PERGAMON

Computers & Education 40 (2003) 183–191

COMPUTERS & EDUCATION

www.elsevier.com/locate/compedu

A comparison of student outcomes with and without teacher facilitated computer-based instruction

Jack V. Powell[a,*], Victor G. Aeby Jr.[b], Tracy Carpenter-Aeby[c]

[a]*Department of Elementary Education, School of Teacher Education, University of Georgia, 427 Aderhold Hall, Athens, GA 30602-3622, USA*

[b]*Department of Health Education and Promotion, School of Health and Human Performance, Christianbury Memorial Gym, East Carolina University, Greenville, NC 27858, USA*

[c]*School of Social Work and Criminal Justice Studies, 214 Ragsdale Building, East Carolina University, Greenville, NC 27858, USA*

Received 8 March 1999; accepted 14 August 2002

Abstract

The SuccessMaker computer-based instructional package can be used to improve the academic outcomes of disruptive students when intervention is teacher facilitated. Over a 2-year period, 215 participants identified as disruptive student were involved in a naturalistic quasi-experimental design in which independent sample *t*-tests were employed to determined differences between comparisons (Group I) and interventions (Group II) on psychosocial and academic measures. A significant difference ($P<0.05$) was found between Group I and Group II on locus of control and grade point average at the end of the first grading period subsequent to the intervention. The difference in grade point averages was suspected to be attributed to the average amount of time spent on two curriculum areas, math and science, within the 14 academic areas that comprise the SuccessMaker computerized program. Evidence from this study provides hope that teacher facilitation with computer-based instruction (CBI) may be the key to improving locus of control and grade point averages of disruptive students.

Keywords: Chronically disruptive students; Teacher-facilitated instruction; Computer-based instruction

1. Student academic outcomes and teacher facilitation

Educating disruptive students is a social concern that has grown immensely in both scope and depth in the past decade. The educational dilemma of providing safe schools while fostering appropriate learning environments for all students has prompted communities to create alternative

* Corresponding author. Tel.: +1-706-542-4244; fax: +1-706-542-4277.
E-mail address: jpowell@coe.uga.edu (J.V. Powell).

0360-1315/03/$ - see front matter
PII: S0360-1315(02)00120-3

forms of education for students whose behaviors interfere with learning. One such intervention has been the establishment of alternative educational programs for disruptive students, already at-risk for academic failure. The alternative education program (AEP) in this study is a public school program for chronically disruptive students whose mission is two-fold: to promote safer schools and to provide a place for students to receive intensive services to prevent school dropout. The students were assigned to the AEP as a result of violating the student code of conduct and after a due process hearing. There were thirteen categories of referral represented by the participants. The three most common reasons for referral were fighting (39%), possession of weapons (18%), and possession of alcohol or drugs (17%) (Carpenter-Aeby, Salloum, & Aeby, 2001).

There is also evidence to suggest that these students interfere with the educational process of other students and cannot function in a traditional school setting nor an alternative school setting as a result of unmet physical, emotional, or social needs (Carpenter-Aeby, 1999). These unmet needs may translate into school-related problem behaviors such as low grades, absenteeism, and suspension, which interfere with the educational process (Richardson, Casanova, Placier, & Guilfoyle, 1989). Teacher concerns can be traced back over 20 years when teachers reported that they spent more time controlling students than teaching (Duke & Perry, 1978). While the trepidation over student behavior has grown, the pressure has mounted to create more learning options for adolescents, particularly disruptive students. There are many issues surrounding the education of disruptive students that remain unresolved.

Teacher facilitation of computer-based instruction (CBI) is such an issue. Although CBI in school settings has been thoroughly researched on academic improvement, (Brehm, Decker, & Heidner, 1994; Brown & Schneider, 1992; Kulik & Kulik, 1991; Repman, Cothern, & Cothern, 1992; Seawel, Smaldino, Steele, & Lewis, 1994; Shaw, Nauman, & Burson, 1994; Wiebe & Martin, 1996), psychosocial functioning (Aeby, Powell, & Carpenter-Aeby, 1999; Powell, 1999), and teacher facilitation (Grejda & Hannafin, 1991; Saveyne, 1993; Troutman, 1991), very little is known about the effects of teacher facilitation of CBI on disruptive students. Recently one school system with which the authors were affiliated implemented the state funded SuccessMaker Curriculum (Curriculum Corporation, 1992). Given the ambiguous contributions of CBI in school, a comparative evaluation was conducted on the effectiveness of this CBI program offered one year, and in the following year, with a teacher facilitation intervention. It was hypothesized that teacher facilitated CBI would generate greater improvements in psychosocial functioning and academic performance. Specifically, the purpose of this study was to determine if there were significant differences in academic and psychosocial outcomes for disruptive students assigned to an alternative school who received teacher facilitation with CBI.

