Florida Journal of Educational Research
Fall 1985, Vol. 27, No. 1, Pp. 43-59

Evaluation of a Pilot Program for Computer Literacy in Grades K-8

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ABSTRACT. A curriculum guide and suggested instructional resource materials were developed for an Orange County School District Program in computer literacy for grades K-8. The program was piloted with 43 teachers in nine elementary schools and one junior high school in the spring of 1984. Both teachers and students were positive about the program and students' achievement gains were satisfactory. The evaluation data provided information about revisions that should be considered in the curriculum guide, resource materials, inservice training and instruction.

Developing an entirely new curriculum for district-wide implementation is a complex process. Minimum student performance standards in computer literacy are being developed by the Florida Department of Education, and they are scheduled to be tested throughout the state in 1986. Although instructional computing has been provided in many schools throughout the Orange County District and minicomputers have been available in schools for several years, no district-wide curriculum had been developed to guide the efforts of teachers or to specify the computer-related skills to be learned by students at each grade level. A computer literacy steering committee was appointed in May 1983 by the Deputy Superintendent of Instruction to study the needs of Orange County Public Schools regarding an instructional program in computer literacy. The committee recommended that a unified curriculum for the district would be the most appropriate approach. They defined computer literacy

as follows: a concept of the capabilities, limitations, applications, and effects of computers, including both an awareness level and a functional working knowledge. The committee also recommended that the curriculum be appropriate for all students, thus representing a minimal competency requirement in computer literacy.

Subsequently, a summer writing team was appointed for 1983 and assigned the task of developing the new, unified curriculum for kindergarten through eighth grades. Their efforts resulted in a curriculum guide for computer literacy that includes the following components:

1. An overall scope and sequence by grade level
2. A skills continuum for grades K-8
3. A list of objectives by grade levels with suggested resources and learning activities
4. Recommendations for implementation
5. An appendix that includes suggested activities and lists of resources.

Rather than initially implementing the new curriculum district-wide, a decision was made to pilot it in a limited number of elementary and junior high schools. The purpose for the pilot study was to identify potential problems with the following: (a) the guide itself, (b) the orientation of teachers to the guide, (c) teachers' skill in using computers themselves, (d) managing instruction given limited availability of computers in the schools, and (e) learning difficulties that students may experience with some of the new objectives.

The program was piloted with 43 teachers in nine elementary schools and one junior high school during the spring semester of 1984. Teachers expected to participate in the program were notified in January, and program orientation workshops were provided for them in February by the curriculum writing team and members of the district's Instructional Computing Office. Classes in instructional computing were offered for participating teachers unfamiliar with computers. Actual implementation of the program began in late February. Based upon experience gained through the pilot program and data gathered, areas where the curriculum and implementation procedures

should be revised could be identified.

Specific evaluation questions included the following:

Curriculum Guide

1. Which objectives in the curriculum guide do teachers implementing the program consider to be appropriate?
2. Given the limited amount of time available for the pilot study, which objectives were actually taught in the classes?
3. Were the activity sources provided in the curriculum guide for each objective considered to be appropriate and adequate for developing instruction?

Inservice Training

4. Was the orientation workshop effective?
5. Did teachers who needed it receive training through instructional computing classes?

Students

6. What were students' attitudes toward the new program?
7. How did the achievement of students in the program compare with that of students not in the program?
8. On which objectives did student achievement fall below 80 percent and 50 percent correct on the posttest?

Method

The sample of schools selected and program implementation schedule were described previously. This section is used to describe instruments developed, the assessment schedule, and data analysis procedures.

Instruments

Four data gathering instruments were developed. For teachers, a structured-response questionnaire and a structured interview form were developed to gather their opinions about the program. The questionnaire was based upon the 27 learning objectives specified in the curriculum guide. For each objective, the

teachers were provided space to indicate whether they: (a) considered it appropriate for students in their classes, (b) taught it during the pilot program, (c) considered the resources provided appropriate, and (d) found the resources adequate to develop lessons. They also indicated whether they: (a) had received a copy of the curriculum, (b) considered the orientation workshop helpful, (c) received training on using computers through instructional computing classes, and (d) actually were able to obtain the resources listed in the curriculum guide.

The structured interview asked for teachers' open opinions about the guide, resources, training, course implementation, and any other suggestions they wanted to make.

Two instruments were used to gather information from students. A questionnaire was developed to gather their impressions about whether they (a) learned about computers during the program, (b) enjoyed the program, and (c) would like more instruction on using computers. They also were asked to list the three things they liked most about the program and three things they thought should be changed.

