



Scientifically-Based Research Snapshot: **Math Skills**

Overview:

The University of Michigan conducted a scientifically-based research study during the 2004-2005 school year in two third grade classrooms at Bach Elementary in Ann Arbor, Michigan. The study objective was to determine if learning basic math facts via a game on a handheld device would be more effective than learning math facts via the more traditional method of flash cards.

Participants:

- Two third (3rd) grade teachers
- Approximately 60 students

Co-Principal Investigators:

Cathleen Norris, Professor, Department of Technology and Cognition, University of North Texas
Elliot Soloway, Arthur F. Thurnau Professor in the Department of Electrical Engineering and Computer Science, College of Engineering, University of Michigan

Study Administrator and Statistical Analyst:

Namsoo Shin, PhD., Research Scientist in the School of Education, University of Michigan

Subject Areas/Skills Tested:

- Single and multi-column addition
- Single and multi-column subtraction
- Single column multiplication

Methodology:

The University of Michigan developed a game, Skills Arena, which runs on Nintendo® Game Boy® handheld devices. One teacher started using the Game Boys to teach basic math facts and another teacher started using the flash cards. Five weeks into the study, the teacher using flash cards switched to using handheld devices with her class. The Game Boy/Skills Arena was a time-based game. Students were asked to answer as many basic math fact questions (i.e. $2 + 3 = ?$) as possible in two minutes. The problems moved across the Game Boy screen at different rates that were selectable by the students. The faster the problems moved across the screen, the more difficult they were to answer since the student had to manipulate the buttons very quickly.

Results:

- In the five-week instruction with the handheld, **the handheld game group (HG) outperformed the flash card group (CG)**. The HG students performed 7 percent better than those of the CG group on the gain scores from pre-test to post-test.
- In the five-week instruction, the **low-achieving students using the handheld performed 11 percent better than the flash card group**. Thus, Skills Arena helped the low-achieving students; Skills Arena was a way for low-achieving students to succeed just like the high-achieving students.



Scientifically-Based Research Snapshot: Science Concepts & Processes

Overview:

With funding from the National Science Foundation, the University of Michigan conducted a scientifically-based research study during the 2003-2004 and 2004-2005 school years in three seventh grade classrooms in Detroit. The study's objective was to determine if learning science content and process via a handheld device would be more effective than learning science via the more traditional method of pencil and paper. Performance on curricular tests was used to measure results.

Participants:

- Three seventh (7th) grade science teachers from different Detroit middle school
- Approximately 360 students

Co-Principal Investigators:

Elliot Soloway, Arthur F. Thurnau Professor in the Department of Electrical Engineering and Computer Science, College of Engineering, University of Michigan
Phyllis Blumenfeld, Professor, School of Education, University of Michigan
Joe Krajcik, Professor, School of Education, University of Michigan

Study Administrator and Statistical Analyst:

Namsoo Shin, PhD., Research Scientist in the School of Education, University of Michigan

Subject Areas/Skills Tested:

- Air chemistry
- Basic chemistry
- Communicable diseases

Methodology:

Each teacher taught the same science curriculum to two different groups (handheld and pencil-and-paper). The curriculum asked students to create various documents such as concept maps, spreadsheets, animations, written reports and slide presentations about the various subject areas. The handheld groups used handheld computers with GoKnow's® Handheld Learning Environment™ to create the documents and illustrate their understanding of the science concepts and processes. Those not using handhelds used pencil-and-paper to create the same types of documents. Curricular tests measured performance in creating the documents as well as student understanding of the science concepts.

Results:

- In the first year of using handheld devices, **the handheld groups performed 2 percent better than the paper and pencil groups** did in combining all gains (%) of three units.
- In the second year of using handheld devices, **the handheld groups performed 13 percent better than the paper and pencil groups** did in the combined gain score (%) of three units.