

Phase II Final Progress Report

SBIR/STTR Phase II grant 5 R44 DA013557-03

Science Snoops—Life Science Investigations for Middle-School Students

1. Beginning date: 09/30/2000 and end date: to 02/28/2007
2. List of key personnel who worked on the project during that period:

Key Personnel	Titles	~ Dates of service	~ Number of hours devoted to the project
Ortabasi, Ilse, Ph.D.	PI	09/01/00-02/28/07	3016
Bussell, Linda, Ed.D.	Director of R & D	09/01/00-02/28/07	3553
Stewart, Rhea, M.A.	Res. Associate	09/01/00-02/28/07	2204

3. Specific aims of the Phase II grant:

The aim of this project remains the same as in the original application, namely to develop new, innovative software entitled *Science Snoops—Life Science Investigations for Middle-School Students*. With this software, students in grades 6–9 will learn about the scientific process through inquiry-based explorations of life and health science topics. Students will play the role of science investigators who solve cases presented to them by clients.

4. Summary of research results:

Kinder Magic met and exceeded the originally proposed grant objectives by conducting field tests in a number of middle school classrooms involving the assessment of 297 school children. The primary target was grade 7 students, although 76 grade 6 students and 57 grade 8 students also participated. The grade 7 data consists of 109 complete sets of pretest and posttest scores. The grade 6 data consists of 76 complete sets of pretest and posttest scores. The grade 8 data consists of 46 complete sets of pretest and posttest scores. Incomplete data sets were excluded from analysis.

The assessment procedures involved an instrument that was used for both the pretest and posttest.

Factors impacting student participation

The seriousness of the participation by certain students at the first school site seemed to be somewhat compromised by the teacher's repeated statement that the students' participation in the study would not count toward their final grade except as a "participation" score. In other words, how well they did was of no

consequence; all that mattered was that they participated in the study process. As a result, some of the students were heard repeatedly commenting to the effect that “it didn’t really count.”

Participation by students in grades 6, 7, and 8 at the second school site was affected by teacher absences in all but one 6th grade classroom. It was also affected by a school-wide fire drill and a school lock-down while the police chased a suspect in a nearby shopping center. During that time some of the classes were instructed by their teachers to take cover under the desks.

Particularly in grades 7 and 8, the completion of the posttest by these students was impacted by classroom management issues that arose as a result of having a substitute teacher during the administration of the posttest. Some students refused to complete the test; others marked random answers.

Technical problems

Technical problems had to do with the fact that the software was a beta version with a number of technical issues affecting the user interaction with the software. At the second school the Macintosh laptop computers also had a number of technical failures unrelated to the software.

Descriptive Statistics – grade 6

The 76 students in grade 6 represented 1 school and 3 different teachers, one of which was a substitute. Their ages ranged from 10-13 with a mean age of 11.66 years. There were 65 males and 51 females. Teachers' descriptions of the students' ethnic identities were as follows: “Unknown” 1; “American Indian-Alaska Native” 0; “Asian” 8; “Hawaiian/Pacific Islander” 2; “African American” 22; “Caucasian” 83. Teachers also identified 42 students as "Hispanic/Latino" and 12 students as "English Language Learners".

There were 76 complete data sets for grade 6. The score profile for grade 6 students is shown in the following table:

Measure	Mean Score
Pretest	13.68
Posttest	14.50
Pre-Post Gain	.82

Complete statistics pertaining to each item of the pretest, posttest, Science Journal and all demographic data related to students in grade 6 are available.

Descriptive Statistics – Grade 7

The 124 students in grade 7 represented two different schools and 3 different teachers, one a substitute. Student ages ranged from 12-14 with a mean age of 12.73 years. There were 63 males and 61 females. Teachers' descriptions of the students' ethnic identities were as follows: “Unknown” 0; “American Indian-Alaska Native” 0; “Asian” 6; “Hawaiian/Pacific Islander” 0; “African American” 8;

“Caucasian” 110. Teachers also identified 15 students as "Hispanic/Latino" and 3 students as "English Language Learners".

There were 109 complete data sets for grade 7. The score profile for these grade 7 students is shown in the following table:

Measure	Mean Score
Pretest	14.64
Posttest	16.04
Pre-Post Gain	1.40

Complete statistics pertaining to each item of the pretest and posttest and all demographic data related to students in grade 7 are available.

