Improving Student Math Skills

A RESEARCH-BASED STUDY OF THE EFFECTIVENESS OF TENMARKS MATH

2011

Study sanctioned by
University of San Francisco
EXECUTIVE SUMMARY

Background and Purpose
During the 2010-2011 school year, the University of San Francisco’s School of Education sanctioned a study at Everest High School, a suburban charter school in Redwood City, CA, to evaluate the effectiveness of TenMarks Math, a web-based instructional program designed to support educators and engage students. TenMarks Math is intended for use in both classrooms and at home and can be used in numerous ways, from introducing a new lesson or topic to refresh knowledge on a topic learned in an earlier grade to reviewing concepts before a test.

The TenMarks Math program is individualized for each student, and assigns an individualized “playlist” (curriculum) for each student, mapped to his or her specific needs. The playlist consists of albums (concepts), which in turn contains several tracks (topics). All content is aligned to state standards, and each track is assigned as an interactive worksheet of practice problems with video explanations and hints for students who need them.

The goal of the study was to evaluate the effectiveness of TenMarks Math and to understand whether a technology-based solution can compliment differentiated instruction in the classroom to increase positive student outcomes.

The findings indicate that students using TenMarks Math made significant improvement in their math skills over a 6-week period as compared to students who did not use TenMarks Math.

Study Design
Approximately 150 students in 9th and 10th grades at Everest High School participated in a controlled study of TenMarks Math effectiveness. Using a quantitative quasi-experimental methodology, this study compared the growth in math scores between students using TenMarks Math (Experimental) and students who did not use the program (Control). Students in the experimental and control groups were well matched in ability and demographically (48% Hispanic, 46% Caucasian, 6% other minorities; 38% on lunch assistance).

Students in both groups took a 50-question pre-test at the beginning of the study period to obtain a baseline measure of math skills. Based on their scores in the pre-test, students in the experimental group were assigned individualized curriculums in the TenMarks Math program. Teachers encouraged students in this group to complete the assigned interactive worksheets and related instruction on TenMarks and continued their usual classroom instruction. Students in the control group only received classroom instruction without the benefit of the TenMarks Math program.

At the end of the study period, students in both the experimental and control groups took a post-test. The results from the pre-test and post-test were compared statistically to determine the level of growth in math skills.
Pre and Post Results for TenMarks Math Users

Students who used TenMarks Math showed substantial improvement in math skills during the course of the study—an average increase of 10% in their scores (see Figure 1). Although students only received six weeks of differentiated instruction using TenMarks, the amount of growth achieved during that period is equivalent to between one and two grade levels of growth when compared to the national sample of students included in the Stanford 10 norm group (Harcourt Assessment, 2002).

While analyzing the pre- and post-test results, another pattern emerged. Students who completed more of their playlist in the TenMarks Math program showed a greater increase in their post-test scores when compared with their pre-test scores.

While the growth achieved by students using TenMarks Math is an important indicator of its effectiveness, a more complete way to assess growth is to compare the growth achieved by students in each of the two groups.

Comparison of TenMarks Users to the Control Group

The study compared the gains made by students using TenMarks Math to the control group using a statistical procedure known as one-way analysis of variance (ANOVA). This analysis compares differences as if the two groups were identically matched in initial math skills. Students using TenMarks Math showed statistically greater gains (significance at \( p = .077 \)) in math skills than those who were not using TenMarks Math.

The study also compared the number of tracks completed and the pre- to post-test difference in scores and found a significant difference. A linear regression analysis showed an R Square correlation of .66 between the number of tracks completed and average increase in scores within the experimental group (Figure 2).

TenMarks Math was found to be equally effective for boys and girls; for students of different ethnicities; and for students receiving special education services through IEP and 504 plans. The interaction between TenMarks Math use and gender, ethnicity and special education status was not statistically significant.
Teacher Perceptions of Effectiveness

At the conclusion of the study, participating teachers were interviewed regarding their perceptions of TenMarks Math. More than 90% of teachers believed that TenMarks Math was good or excellent at increasing students’ cognitive and intellectual growth. All teachers felt that TenMarks Math was good or excellent at improving students’ attitudes toward school and learning. All (100%) of the teachers indicated that they would definitely recommend TenMarks Math to others.

Teachers are generally in agreement that that differentiated instruction individualized to each student will have the greatest effect on that student’s outcomes, and generating that teacher-led differentiation has been a focus of many teacher education programs. That differentiation, though, is also a source of stress for teachers, as it can be nearly impossible to address the individual learning needs of 25 students simultaneously when every student is at a different place.

In math instruction, this becomes apparent quickly because math is a very linear subject. It has a base of skills that are required to move on in grade level content and in subject matter. In a differentiated math program, it is common practice to slow the students down in order to ensure that they are gathering the content that they need to gather, but that is often to that student’s detriment. A student struggling in Algebra may be struggling due to basic misunderstandings of fractions, and that fundamental skill gap is not addressed through slowing Algebra instruction but through adding basic arithmetic instruction, and therefore is never closed.

Impact of Differentiated Learning

The TenMarks intervention at Everest Public High School targeted those most basic skills, and did so in an independent environment where no one would necessarily see a student struggling in fractions or decimals or arithmetic. Students, therefore, could focus on those basic skills outside of the curricular content areas, and use that time to build skills that would not have otherwise been addressed. That practice allowed them to increase their broad mathematical knowledge, and, subsequently, their performance on skills assessments was much improved over the intervention period. The effect of that skill growth in the math curriculum is yet to be determined.

Students using the program increased their math scores between 3% and 36%, or by an average of 10% for the whole experimental group.
The control group received the same curricular mathematical instruction from the same teachers at the same school as those who were in the experimental group, but they improved in basic skills at a markedly lower rate. That does not mean they did not learn anything. The skills assessment focused on basic math skills, and a student in Algebra I and Geometry would not, over a six week period, learn more than one or two new concepts in math that would be pertinent to that skills assessment. They did not grow in basic skills because the questions they did not know the answer to were not taught in their curriculum and they simply did not learn how to solve those problems.

If, in the course of their regular classes, the students in the control group had been exposed to direct instruction in fractions, for instance, they very likely would have increased their ability to do basic fractions. Because they were only exposed to fractions as a portion of an algebraic or geometric problem set, they did not encounter any direct instruction in fractions concepts, and therefore did not gain any basic skills in using fractions.

**SUMMARY**

Students who used TenMarks Math showed substantial growth in math skills during the course of the study, increasing their math scores between 3% and 36%, or by an average of 10% for the whole group. When controlling for students’ initial ability using analysis of variance, students using TenMarks Math achieved substantially greater gains in math skills than students who did not use TenMarks Math. TenMarks Math users finished the study period with scores that were on average 10% higher than the Control group.

TenMarks Math was found to be effective at both grade levels included in the study (grades 9 & 10) and was equally effective for boys and girls; students of different ethnicities; and both students receiving special education services and those not receiving this service.

Students received approximately 6 weeks of instruction using TenMarks Math, yet the amount of growth achieved is equivalent to between one and two grade levels of growth when compared to the national norm group.