



WWC Single Study Review

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



February 2017

WWC Review of the Report “The Impact of Computer Usage on Academic Performance: Evidence from a Randomized Trial at the United States Military Academy”¹

The findings from this review do not reflect the full body of research evidence on the impact of Internet-enabled devices in college classrooms.

What is this study about?

The study authors examined how technology access in the classroom impacts student achievement by comparing the performance of students in classes that allowed the use of Internet-enabled laptops or tablets in a college-level course to the performance of students in classes that prohibited Internet-enabled devices. In this study, Internet-enabled device use was either unrestricted, restricted, or not permitted.

The students in this study were sophomores attending the United States Military Academy (USMA) at West Point. The USMA is a 4-year undergraduate institution that enrolls approximately 4,400 students per year.

Sections of an introductory Economics course were randomly assigned to conditions, and students were randomly assigned to course sections. There were 726 students in the study: 248 were assigned to classrooms that permitted unrestricted device use in the classroom, 208 were assigned to the restricted-use group (only tablet devices were allowed), and 270 were in the “no technology in the classroom” group (no Internet-enabled devices were allowed at all).

The authors assessed student academic achievement in the Economics course by using scores on the department-wide final exam. The study reports on the impact of technology access on the combi-

nation of multiple choice and short answer questions from the final exam and, separately, on the essay questions from the same exam. Supplemental analyses examined the effect of the intervention on the multiple choice and short answer questions separately as well as for several subgroups. The supplemental findings do not factor into the intervention’s rating of effectiveness (see Appendix D).

WWC Rating

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

This study is a cluster randomized controlled trial with no attrition at the cluster level and low attrition at the student level. There were two primary outcome measures in the study.

The impact estimate for the combined multiple choice and short answer portion of the final exam meets WWC group design standards without reservations.

The impact estimate for the essay questions on the final exam do not meet WWC group design standards. Professors graded essay questions for students in sections that they taught; therefore, each essay question was only graded once. As a result, the authors were unable to report a measure of reliability for the essay question scores.

Research Conditions of West Point's Internet-enabled Devices Study

In most US college classrooms, students have access to the Internet using their personal devices (phones, tablets, laptops). The authors of this study were interested in examining whether having access to the Internet during class facilitated student learning. To investigate this, they created three groups of students. The “unrestricted use” group had full access to Internet-enabled devices in the classroom. In the “restricted use” group, students were permitted to use tablet computers; students in this group were required to keep the tablets placed flat on the surfaces of their desks at all times. In the comparison group, students were not permitted to use Internet-enabled devices in class.

What did the study find?

For the primary analyses, the study authors combined the two groups that were allowed to use Internet-enabled devices. The authors reported, and the WWC confirmed, that students who did not have access to Internet-enabled devices scored statistically significantly better than the comparison group students ($g = 0.18$) on the combined multiple choice and short answer portions of the department-wide final exam (see Appendix C). Students who were not allowed Internet access earned about 73% of the possible points on the multiple choice and short answer portion of the final exam, whereas students who had access to Internet-enabled devices earned about 71%.

The outcome based on the essay questions does not meet WWC standards; therefore, the findings on this outcome are not presented in this report.

Appendix A: Study details

Carter, S. P., Greenberg, K., & Walker, M. (2016). *The impact of computer usage on academic performance: Evidence from a randomized trial at the United States Military Academy (SEII Discussion Paper #2016.02)*. Cambridge, MA: School Effectiveness and Inequality Initiative.

Setting	The study took place at the United States Military Academy (USMA) at West Point in New York. The USMA is a 4-year undergraduate university with an approximate enrollment of 4,400 students. The USMA provides students with a full scholarship with students' commitment to serve as an officer in the military for 8 years post-graduation.
Study sample	Students enrolled in sections of an introductory Economics course participated in the study. The sections dictated when a student participated in the course. The exact number of sections assigned to each condition was not reported, but a total of 50 sections were enrolled in the study. From the 50 sections, the study authors included 726 students in the sample. Of these, 270 were assigned to the group that did not allow Internet-enabled devices, 248 were assigned to the group that permitted full access to the use of computers or tablets (unrestricted use), and 208 were assigned to the group that permitted access to tablet use only.
Intervention group	Students in the intervention classrooms were not allowed to use their Internet-enabled laptops or tablets during the course for the entire semester.
Comparison group	Students in the first comparison group (unrestricted use) were allowed to use Internet-enabled laptops or tablets throughout the class without restrictions. Students in the second comparison condition were allowed to use Internet-enabled tablets, but the tablets had to remain face-up on their desks. In both conditions, professors were allowed to restrict or remove the use if it was obvious a student was distracted from the class discussion.
Outcomes and measurement	The study included two outcomes, both of which were components of a department-wide final exam: students' scores on the multiple choice and short answer portion of the final exam, and students' scores on the essay portion of the final exam. These outcomes fall within the academic achievement domain. Students had 210 minutes to complete the exam, which was delivered via an online testing platform. The testing software automatically scored the multiple choice and short answer questions, and professors graded the essay questions for students in their section of the course.
Support for implementation	Information on support for implementation was not reported.
Reason for review	This study was identified for review because it received significant media attention.

