WWC Single Study Review

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

ies INSTITUTE OF EDUCATION SCIENCES

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WWC Review of the Report "The Struggle to Pass Algebra: Online vs. Face-to-Face Credit Recovery for At-Risk Urban Students"[1]

The findings from this review do not reflect the full body of research evidence on online credit recovery programs.

What is this study about?

The study authors used a randomized controlled trial to investigate the impact of online Algebra I credit recovery courses on student performance and subsequent coursetaking. Online credit recovery courses are used when students who fail required courses in high school need to "recover" those failed credits in order to graduate. The authors compared online credit recovery courses to traditional face-to-face credit recovery courses in Algebra I in 17 Chicago public high schools during the summers of 2011 and 2012.

Students in the participating high schools who had failed Algebra I in the second semester of their freshman year were encouraged to enroll in summer school. Students who enrolled and attended the first or second day of summer school were randomly assigned to either an online credit recovery course (n=613) or a face-to-face credit recovery course.

The study authors reported impacts of the intervention on recovering Algebra I credit and on an algebra assessment at the end of the course. In addition, the authors also reported math scores on the ACT's PLAN assessment, a standardized test taken by students in the tenth grade. The school district also provided information on math credits earned in high school and whether students were on-track to graduate.

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.

Features of Online Algebra I Credit Recovery

The online version of Algebra I credit recovery courses in this study was developed by Aventa Learning (now called Fuel Education), an online learning provider. The course focused on typical second-semester Algebra I topics: systems of equations, polynomials, quadratics and radicals, rational expressions, and exponents. The course took place over one or both of two 3- to 4-week summer sessions. Two adult instructors taught the online course: one certified math teacher and one "in-class mentor." The online course structure offered students the flexibility to pace themselves through content and provided standardized content, organized sequentially with five units. In the version of the courses delivered in this study, schools provided a site-based mentor to support and monitor students who were taking the courses.

What did the study find?

The study authors reported that students who took the online course were significantly less likely to recover Algebra I credit, compared to students in face-to-face courses (66% in the online condition vs. 78% in the face-to-face condition). There were no statistically significant differences between the online and face-to-face groups on PLAN math scores or math credit accumulation. Finally, the results indicated that about one-fourth of the students in both groups were on-track for high school graduation by the end of their second year. This difference was not statistically significant. All findings were confirmed by the WWC. More detail about these findings is presented in Appendix C. Supplementary findings not reported here are shown in Appendix D.

Appendix A: Study details

Heppen, J. B., Sorensen, N., Allensworth, E., Walters, K., Rickles, J., Taylor, S. S., & Michelman, V. (2016). The struggle to pass algebra: Online vs. face-to-face credit recovery for at-risk urban students. *Journal of Research on Educational Effectiveness.* http://dx.doi.org/10.1080/19345747.2016.1168500

Additional sources:

Heppen, J., Allensworth, E., Sorensen, N., Rickles, J., Walters, K., Taylor, S., ... Clements, P. (2016). *Getting back on track: Comparing the effects of online and face-to-face credit recovery in Algebra I (Research Brief 1)*. Retrieved from http://www.air.org/

Rickles, J., Heppen, H., Taylor, S., Allensworth, E., Michelman, V., Sorensen, N., ... Clements, P. (2016). *Getting back on track: Who needs to recover algebra credit after ninth grade? (Research Brief 3)*. Retrieved from http://www.air.org/

Taylor, S., Clements, P., Heppen, J., Rickles, J., Sorensen, N., Walters, K., ... Michelman, V. (2016). *Getting back on track: The role of in-person instructional support for students taking online credit recovery (Research Brief 2)*. Retrieved from http://www.air.org/

Setting

The study took place in 17 Chicago Public Schools that participated in the study during the summers of 2011 and 2012. Schools were recruited to participate in the research because they had summer school programs and large numbers of students who failed Algebra I in the second semester of their freshman year.

Study sample

Over the two summers, 1,224 students participated. There were 613 students assigned to the intervention (online) condition, while 611 students were assigned to the comparison (face-to-face) condition. Eleven schools participated in both 2011 and 2012, four participated in 2011 only, and two schools participated in 2012 only. Each school had at least two credit recovery courses: one online, and the other face-to-face.

There were 63 school staff who participated as either teachers and/or mentors. Over the two cohorts, there were 34 face-to-face algebra teachers and 30 in-class mentors. Aventa Learning, the online course provider, selected six online teachers for the study, all of whom were certified to teach mathematics.

Students in the intervention condition were 38% female and 56% Latino, while the comparison condition was 37% female and 58% Latino. The full sample (i.e., not disaggregated by condition) was 38% female, 57% Hispanic, 33% African American, 8% White, and 2% other races/ethnicities. In the full sample, 86% of the students were eligible for free or reduced-price lunch, 12% were eligible for special education services, and 47% were native Spanish speakers. The proportion of students who passed Algebra IA (first semester of Algebra) was similar across groups (40% in the intervention group and 41% in the comparison group). Only 5% of students in each condition came from census blocks with concentrated poverty.