Descriptive Statistics – grade 8

The 57 students in grade 8 represented 1 school and 2 different teachers, one of which was a substitute. Their ages ranged from 13-15 with a mean age of 13.67 years. There were 33 males and 24 females. Teachers' descriptions of the students' ethnic identities were as follows: “Unknown” 0; “American Indian-Alaska Native” 1; “Asian” 9; “Hawaiian/Pacific Islander” 1; “African American” 10; “Caucasian” 36. Teachers also identified 25 students as "Hispanic/Latino" and 6 students as "English Language Learners".

There were 47 complete data sets for grade 8. The score profile for grade 8 students is shown in the following table:

Measure	Mean Score
Pretest	15.23
Posttest	13.30
Pre-Post Loss	-1.93

Complete statistics pertaining to each item of the pretest, posttest, Science Journal and all demographic data related to students in grade 8 are available.

Analysis of Score Profiles-grade 6

The pre-post gain in scores for grade 6 students was .82. This result was insignificant. The inter-correlation between pretest and posttest scores were:

Inter-correlations	r	P
Pretest / posttest	.359	.001

Complete details on the above statistical analyses are available.

Analysis of Score Profiles-grade 7

The pre-post gain in scores for grade 7 students was 1.4. While this is a statistically significant gain ($p = .003$), this should be interpreted in the context of a relatively small effect size. The inter-correlation between pretest and posttest scores were

Inter-correlations	r	P
Pretest / posttest	.479	<.001

Complete details on the above statistical analyses are available.

Analysis of Score Profiles-grade 8

The pre-post loss in scores for grade 8 students was 1.93. This result was significant ($p=.047$). This group was impacted by the classroom management breakdown that ensued as a result of having a substitute teacher during the administration of the posttest, so the loss is disappointing, but not surprising. The inter-correlation between pretest and posttest scores were

Inter-correlations	r	P
Pretest / posttest	.176	.238

Complete details on the above statistical analyses are available.

Performance Scores Related to Student Demographics

More pertinent analyses of the pretest, posttest, and gains scores were conducted. These analyses examined score differences related to gender, age, grade level, and teacher description of students' ethnicity and "English Language Learner" status. The following findings were obtained from these analyses:

- There were no differences between male and female student performance on these measures.
- There were differences in performance scores between age groups on these measures.
- Regarding data on ethnicity, subgroup sizes were too small and unequal to allow meaningful analysis of the data. In order to further explore the issue of ethnicity related to performance the "ethnicity" data was receded as follows:

Non-Hispanic Caucasian (n = 125) Minority (n = 107)

- An analysis of score differences on the four performance measures showed that the mean pretest scores of the Caucasian students were not significantly higher than those of the minority students (Caucasian = 14.86, minority = 13.97, $p = .15$). There was a significant difference in posttest scores, however, with the Caucasian students performing significantly better (Caucasian = 16.05, minority = 13.73, $p < .001$). A possible explanation for this difference between the two groups is the difference in classroom environments and classroom management issues related to having a substitute teacher during the administration of the treatment and posttest.
- Students who were identified by their teachers as "Hispanic / Latino" scored significantly lower than their counterparts on the posttest ("Hispanic/Latino" = 12.97, others = 15.65, $p < .001$) and gain/loss "Hispanic/Latino" = -1.05, others = 1.06, $p = <.01$), but not on the pretest. ("Hispanic/Latino" = 14.02, others = 14.59,

$p = .434$). A probable explanation for this difference is the breakdown in classroom management during the administration of the treatment and posttest.

- An analysis of performance score differences between ELL and English proficient students was not possible due to the small number of ELL and unequal subgroup sizes related to these two variables.

An analysis of performance score differences between school sites showed insignificant differences between groups on pretest scores and a significant difference between groups on posttest scores (15.95 v. 14.33, $p = .013$). Possible explanations for this difference are the differences in school environments, classroom management effectiveness, ages of participants, and prior knowledge of participants.

GForce sessions

Six students (3 boys and 3 girls) from the Cardiff School District After School Program tested a prototype of a force feedback-enabled simulation of a paddleball game. The mass of the ball and the gravitational force acting upon the ball are adjustable and the force feedback changes as these variables are changed. The simulation also displayed the velocity and altitude of the ball. The students paid attention to these displays as they tried to determine in what ways the simulation reacted to variable changes.