2. Method

2.1. Student participants

Student participants for the two school years (1994–1995 and 1995–1996) who were assigned to the AEP for disciplinary reasons had several characteristics in common. Students were more likely to be male (80%) than female (20%); were African-American (85%) rather than Euro-American

(14%); were 15 years or older (73%) and were classified as eighth (21%), nineth (45%), or tenth (19%) graders. In addition, family patterns were similar. Sixty-three percent of the legal guardians were grandmothers while single mothers represented 19%. The majority of families qualified for free lunch (91%). Eighty-four percent of the families were involved with social service agencies such as mental health, juvenile court, or social security. Students were assigned for less than 45, 90, 180, days depending on the severity of the offense.

The records of the students ($N=215$) who completed their assignments during the 1994–1995 and 1995–1996 school years at the AEP were the social artifacts for this study and served as the data source. Students ($N=12$) not assigned to the AEP for at least 45 days were omitted, a time too short to legitimately evaluate the AEP teacher facilitated and non-facilitated CBI program. Of this group, 95 students entered the AEP program during the 1994–1995 school year (Group I—comparison group), and 115 students entered the AEP program during the 1995–1996 school year (Group II—intervention). The control group, Group I, received the non-facilitated CBI program while the intervention group, Group II, received the teacher-facilitated program.

2.2. Procedures

2.2.1. Research design

This study employed a naturalistic, quasi-experimental research design involving nonrandom assignment to two treatments, which did not overlap in time. Schematically, the posttest only comparison group design can be represented as:

1995–1996 (Group II—intervention)	X–O
	- - - - - - - - - -
1994–1995 (Group I—comparison)	O

with the dashed line representing non-random assignment to the two groups.

2.2.2. Analysis

In this study, researchers used both a pretreatment analysis and statistical analysis. Pretreatment analysis was used in the absence of random assignment as it was important to determine whether there were differences in demographic characteristics. Therefore, researchers used a pretreatment analysis to determine if any prior differences existed. An independent sample t-test was applied to determine if the mean scores on the pretest psychosocial variables for the student participants in the intervention group were significantly different from the mean scores on the pretest psychosocial variables of the comparison group. The three measures of student psychosocial functioning were self-esteem, depression, and locus of control.

Statistical analysis was used to determine whether or not a difference between Groups I and II was significant. Two types of posttests were examined, psychosocial and educational. These posttests were analyzed using independent sample t-tests to determine if there were a statistical significance between the comparison and the intervention groups, in this case $P<0.05$.

2.2.3. Non-facilitated CBI program (Group I)

The SuccessMaker Secondary Adult Package implemented in the program with chronically disruptive students assigned to the AEP provide a challenge in math, science, reading, and writing on a number of levels (Computer Curriculum Corporation, 1992). Math courses cover review work, logic, complete algebra curriculum, and the GED preparation in arithmetic geometry and algebra. Also, the science uses laboratory simulations to encourage student exploration.

In addition, the reading area is intended to develop various reading skills including basic adult literacy and critical reading. Specific instructions are given for students to prepare for the GED exam with highlighting instructions and practice in the areas of reading, literature, the arts, social studies, and science. Writing skills are also cultivated through instructions in spelling, sentence correction, while the writing process course fosters individual expression, creativity and math skills to everyday situations.

The majority of the SuccessMaker products are available on Macintosh and Windows; and all products are accessible through electronic network, expect those on CD-ROM (Computer Curriculum Corporation, 1992). A Manager's Guide, teacher's handbook, student textbooks, laser discs, VHS tapes and Presentation Guide are available for implementing the Success Maker Curriculum.

