



Review of:

**Computer-Assisted Middle
School Mathematics
Remediation Intervention: An
Outcome Study**

James Craig

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**Computer-Assisted Middle School Mathematics Remediation
Intervention: An Outcome Study**

By

**Nicholas McDonald Ph.D.
Thomas Trautman Ed.D.
The American Education Corporation**

**Letha Blick, M.A.
Buhl Middle School
Buhl, Idaho**

Abstract

The study reported presents the results of a 3 X 2 between/within design with non-random assignment of participants to experimental and control conditions. The intent of the investigators was to study the efficacy of a Title I math and after-school program that made extensive use of commercially available mathematical educational computer programs. A convenience sample of 86 fifth (n=34), sixth (n=19), and seventh (n=33) grade students who scored below proficiency on the math portion of the Idaho Standards Achievements Test (ISAT) between spring 2003 to spring 2004 was employed. Based on scheduling requirements and limited space in the program, students were non-randomly assigned to one of two groups: a Treatment group that received the Title I math and after-school program (n=51) or to a no-treatment Comparison group that did not receive that program (n=35). Students were assessed utilizing the ISAT at four points during the year: spring 2003, fall 2003, winter 2004, and spring 2004. Since the differences in gender, racial background, and grade level were non-significant, all inferential analyses conducted were collapsed over those variables. A significant starting difference between the groups on the ISAT spring 2003 scores was found. Therefore, those scores were used as a covariant in the 3 (three ISAT testing times) by 2 (Treatment or no-treatment Comparison groups) between/within analysis of covariance. The main effect of groups was found to be significant ($p = .023$) with the Treatment group performing significantly better on the ISAT exams than the no-treatment comparison group. To further investigate the efficacy of the treatment, a Chi-square test was calculated one year after treatment (spring 2004). This analysis revealed that significantly more Treatment students exceeded or matched their ISAT cutoff scores than did students in the no-treatment Comparison condition ($p = .016$).

Reviewer Comments

RELEVANCE

Does the evidence provided by the researchers or the developers address a question that is important to your needs?

The intent of the study was to examine the efficacy of a Title I math and after-school program for low achieving students that made extensive use of commercially available mathematical educational computer programs. Therefore, the study addresses a relevant instructional technology application question regarding whether the use of computer software in a school setting to assist student learning has a positive effect on student achievement.

Do the developers provide evidence that the research they claim supports their product or program links to and flows from relevant theory and theory-based research?

A specific theoretical base is not referenced or established in the research report. The authors do point out that the use of computers in everyday instruction is becoming more common and that other researchers (e.g., Valdez, 2000) offer specific recommendations to increase the effectiveness of the technology in producing positive outcomes. They also note that there are few published scientific studies that investigate specific technologies and software programs relative to producing increases in student achievement.

Do the research procedures, analysis, and findings support the researcher'/developers' claims?

Given the limitations of the research design dictated by the circumstances in which the study was conducted, the research procedures, analyses, and findings generally indicate the extensive use of commercially available mathematical educational computer programs (e.g., *A+nyWhere Learning System™*, *Accelerated Math™*, and *Math Facts in a Flash™*) leads to larger learning gains on a standardized assessment of mathematics that in a control condition where the educational computer programs were not used.

Rigor

If the researchers or developers claim a causal relationship between the intervention (product, service, program) and an outcome measure such as student achievement, did they include a control or comparison group in the study, in addition to the experimental group?

A comparison group was available for inclusion in the study. The design can be characterized as a between/within design with non-random assignment of participants to the experimental and control conditions (i.e., the between factor).

Were the study participants (usually students or teachers or schools) randomly selected and/or randomly assigned to experimental versus control/comparison groups?

The students were not randomly selected and/or assigned to the experimental conditions. Rather, a non-random procedure was used by school administration based on student scheduling conflicts and limited space in the program. The nature of conflicts or whether those conflicts systematically prevented certain students from participating in the program was not mentioned.