An achievement test was developed by the writing team and reviewed by the evaluator. All objectives of the curriculum were addressed unless the skill required the actual hands-on work with the computer. The exam was field tested at a school not participating in the pilot study and revisions were made in it based upon input from students, teachers, and the principal. The test is criterion-referenced, and the writing team set 70 percent correct as the minimum acceptable passing level for students.

Testing Schedule

Pretests were administered to sixth grade students in the pilot programs during the first week of February. A control group of students, not participating in the pilot program, also was given the pretest during the same week. Schools similar to those in the pilot program were chosen as control schools. Matching of schools was based upon the percentage of free and reduced lunches and achievement

test scores (CTBS-U). Posttests were administered to the same groups during the second week of May.

Teachers participating in the program were sent the questionnaire during the second week of May. Teachers at all grade levels in six of the nine pilot schools were interviewed as a group after questionnaire data had been summarized and analyzed.

Data Summary and Analysis Procedures

The percentage of teachers responding to each item on the questionnaire was tallied. Their responses during the interview were classified by topic addressed and summarized. The percentage of students responding to items on the attitude questionnaire was tallied, and their likes and suggestions classified and summarized. For the achievement test, the mean raw score, average percent of items correct, and the number and percent of students who scored above the 70 percent criterion level were calculated for the pretest and posttest for both the program and control groups. Only test scores for students who had both pretest and posttest scores were used. An analysis of covariance statistical procedure was applied to the data to test for differences in posttest scores for the program and control groups. Pretest scores were the covariate which adjusted for initial differences between the groups. In addition an item analysis was produced to identify objectives where students experienced difficulty.

Results

The questionnaire for teachers was returned by 39 of the 43 participating teachers. Table 1 includes the percentage of teachers responding affirmatively to questions asked about each of the 27 program objectives. This table can be used to identify whether teachers: (a) thought each objective was appropriate, (b) taught the objective in their classes, (c) considered the activity sources provided for each objective appropriate, and (d) found resources adequate. Related to the appropriateness of objectives, all 27 were rated as appropriate by 75 percent or more of the teachers. In fact, all of the

Table 1

Percentage of Teachers Responding Affirmatively to the Objectives and Activity Sources

N = 39

		Objective		Activity Sources	
Area	Obj.	Appro-priate	Taught	Appro-priate	Ade-quate
1	101	100*	97	100	74
	102	100	95	100	76
	103	93	83	100	55
	104	83	48	88	47
	201	100	86	96	64
	202	100	88	100	65
	203	100	89	96	55
	204	91	68	88	62
	301	86	69	92	53
	302	80	75	92	33
	401	77	39	69	62
2	501	100	67	100	67
	502	100	81	100	81
	601	97	97	97	87
	602	97	86	100	58
	701	100	86	97	69
	702	93	76	96	80
	703	82	73	88	83
	704	90	77	95	50
	705	87	68	100	61
	801	100	76	100	64
	802	100	50	100	71
	803	86	40	80	60
	804	96	44	93	43
3	901	96	58	96	58
	902	95	76	95	81
	1001	91	33	83	60

* Percentage of teachers responding affirmatively

objectives except six were rated as appropriate by 90 percent or more. This indicates overwhelming agreement by teachers that the objectives selected by the writing team were appropriate for the new program.

The second question of interest was whether teachers actually taught the objective related skills during the pilot program. All of the objectives were taught by at least 33 percent of the teachers. Twenty-two of the objectives were taught by 50 percent or more of the teachers. Two factors contributed to the fact that all teachers did not teach all objectives. First, some of the objectives are appropriate for only limited grade levels, the easier being intended for grades K-3 and the more complex for grades 4-8. Second, teachers had only from the end of February until early May to implement the curriculum which is designed to span an entire school year. Given these two realities, the proportion of teachers who used each objective is acceptable for pilot study purposes. None of the objectives was omitted from the pilot program and data are available for them all.

The data regarding the appropriateness and adequacy of resource materials are based only upon teachers who used them. Teachers who did not teach an objective or use related resource materials did not respond to these items. Eighty percent or more of all responding teachers considered the activity resources appropriate for 26 of the 27 objectives. Resources for objective, 401, "understanding the implications of copyright laws," were considered appropriate by only 69 percent of the teachers. All of the activity sources for 21 of the objectives, were considered appropriate by over 90 percent of the teachers. This data provides a good endorsement for the appropriateness of resource materials provided.