Appendix B: Outcome measures for the academic achievement domain

Academic achievement	
<i>Final exam: Multiple choice and short answer questions</i>	This outcome is a combination of multiple choice and short answer items from the department-wide final exam, and accounted for about 85% of the total final exam grade. The exam was delivered via an online testing platform, and the testing software graded all multiple choice and short answer responses.
<i>Final exam: Essay questions</i>	The essay portion of the department-wide final exam accounted for about 15% of the total final exam grade. The exam was delivered via an online testing platform. Professors graded the essay responses for students in their sections.

Table Notes: The multiple choice and short answer questions were also reported separately. These supplemental findings are reported in Appendix D.

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>Final exam: Multiple choice and short answer questions</i>	Combined	711 students	nr (1.00)	nr (1.00)	0.18	0.18	7	.01
Domain average for academic achievement						0.18	7	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. nr = not reported.

Study Notes: The WWC did not need to make corrections for clustering or multiple comparisons. The p-value was reported in the original study. The WWC calculated the intervention effect by dividing the reported regression coefficient by the pooled sample standard deviation. The authors did not report the sample standard deviations separately by group, but reported that the outcomes were standardized within each condition for analysis. Please see the WWC Procedures and Standards Handbook (version 3.0) for more information. This study is characterized as having a statistically significant negative effect because the effect for at least one measure within the domain is negative and statistically significant, and no effects are positive and statistically significant, accounting for multiple comparisons. For more information, please refer to the WWC Standards and Procedures Handbook (version 3.0), p. 26.

Appendix D: Supplemental 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>Final exam test score</i>	Unrestricted use	507	nr (1.00)	nr (1.00)	0.18	0.18	7	.01
<i>Final exam test score</i>	Tablet only	466	nr (1.00)	nr (1.00)	0.17	0.17	7	.05
<i>Final exam test score: Short answer only</i>	Combined	711	nr (1.00)	nr (1.00)	0.21	0.21	8	.01
<i>Final exam test score: Short answer only</i>	Unrestricted use	507	nr (1.00)	nr (1.00)	0.18	0.18	7	.01
<i>Final exam test score: Short answer only</i>	Tablet only	466	nr (1.00)	nr (1.00)	0.23	0.23	9	.01
<i>Final exam test score: Multiple choice only</i>	Combined	711	nr (1.00)	nr (1.00)	0.14	0.14	6	.05
<i>Final exam test score: Multiple choice only</i>	Unrestricted use	507	nr (1.00)	nr (1.00)	0.15	0.15	6	.05
<i>Final exam test score: Multiple choice only</i>	Tablet only	466	nr (1.00)	nr (1.00)	0.13	0.13	5	.10
<i>Final exam test score</i>	Male	580	nr (1.00)	nr (1.00)	0.21	0.21	8	.01
<i>Final exam test score</i>	Female	131	nr (1.00)	nr (1.00)	-.02	-.02	-1	ns
<i>Final exam test score</i>	White	467	nr (1.00)	nr (1.00)	0.18	0.18	7	.05
<i>Final exam test score</i>	Non-White	244	nr (1.00)	nr (1.00)	0.22	0.22	9	.05

Table Notes: The supplemental findings presented in this table are additional findings that do not factor into the determination of the evidence rating. 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. Some statistics may not sum as expected due to rounding. nr = not reported. ns = not significant.

Study Notes: No corrections for clustering or multiple comparisons and no difference-in-differences adjustments were needed. The p-values presented here were reported in the original study. The full sample represents the analysis of both intervention groups versus the comparison group; the Unrestricted use represents the intervention group that was allowed access to computer or tablet computers; the Tablet only intervention group had access to tablet computers only. The WWC calculated the intervention effect by dividing the reported regression coefficient by the pooled sample standard deviation. The authors did not report the sample standard deviations separately by group, but did report that the outcomes were standardized within each condition for analysis. The WWC determined that the effects for men were not statistically significantly different from the effects for women ($p = .07$) and that the effects for White students did not differ from the effects for non-White students ($p = .34$) (see Altman & Bland, 2003). Please see the WWC Procedures and Standards Handbook (version 3.0) for more information.

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 Supporting Postsecondary Success review protocol, version 3.0. The WWC rating applies only to the study outcomes that were eligible for review under this topic area. The reported analyses in this single study review 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. A quick review of this study was released on July 7, 2016, and this report is the follow-up review that replaces that initial assessment.

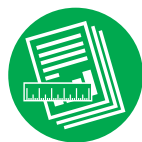
Recommended Citation

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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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