Is sufficient information provided to determine whether the research design, instruments, and procedures are appropriate for answering the research questions posed by the researchers/developers?

The procedures by which students were assigned to the conditions of the study dictated the statistical analyses employed to analyze the data. Given the study circumstances, the analysis procedures seem to have been applied appropriately to the mathematics achievement scores derived from the *Idaho Standards Achievements Test (ISAT)*, a standardized of language usage, mathematics, and reading .

Were the research instruments and procedures applied with consistency, accuracy, and for the purpose intended by the developers of the instruments and procedures?

The *ISAT* appears to have been applied appropriately and for the purpose intended by the instrument's developers.

Systematic Approach

Was the research conducted using carefully planned, logical steps?

Other than the non-random assignment of students to the experimental and control groups, the research seems to have been carefully planned and conducted to address two questions:

Question 1: Do students who were not proficient in mathematics as measured by the Idaho State Achievement Test in the spring of 2003, and participated in the Title I Remedial Mathematics and after-school program for the 2003/2004 school year make greater gains on the ISAT than non-mathematically proficient students who did not participate in the program?

Question 2: Do students who were not proficient in mathematics as measured by the Idaho State Achievement Test in the spring of 2003, and participated in the Title I Remedial Mathematics and after-school program for the 2003/2004 school year meet proficiency at a rate greater than non-mathematically proficient students who did not participate in the program?

Objectivity

Did someone other than the publisher or developer conduct the research attesting to the products or programs effectiveness?

Two of the researchers are associated with the publisher and one is associated with the participating school district. Under such circumstance, others might question the objectivity of the researchers. Therefore, an independent, third-party review of the research report was requested by the researchers.

Replicability

With the information provided, could the same researchers likely repeat the study and obtain the same or highly similar results?

There is sufficient information provided that the researchers could conduct a replication of the study again. However, the exact knowledge of how administrators assigned students to the experimental and comparison conditions is not known and would be a stumbling block to an effort to replicate the study. If a replication were to be undertaken, this problem would be best alleviated if the researchers incorporated random assignment of students to the experimental and conditions into the design.

With the information provided, could other researchers likely replicate the study's methodology and obtain the same or highly similar results?

There is sufficient information provided that other researchers could complete a replication of the study. However, in replicating the conditions of the study, it would be important for other researchers to improve the research methodology by using a true experimental methodology with random selection and assignment rather than to simply attempt to implement a straightforward replication of the design. If an exact replication was attempted, the assignment of students to the experimental and comparison conditions were be problematic since the exact procedures used for assignment are not known.

Data Analyses and Interpretation

Does the research evidence provided include data or data summaries?

The researchers provide summaries of various data of interest including a table and a graph presenting the mean *ISAT* values representing the interaction of the experimental and control conditions across the three testing dates. In addition, the number of students in the experimental group meeting or exceeding *ISAT* cutoff scores one year after being provided the

treatment is provided.

Are significance levels and effect sizes reported?

The analysis of co-variance was conducted on the *ISAT* mathematics achievement scores to address the first research question. Both the level of significance and the effect size estimation were reported. The effect size for the statistically significant difference revealed by the analysis was small (i.e., .06). The researchers acknowledge that the effect size was small. They go on to point out that school administrators are concerned with raising the students' proficiency to meet state-mandated requirements and, therefore, an additional analysis conducted found that significantly more students enrolled in the program met the state requirements than non-program students.

Are the conclusions drawn by the researchers/developers clearly supported by the data?

The conclusions offered by the researchers are appropriate within the limitations of the study. The researchers note that additional research is needed to replicate and extend the findings reported. Appropriate use of experimental methodology that employs randomization is also recommended to further examine the relationship between the systematic use of computer software in a school setting to assist student learning and to determine if such use has a positive effect on student achievement.

James R. Craig, Ph.D.
Director of Research
Regional Educational Laboratory
AEL
P.O. Box 1348
Charleston, WV 25325