Teachers were not as positive about the adequacy of resource materials provided. Fifty percent or more of the teachers considered the materials adequate for 25 of the 27 objectives. However only 33 percent considered the resources adequate for objective 302, "describe the social, political, and economic impact of computers," and 43 percent considered the resources adequate for objective 804, "interact with a problem-solving program." From teachers' reactions, it

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is obvious that more resource materials will be needed in order for them to develop and implement lessons for several of the objectives identified. Table 3 includes a summary of teachers' comments about program implementation procedures and resource materials provided. Basically, they want simulation keyboards for practice, more materials at a higher level of sophistication for older students, consumable materials, a catalogue of all available resources, and more information about how to use the materials available. They also recommended two commercially available instructional packages.

Teachers responded to the adequacy of inservice training received, and their comments about training activities are summarized in Tables 2 and 3. Almost all of the participating teachers were given copies of the curriculum guide, but slightly more than half, 57 percent, felt they had received an adequate introduction to the new materials. Only two thirds reported participating in the inservice computing classes, and during the interviews these teachers reported that the classes were very helpful. They felt that the introductory workshop needed to be improved and that sample lessons should be provided. Basically, they were positive about the inservice; they simply indicated that more was necessary.

Students

An attitude questionnaire and achievement test were administered to sixth grade students who participated in the pilot program. Students' responses to the questionnaire are summarized in Table 4. Three hundred and thirty students responded. Over 80 percent thought they knew more about computers after the program than before and that they would like more of this kind of instruction. Over 90 percent reported enjoying the program. Students were asked to list the three things they enjoyed most about the program and the three things they would recommend changing about the program. Their responses to these two questions are summarized at the bottom of Table 4.

Table 2

Teachers' Responses to Questions about Resources and Training

Questionnaire	Yes	No	NR
1. Did you receive a copy of the curriculum guide?	34 97%	1 3%	4
2. Did you receive an adequate introduction to the new curriculum?	20 57%	15 43%	4
3. Were you provided with adequate resources from the suggested resources in the curriculum guide?	28 80%	7 20%	4
4 Did you receive training through the Instructional Computing inservice classes?	23 66%	12 34%	4

Table 3

Summary of Teacher's Comments by Topic from Structured Interview

Curriculum Guide
Positive: Helpful, easy to follow, thorough. Suggestions: Curriculum should be expanded to higher levels since students are becoming quite sophisticated.
Inservice Training
Positive: Instruction provided was helpful. Suggestions: Training should be available for all teachers implementing the program. Allow teachers to become familiar with guide before attending workshops. Need a better introduction to the curriculum and sample lessons. Need more ideas on how to implement the program. Have computer classes apply toward certification. Use teachers from pilot program to assist with inservice for other teachers.
Implementation
Suggestions: More time working on the computer was needed for each student. Have simulated keyboards for students to enable them to learn to use the keyboard before actually going to the computer. Encourage one teacher in each school to become the resource person for computer materials. Provide for a comparison of different computers to aid students who have access to different computers.
Materials
Suggestions: It would be better for the Basic Computing books to be consumable. Teachers at K-2 grade levels indicated that it was mandatory for the books to be consumable. The available materials were good for a start but more ideas and resources are needed. A good introduction to the software and workshops is needed. Basic Computing was cited as good for the lower grades but too easy for grades 3-6. Many classes are ready for programming and a separate manual for programming needs to be provided. More software choices are needed. A catalogue of available software and information on how to use it should be provided. Provide higher level material since most materials provided were too easy for sixth grade students. Resources found useful that were not provided with the curriculum include Golden Steps Ahead, a series of books on science and social studies, and All About Computers, which are available in local commercial shops.

Table 4

Summary of Sixth Grade Students' Responses from the Attitude Questionnaire

N=330

	Yes	No	NR
1. Do you know more about the computer now than you did before your teacher implemented the program?	266 81%	62 19%	2
2. Did you enjoy learning about the computer?	308 94%	21 6%	1
3. Would you like to do more of this kind of work?	276 84%	49 15%	5

Summary of things students liked most about program	Summary of changes students recommended
1. Getting to work on the computer	1. More time on the computer
2. Learning how the computer works	2. More than one computer in a class
3. Programming	3. Opportunity to program
4. Computer books	4. Different types of computers
5. Flow charting	5. More games
6. Graphics	6. A regular textbook
7. Games	7. More interesting books
8. Learning the history of computers	8. Let us write in the book
9. Math problems	9. Make it more difficult
10. Teachers	10. Provide a printer
11. Binary system	11. More diskettes and programs
	12. Field trips to learn about computers
	13. Be able to do math on the computer

The results of the achievement tests are reported in Table 5. Over three hundred students took the pretest and posttest in both the pilot and control groups. Students in the pilot and control groups were comparable in achievement on the pretest, and students in both groups demonstrated some degree of competency in computer literacy skills at the outset of the program. This was expected since students in both groups had received instruction related to computers before the unified curriculum was introduced in February. In fact, a quarter of the students in each group mastered 70 percent or more of the items prior to the introduction of the program. On the posttest, 54 percent of the students met the criterion of 70 percent or more correct as did 33 percent of the students in the control group. These results are very encouraging since the program was in operation for less than half of the school year, instruction was hurried, and many teachers were unfamiliar with the materials they were using. Under ideal time and implementation conditions the number of students reaching mastery should increase significantly.