Intervention group

Summer Algebra credit recovery courses designed by Aventa Learning were offered to high school students who had failed Algebra I in the second semester of their freshman year. The intervention condition was an online course that focused on typical second-semester Algebra I (designed as a 60-hour course). This included systems of equations, polynomials, quadratics and radicals, rational expressions, and exponentials. The instructional content of the online version was standardized with clear ordering of topics, but flexible in terms of student pacing (in face-to-face classes, teachers have flexibility of content and sequencing, but pacing is generally uniform for the whole class). The online courses were delivered via computer in computer labs at the high schools. Each course was taught by two instructors: one online teacher and one in-class mentor. The course took place over one or both of two 3- to 4-week summer sessions at each participating school.

Comparison group

The comparison condition received traditional, face-to-face Algebra I instruction by a certified mathematics instructor. The content tended to include both second semester Algebra I topics, as well as pre-Algebra and first semester Algebra I topics; about 50% of the content was from the second semester Algebra I course, while the remaining 50% was derived from first semester Algebra and pre-Algebra courses. The course took place over one or both of two 3- to 4-week summer sessions at each participating school. Face-to-face courses had one instructor and were delivered in traditional classrooms. The face-to-face courses used teacher-created and published materials, including textbooks. Teachers had flexibility of content and sequencing, but pacing was generally uniform for the whole class. In-class mentors provided feedback and communication on students' progress.

Outcomes and measurement

The outcome data were obtained from district administrative records and were collected in the same timeframe and manner across groups, except for the end-of-course algebra assessment, which was administered by the study team. The study reported impacts on four primary outcomes and four supplementary outcomes:

Primary outcomes:

1. Recovered Algebra I by passing the Algebra Credit Recovery course with a D or higher;
2. PLAN mathematics assessment score, a standardized ACT test, administered in fall of Grade 10;
3. Cumulative math credits earned by the end of the students' second year of high school; and
4. On-track for high school graduation based on earning at least 11 full-year course credits (or 22 semester credits) by the end of the students' second year of high school.

Supplemental outcomes:

1. End-of-course posttest score, a 28-item test from the National Assessment of Educational Progress (NAEP) covering pre-Algebra and first and second semester Algebra topics, which did not count toward the students' course grade;
2. PLAN algebra subtest score, a standardized ACT test administered in the fall of Grade 10;
3. Earned course credit in Geometry or higher as of the end of Semester 1 of the second year of high school; and
4. Earned course credit in Geometry or higher as of the end of Semester 2 of the second year of high school.

Support for implementation

The in-class mentors and the face-to-face teachers were paid their regular teaching rates, and the online teachers were paid by the number of students enrolled in the course, which ended up being slightly higher than face-to-face teachers. In-class mentors received training on how to use the online course system, how to monitor student progress, and how to communicate with online teachers. The online teachers received ongoing professional development and support from Aventa. The face-to-face teachers received traditional supports from their schools and district for teaching summer Algebra classes.

Reason for review

This study was identified for review because it received significant media attention.

Appendix B: Outcome measures for each domain

College readiness	
Recovered Algebra I credit	Students recovered Algebra I credit if they passed the assigned summer Algebra I course with a grade of D or higher. Students did not recover Algebra I credit if they dropped the course or received an F.
On track for high school graduation by the end of the following year	Students were on-track for high school graduation if they earned at least 11 full-year course credits (or 22 semester credits), by the end of students' second year of high school.
General academic achievement	
Score on the PLAN math test	The PLAN tests from ACT are administered in the fall of tenth grade in the Chicago Public Schools. The composite math test scaled scores range from 1–32. The estimated reliability is .80.
Score on the PLAN Algebra subtest	The PLAN tests from ACT are administered in the fall of tenth grade in the Chicago Public Schools. The Algebra subtest scaled scores range from 1–16. The estimated reliability is .80.
Score on the end-of-course posttest	The end-of-course posttest had 28 Algebra items from the National Assessment of Educational Progress (NAEP). The scaled scores were standardized for the Algebra NAEP items in the Chicago Public Schools. The overall reliability was .70, and students' item-level accuracy was Rasch-scaled separately by cohort, in order to produce an overall scale score.
Progressing in school	
Cumulative math credits earned by the end of following school year	Cumulative math credits were calculated as the total number of semester credits earned in mathematics courses (0 to 4 semester credits) by the end of the second year of high school.
Earned course credit in Geometry or higher in Semester 1 of second year of high school	For Semester 1 of the second year of high school, students earned course credit in Geometry or higher if they received a grade of D or higher. Student who did not take Geometry or higher in Semester 1 or received an F were coded as not earning credit. Students who transferred were treated as missing.
Earned course credit in Geometry or higher in Semester 2 of second year of high school	For Semester 2 of the second year of high school, students earned course credit in Geometry or higher if they received a grade of D or higher. Students who did not take Geometry or higher in Semester 2 or received an F were coded as not earning credit. Students who transferred were treated as missing. If a student retook his or her first-semester math course alongside their second-semester math course in Semester 2, the highest math grade between the two courses was used.