All participants in this study were exposed to the SuccessMaker computerized curriculum on a continuous basis during the 1994–1996 academic years (both Groups I and II). It was the dominant mode of individualized instruction within the computer laboratory in the AEP. Small groups were scheduled in the laboratory during each regular school day, and the students chose the academic activity. Students also chose the activity for the class with assistance as needed by the laboratory manager. Table 1 illustrated the percentage of students by group and their choices of curriculum items. The student selections of Spelling Skills (SPS) and The Reading Network

Table 1
Percentage of students by Group on each of the Curriculum items

	Group I (*N*)	*N* = 94 (%)	Group II (*N*)	*N* = 120 (%)
CRS	9	9.6	0	0
ELW	5	5.3	19	15.8
FUN	24	25.5	27	22.5
GED	7	7.5	7	5.8
MCS	33	35.1	35	29.2
MI	0	0	20	16.7
PRS	9	9.6	0	0
RI	0	0	17	14.2
RW	30	31.9	60	50
SD	26	27.7	12	10
SPS	39	41.5	66	55
TRN	33	35.1	58	48.3
WPS	0	0	2	1.7

CRS (Critical Reading Skills); ELW (Essentials for Living and Working); FUN (Fundamentals of English); GED (Graduation Equivalency Degree); MCS (Math concepts and Skills); MI (Math Investigation); PRS (Practical Reading Skills); RI (Reading Investigation); RW (Reader's Workshop); SD (Science Discovery); SPS (Spelling Skills); TRN (The Reading Network); WPS (Writing Process and Skills).

(TRN) varied by group with more of the students in Group II (Intervention) choosing them by almost two to one.

2.2.4. Teacher facilitated CBI program (Group II)

As with participants in Group I, all participants in the 1995–1996 academic year (Group II) were exposed to the SuccessMaker computerized curriculum on a continuous basis. It was the dominant mode of individualized instruction in each classroom. The classroom teacher facilitated student activity in the following manner:

1. The CBI program identified student reading, spelling, and math levels.
2. Teacher assignments were created on a daily basis for each student.
3. Students were required to correct their mistakes.
4. Teachers provided supplemental work for students identified by the CBI program as deficit.
5. Teacher monitored student progress daily and directed students' activities.
6. Students reading, spelling, and math levels were identified by the CBI program upon completion.

Unlike students in Group I who made their own curriculum choices, students in Group II were teacher directed. Teacher facilitation with CBI concentrated on developing remedial skills and emphasizing the content area for specific classes. As a result, if a student were in math class, he or she would work within the CBI math curriculum. This is a major distinction from Group I in which students had maximum freedom in their choice of CBI curricula.

3. Results

The aim of this study was to determine the effectiveness of the SuccessMaker Secondary/Adult Curriculum with teacher facilitation as measured by psychosocial functioning and academic performance. In an effort to determine the differences between Groups I and II, researchers conducted an independent sample *t*-test to compare the mean scores on the pretest outcome variables for Group I and Group II. Data in Table 2 indicated that the groups were similar or equivalent at the beginning of the study. Although not statistically significant, there was a clinically significant difference in locus of control between the groups. Group I entered the AEP with an external locus of control ($m = 18.2$) whereas Group II entered with an internal locus of control ($m = 17.0$). Once the subjects were determined to be similar, then the researchers examined the average time spent by the student participants on curriculum categories as depicted in Table 3. Group I demonstrated a significant difference in time spent on curriculum items, specifically in Spelling Skills and The Reading Network.

As for the psychosocial functioning, there were significant differences in locus of control as illustrated in Table 4. Likewise, there were significant differences between Groups I and II for the academic posttest measures, grade point average and attendance, shown in Table 4. Specifically, the grade point averages for students participating in Group II with teacher facilitated CBI was higher than those students in Group I with no teacher facilitation.

Table 2
Independent samples *t*-test of pretest for psychosocial and academic measures

Intervention $N=215$	Dependent variable	Mean	S.D.	Pretest *t*	Significant *P*
Group I	Self-esteem	7.76	2.06	0.35	Ns
Group II		7.9	2.3		
Group I	Depression	9.98	4.33	1.32	Ns
Group II		10.89	5.32		
Group I	Locus of control	18.2	4.48	1.47	Ns
Group II		17	4.99		
Group I	GPA	58.65	20.36	0.54	Ns
Group II		60.12	18.99		
Group I	Attendance	72.49	11.74	1.16	Ns
Group II		74.23	10.09		

Ns, not significant.

