment of whether the study meets WWC group design standards and summarizes the study findings following WWC conventions for reporting evidence on effectiveness. This study was reviewed using the Postsecondary Education review protocol (version 3.1). The WWC rating applies only to the study outcomes that were eligible for review under this topic area. The reported analyses in this SSR are only for those eligible outcomes that either met WWC group design standards without reservations or met WWC group design standards with reservations, and do not necessarily apply to all results presented in the study.

² This manuscript also reports on two earlier quasi-experimental studies. The first quasi-experimental study is not eligible for WWC review because it did not report on any eligible outcomes. The second quasi-experimental study included two different comparison groups: (1) a group of students taking the traditional lecture course and (2) a national sample. The comparison of the intervention group with the first comparison group was not eligible for review because it did not report on any eligible outcomes. The comparison of the intervention group to the national sample did not meet WWC group design standards because it did not demonstrate baseline equivalence on a pretest measure of the outcome. These studies are not described in this single study review.

³ There were two earlier quasi-experimental studies reported in the manuscript whose outcomes are not described in this WWC report. The two earlier pilot studies reported findings on mid-term exams and a final exam. These outcomes are not eligible for review because they do not meet the requirements for academic achievement outcomes specified in the protocol. One of the earlier pilot studies also reported results on the Comprehensive Assessment of Outcomes in a first Statistics course (CAOS) for the intervention group compared to a national sample of students who took the CAOS. This comparison did not meet WWC standards. See the table notes in Appendix B for more information.

Recommended Citation

U.S. Department of Education, Institute of Education Sciences, What Works Clearinghouse. (2016, March). *WWC review of the report: The Open Learning Initiative: Measuring the effectiveness of OLI statistics courses in accelerating student learning*. Retrieved from <http://whatworks.ed.gov>

Glossary of Terms

Attrition	Attrition occurs when an outcome variable is not available for all participants initially assigned to the intervention and comparison groups. The WWC considers the total attrition rate and the difference in attrition rates across groups within a study.
Clustering adjustment	If intervention assignment is made at a cluster level and the analysis is conducted at the student level, the WWC will adjust the statistical significance to account for this mismatch, if necessary.
Confounding factor	A confounding factor is a component of a study that is completely aligned with one of the study conditions, making it impossible to separate how much of the observed effect was due to the intervention and how much was due to the factor.
Design	The design of a study is the method by which intervention and comparison groups were assigned.
Domain	A domain is a group of closely related outcomes.
Effect size	The effect size is a measure of the magnitude of an effect. The WWC uses a standardized measure to facilitate comparisons across studies and outcomes.
Eligibility	A study is eligible for review if it falls within the scope of the review protocol and uses either an experimental or matched comparison group design.
Equivalence	A demonstration that the analytic sample groups are similar on observed characteristics defined in the review area protocol.
Improvement index	Along a percentile distribution of individuals, the improvement index represents the gain or loss of the average individual due to the intervention. As the average individual starts at the 50th percentile, the measure ranges from -50 to +50.
Multiple comparison adjustment	When a study includes multiple outcomes or comparison groups, the WWC will adjust the statistical significance to account for the multiple comparisons, if necessary.
Quasi-experimental design (QED)	A quasi-experimental design (QED) is a research design in which study participants are assigned to intervention and comparison groups through a process that is not random.
Randomized controlled trial (RCT)	A randomized controlled trial (RCT) is an experiment in which eligible study participants are randomly assigned to intervention and comparison groups.
Single-case design (SCD)	A research approach in which an outcome variable is measured repeatedly within and across different conditions that are defined by the presence or absence of an intervention.
Standard deviation	The standard deviation of a measure shows how much variation exists across observations in the sample. A low standard deviation indicates that the observations in the sample tend to be very close to the mean; a high standard deviation indicates that the observations in the sample are spread out over a large range of values.
Statistical significance	Statistical significance is the probability that the difference between groups is a result of chance rather than a real difference between the groups. The WWC labels a finding statistically significant if the likelihood that the difference is due to chance is less than 5% ($p < .05$).
Substantively important	A substantively important finding is one that has an effect size of 0.25 or greater, regardless of statistical significance.

Please see the [WWC Procedures and Standards Handbook \(version 3.0\)](#) for additional details.



Intervention
Report



Practice
Guide



Quick
Review



Single Study
Review

A **single study review** of an individual study includes the WWC's assessment of the quality of the research design and technical details about the study's design and findings.

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