Table Notes: There are several ineligible outcomes that do not relate to any WWC outcome domain. These measures include survey constructs regarding student engagement, class difficulty, teacher expectations, classroom personalism, class clarity, and comfort with computers (p. 21). Another set of survey constructs measured students' mindsets about math: usefulness of mathematics and liking/confidence in mathematics, which are also not eligible under any WWC outcome domain.

Appendix C: Study findings for each domain

Domain and outcome measure	Study sample	Sample size	Mean (standard deviation) Intervention group	Mean (standard deviation) Comparison group	WWC calculations Mean difference	WWC calculations Effect size	WWC calculations Improvement index	*p*-value
College readiness								
Recovered Algebra I credit (%)	Full sample, end of summer school	1,224 students	66 (na)	78 (na)	–0.12	–0.36	–14	.000
On track for high school graduation (%)	Full sample, end of second year of high school	1,015 students	28 (na)	25 (na)	0.03	0.09	4	.403
Domain average for college readiness						**–0.14**	**–5**	**Statistically significant**
General academic achievement								
Score on the PLAN math test	Full sample, fall of second year of high school	878 students	14.16 (2.83)	13.94 (3.07)	0.23	0.08	3	.213
Domain average for general academic achievement						**0.08**	**+3**	**Not statistically significant**
Progressing in school								
Cumulative math credits earned	Full sample, end of second year of high school	1,015 students	2.39 (1.29)	2.51 (1.25)	–0.12	–0.09	–4	.089
Domain average for progressing in school						**–0.09**	**–4**	**Not 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 WWC-computed average effect size is a simple average rounded to two decimal places; the average improvement index is calculated from the average effect size. The statistical significance of the study's domain average was determined by the WWC. Some statistics may not sum as expected due to rounding. na = not applicable.

Study Notes: A correction for multiple comparisons was needed for the outcomes in the College readiness domain but did not affect whether any of the contrasts were found to be statistically significant. The *p*-values presented here were reported in the original study. The WWC did not need to make corrections for clustering, multiple comparisons, or to adjust for baseline differences for the General academic achievement and Progressing in school outcomes. This study is characterized as having a statistically significant negative effect on College readiness 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. The study is characterized as having an indeterminate effect on General academic achievement and Progressing in school because the estimated effect for each outcome is neither statistically significant nor substantively important. For more information, please refer to the WWC Standards and Procedures Handbook (version 3.0), p. 26.

Appendix D: Supplemental findings for each 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	
General academic achievement								
Score on the PLAN Algebra subtest	Full sample, end of second year of high school	878 students	5.42 (2.13)	5.27 (2.23)	0.15	0.07	3	.24
Score on the end-of-course posttest	Full sample, end of summer school	1,224 students	272.97 (34.75)	279.62 (33.62)	–6.64	–0.19	–8	.002
Progressing in school								
Earned course credit in Geometry or higher (%)	Full sample, first semester, second year of high school	1,120 students	53 (na)	54 (na)	–1%	–0.02	–1	.772
Earned course credit in Geometry or higher (%)	Full sample, end of second year of high school	1,056 students	47 (na)	48 (na)	–1%	–0.02	–1	.783

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. na = not applicable

Study Notes: A correction for multiple comparisons was needed for the two measures of General academic achievement and for the two measures of Progressing in school but did not affect whether any of the contrasts were found to be statistically significant. The *p*-values presented here were reported in the original study.

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 Transition to College review protocol, version 3.2. 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.

Recommended Citation

U.S. Department of Education, Institute of Education Sciences, What Works Clearinghouse. (2017, February). *WWC review of the report: The struggle to pass Algebra: Online vs. face-to-face credit recovery for at-risk urban students*. Retrieved from https://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.

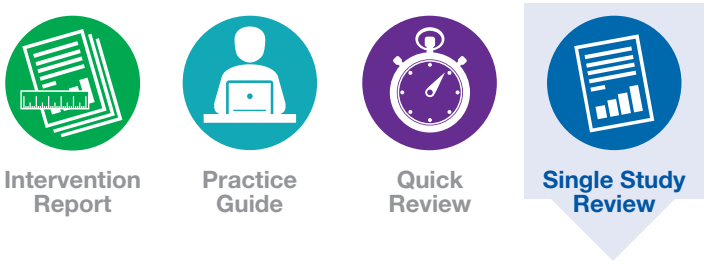
Single-case design (SCD) A research approach in which an outcome variable is measured repeatedly within and across different conditions that are defined by the presence or absence of an intervention.

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.



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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