Table 3
Average number of hours by students on curriculum categories

Curriculum	*N*	Group I		*N*	Group II		*t*	*P*
		M	S.D.		M	S.D.		
CRS	9	61.8	53.2	0				
ELW	5	38.2	27.0	19	66.2	91.8	0.66	Ns
FUN	24	74.8	68.0	27	56.8	40.7	1.33	Ns
GED	7	49.7	45.8	7	57.1	53.6	0.28	Ns
MCS	33	186.2	284.5	35	144.9	152.8	0.75	Ns
MI	0			20	239.6	632.3		
PRS	9	62.4	58.0	0				
RI	0			17	102.0	330.9		
RW	30	152.4	245.6	60	80.1	72.2	1.58	Ns
SD	26	229.7	794.1	12	427.0	297.8	0.58	Ns
SPS	39	212.9	351.1	66	79.7	82.2	2.33	<0.05
TRN	33	175.6	260.5	58	51.5	48.4	2.71	<0.05
WPS	0			2	71.0	76.4		

CRS (Critical Reading Skills); ELW (Essentials for Living and Working); FUN (Fundamentals of English); GED (Graduation Equivalency Degree); MCS (Math concepts and Skills); MI (Math Investigation); PRS (Practical Reading Skills); RI (Reading Investigation); RW (Reader's Workshop); SD (Science Discovery); SPS (Spelling Skills); TRN (The Reading Network); WPS (Writing Process and Skills); Ns, not significant.

4. Discussion

Computer-based instruction appears to be a useful learning option for disruptive students. With teacher guidance, these students appear to take more responsibility for their learning. As a result, students experience academic gains that can be sustained for 180 days post assignment to AEP.

Table 4
An independent samples *t*-test of posttest for psychosocial and academic measures

Measure	Group	Post treatment		*t*	*P*
		M	S.D.		
Psychosocial					
Self-esteem	I	8.08	1.94	0.32	Ns
	II	7.98	2.11		
Depression	I	10.67	4.80	1.41	Ns
	II	9.65	4.74		
Locus of control	I	17	4.6	2.33	<0.05
	II	15	4.5		
Academic					
GPA	I	56.05	30.43	2.52	<0.05
	II	66.35	28.16		
Attendance	I	64.87	28.32	2.21	<0.05
	II	72.44	18.02		

Ns, not significant.

Regarding the psychosocial functioning variable, locus of control, there was a significant difference between Group I (17.0) and II (15.0) at exit. Group II entered the AEP with an internal locus of control and became significantly more internal as a result of the intervention. Furthermore, there were significant differences between Groups I and II in grade point averages and attendance 180 days post assignment to AEP. Group II (66.35) experienced at least a 10-point difference in grade point average as compared with Group I (56.05). Even though Group II made significant improvement in their grade point average (66. 35), it was not enough to attain a passing grade of 70. Unfortunately, all participants, on average, entered the program failing academically and continued to fail following exit from the AEP. While Group I's grade point averages dropped 2.60 points (from 58.65 to 56.05), Group II's grade point averages increased 6.23 points (from 60.12 to 66.35) with teacher facilitation.

The two areas of CBI that appeared to have contributed significantly to differences between groups were math and science. In Group II, teacher facilitated CBI, students were encouraged to work on the areas of academic weaknesses through remediation. In addition, teachers aided students in staying on task by limiting computer activities to the relevant content area.

This study was limited to the students who were available during the 1994–1996 school years and who were assigned to the AEP. There was no random selection; therefore, findings cannot be generalized to other settings. Furthermore, the study was limited by the SuccessMaker program, itself.

The findings in this study do support research that has been in existence for the last 30 years that links an internal locus of control with academic gains (Nowicki & Strickland, 1973). In a more recent study relating teacher computer attitudes and locus of control, the prediction that students who have an internal locus of control will likely gain more from low-structured activities than those students with an external locus of control was supported (Woodrow, 1990). Furthermore,

findings in this study suggest "individuals with an internal locus of control will be more computer positive and more motivated to become computer literate than those whose locus of control is external (Woodrow, 1990, p. 423). While Group I entered with an external locus of control, they exited with an internal locus of control; however the grade point averages declined. Whereas Group II entered with internal locus of control, the locus of control became more internal and their grade point averages increased. It appears that there may be support for the assumption that students with an internal locus of control may benefit academically from CBI, particularly teacher facilitated CBI. Perhaps teacher facilitated CBI may only be beneficial for those students who can and will take responsibility for their own learning.