Students performed four experiments and described their results. The experiments were low mass-low gravity, high mass-low gravity, high mass high gravity, and low mass-high gravity. The force feedback effects were determined to be less stable at the extremes, especially at the high end of the scale, so the terms “low” and “high” were relative and not the same for all students. In some cases the force feedback effect would disappear after a time and the program would have to be reset.

All students were enthusiastic about the activity, generally deeming it “cool” for a learning activity. Most students felt that they had learned from the activity, though they could not always describe what it was they had learned and it also was not clear that they had in fact learned.

From this usability test it was determined that the software needs to be modified so that the force feedback effect is more stable. It may be that the range of effects needs to be narrower.

The simulation was based in part upon a demonstration program “Feelitpaddle.exe” that came with the Logitech Wingman Force Feedback Mouse, which is no longer manufactured. The new software uses a force feedback enabled joystick. The addition of the effect ranges with units (mass in kilograms and gravitational acceleration in $m/s/s$) and velocity and altitude displays were in response to previous research with children using the Feelitpaddle software. In the previous study, children would sometime describe

the mass and gravity as being “equal” and the lack of units in the display added to their confusion.

Compared with the previous software, GForce seemed better able to convey the sense of inertia that needed to be overcome to manipulate the high mass ball. GForce may have potential as a teaching tool once the technical issues have been addressed and its effects are stable and consistent.

Reference

Ary, D., Jacobs, L.C., & Razavieh, A. (2002) *Introduction to Research in Education* (6th Ed.) Belmont, CA: Wadsworth.

Principal Investigator/Program Director:

Ortabasi, Ilse, M.J.

Inclusion Enrollment Report

Study Title: Science Snoops—Life Science Investigations for Middle-School Students

Total Enrollment: 297 **Protocol Number:** SNPhase2

Grant Number: 5 R44 DA013557-03

Number of Subjects Enrolled to Date (Cumulative) by Ethnicity and Race				
Ethnic Category	Sex/Gender			Total
	Females	Males	Unknown or Not Reported	
Hispanic or Latino	34	48	0	82 **
Not Hispanic or Latino	102	113	0	215
Unknown (individuals not reporting ethnicity)	0	0	0	0
Ethnic Category: Total of All Subjects*	136	161	0	297 *
Racial Categories				
American Indian/Alaska Native		1	0	1
Asian	10	13	0	23
Native Hawaiian or Other Pacific Islander	2	1	0	3
Black or African American	17	23	0	40
White	107	122	0	229
More Than One Race	0	0	0	0
Unknown or Not Reported		1	0	1
Racial Categories: Total of All Subjects*	136	161	0	297 *
PART B. HISPANIC ENROLLMENT REPORT: Number of Hispanics or Latinos Enrolled to Date (Cumulative)				

Racial Categories	Females	Males	Unknown or Not Reported	Total
American Indian or Alaska Native				
Asian				
Native Hawaiian or Other Pacific Islander				
Black or African American				
White	34	48		82
More Than One Race				
Unknown or Not Reported				
Racial Categories: Total of Hispanics or Latinos**	34	48	0	82 **

5. Titles and complete references to publications: N/A
6. Patents, copyrights, trademarks, invention reports and other printed materials:
The software, websites and all included printable materials resulting from this Phase II will be copyrighted to Kinder Magic Software.
7. The technology developed under this SBIR is an educational multimedia software entitled *Science Snoops*. With this software, students in grades 6–9 learn about the scientific process through inquiry-based explorations of life and health science topics.
8. The current status of the product: The product is being commercialized. Negotiations are under way with Coastline Community College, Coast Learning Systems and NorthWest Media.
9. FDA approval: Not applicable
10. Kinder Magic Software has benefited from the project in the following ways:
a. increased expertise in the fields of science education, instructional design, educational research, multimedia software development, and video production
b. building of strong team for development of further products;
c. increased number of products to promote the firms growth.
11. Name of products developed under this SBIR funding: *Science Snoops—The Monarch Case* and *Science Snoops—The Space Case*.
12. Current number of employees: FTE: 1.