The teacher facilitation of the CBI was powerful enough to endure for Group II over one school year as compared with the disruptive students who did not receive intervention. Because there was, indeed, a significant improvement in grade point average for Group II, in order to assure continuous academic success, consideration should be given to creating more learning options for disruptive students using teacher facilitated CBI outside the AEP, or increase the length of assignment to the AEP to promote academic remediation through teacher facilitated CBI.

In conclusion, the complexities of educating disruptive students are formidable. Innovative solutions aimed at improving the education of disruptive students are critical as the number of disruptive students appears to be increasing. In this study, teacher facilitation of CBI served as the cornerstone for one such innovation. Evidence from this study provides hope that teacher facilitation of CBI with students possessing internal loci of control may be the key to improving the grade point averages of disruptive students.

References

Aeby, V. G., Powell, J. V., & Carpenter-Aeby, T. (1999). Effects of successmaker computerized curriculum on the behaviour of disruptive students. *Journal of Educational Technology Systems*, *28*(4), 335–347.

Brehm, D. M., Decker, C., & Heidner, R. (1994). Using graphing to teach subtraction. *The Computing Teacher*, *22*(3), 36–38.

Brown, D. W., & Schneider, S. D. (1992). Young learner's reactions to problems solving contrasted by distinctly divergent computer interfaces. *Journal of Computing Childhood Education*, *3*(3/4), 335–347.

Carpenter-Aeby, T. (1999). *An evaluation of psychosocial and educational outcomes in an alternative educational program*. Unpublished doctoral dissertation, The University of Georgia, Athens, Georgia.

Carpenter-Aeby, T., Salloum, M., & Aeby, V. (2001). A process evaluation of school social work services in a disciplinary alternative educational program. *Children & Schools*, *23*(3), 171–181.

Computer Curriculum Corporation. (1992). *The SuccessMaker secondary/adult package*. Sunnydale, CA: Computer Curriculum Corporation.

Duke, D. L., & Perry, C. (1978). Can alternative schools succeed where Benjamin Spock, Spiro Agnew, and B.F. Skinner have failed? *Adolescence*, *13*, 375–392.

Grejda, G. F., & Hannafin, M. J. (1991). The influence of word processing on the revisions of fifth graders. *Computers in the Schools*, *8*(4), 89–102.

Kulik, C. C., & Kulik, J. A. (1991). Effectiveness of computer-based instruction: An updated analysis. *Computers in Human Behavior*, *7*, 75–94.

Nowicki, S., & Strickland, B. R. (1973). A locus of control scale for children. *Journal of Consulting and Clinical Psychology*, *40*, 148–154.

Powell, J. V. (1999). Interrelationships between importance, knowledge, and attitude of the inexperienced. *Computers & Education: An International Journal*, 32, 127–136.

Repman, J., Cothern, N. B., & Cothern, J. S. (1992). Novice writers and word processing in the one-computer classroom. *Journal of Computing in Childhood Education*, *3*, 203–214.

Richardson, V., Casanova, U., Placier, P., & Guilfoyle, K. (1989). *School children at risk*. New York: The Falmer Press.

Savenye, W. C. (1993). Effects of an educational computing course on preservice teachers' attitudes and anxiety towards computers. *Journal of Computing in Childhood Education*, *3*(1), 31–41.

Seawel, L., Smaldino, S. E., Steele, J. L., & Lewis, J. Y. (1994). A descriptive study comparing computer-based word processing and handwriting on attitudes and performance of third and fourth grade students involved in a program based on a process approach to writing. *Journal of Computing in Childhood Education*, *5*(1), 43–59.

Shaw, E. L., Nauman, A. K., & Burson, D. (1994). Comparisons of spontaneous and word processed compositions in elementary classrooms: a three-year study. *Journal of Computing in Childhood Education*, *5*(3/4), 319–327.

Troutman, A. P. (1991). *Attitudes toward personal and school use of computers (ERIC Document #ED331480)*. Boston, MA: Annual Conference of the Eastern Educational Research Association.

Wiebe, K. J., & Martin, N. J. (1996). The impact of a computer-based adventure game on achievement and attitudes in geography. *Journal of Computing in Childhood Education*, *5*(1), 61–71.

Woodrow, J. E. J. (1990). Locus of control and student teacher computer attitudes. *Computers and Education*, *14*(5), 421–432.