To determine whether the students in the program improved more than those in the control group, an analysis of covariance test was performed and data are included in Table 6. The program students performed significantly better on the posttest than did control students ($p<.01$). These data provide evidence supporting the effectiveness of the program even under the constraints of a pilot program.

To aid in locating objectives where student achievement was less than desirable, the items on the posttest were clustered by objective. The percentage of students answering each question correctly is reported in Table 7. When less than 80 percent of the students answered the items correctly, an asterisk was used to highlight the items. When less than 50 percent of the students answered an item correctly, two asterisks were used to highlight the item. These data can be used to locate objectives that need to be reviewed and revisions made in either the items on the exam, the materials, the manner in which instruction was implemented, or the time spent on instruction related to the objective.

Table 5

Results of Computer Literacy Achievement Tests for Sixth Graders

Test	Grp.	N*	$\bar{X}$	Avg. % Items Cor-rect	No.of Stud. Above 70% Crit.	% of Stud. Above 70% Crit.
Pre	Pro-gram	309	20	59	74	24%
	Con-trol	312	20	61	79	25%
Post	Pro-gram	306	24	71	164	54%
	Con-trol	309	21	64	101	33%

Table 6

Analysis of Covariance Data on Achievement Test for Sixth Grade Students in Program and Control Groups

Source of Varia-tion	df	Sum of Squares	Mean Square	F
Between Groups	2	3406.8	1703.4	165.7 *
Within Groups	227	2333.4	10.3	

*p<.01

Table 7

Achievement Test: Objective by Item Analysis for Posttest

n=306

Obj.	Item	Percent Passing
101	1	99
	2	97
	3	90
	4	96
102	5	61*
	6	50*
	7	80
	8	87
	32	68*
103	27	65*
	28	80
104	10	72*
	15	45**
201	11	81
	13	85
	31	34**
203	9	88
	12	67*
	14	49**
301	28	80
	29	52*
401	16	88
501	17	72*
502	17	72*
	18	86
	33	56*
601	33	56*
602	19	82
	20	82
	21	87
701	23	64*
704	17	72*
705	22	26**
902	24	92
	25	74%
	26	34**
1001	30	61*

*Answered correctly by fewer than 80 percent of the students.

**Answered correctly by fewer than 50 percent of the students.

Summarized data from teachers and students were shared with the curriculum writing team, the Instructional Computing Office personnel, teachers and principals in participating schools, and district administrators. Each of these groups may have their own interpretations and conclusions which will be helpful in refining the program. The following section includes the conclusions and recommendations of the evaluator.

Conclusions and Recommendations

The Computer Literacy Curriculum Guide for Grades K-8 was well received by teachers and students alike. Teachers were enthusiastic about the program and diligent in implementing it, even in the compressed time frame of the pilot study. Students made impressive achievement gains compared to control students even though instruction was brief and initial resources were considered inadequate by teachers. The program received such favorable feedback that it can be implemented confidently throughout the district next year.

As with any new program, some revisions will need to be made prior to district-wide implementation. The data from the pilot study provide indications of where revisions need to be considered. Based upon an analysis of the data, the following recommendations are offered:

Curriculum Guide. Basically, the curriculum guide is effective as it is. More sophisticated objectives need to be added for students in grades six through eight. The curriculum guide should be compared to the Florida DOE Proposed Minimum Performance Standards for Computer Literacy to determine whether all the state standards are addressed by the 27 objectives in the curriculum guide. If any are missing, they should be added in the near future.

Inservice Training. Plans should be made for a more comprehensive introduction to the curriculum guide, resources, and implementation methods. Many of the teachers who participated in the pilot program were unfamiliar with computers themselves, and therefore uncomfortable with the program at the outset.

Training in using the computer should be made available for every teacher who wants it. Particular suggestions teachers made about orientation, training, and using resource materials should be considered by the revision team.

Materials. An annotated catalogue of all available resource materials should be made available to participating teachers. Teachers believed that the materials provided were appropriate, but more are needed. The area where teachers thought the materials less adequate can be located in the summary of teachers' responses to the questionnaire and interview.

Implementation. Plans for implementing the curriculum should be shared with participating teachers early in the year so they can plan accordingly for fitting the curriculum into their overall program. Additionally, those that need to schedule inservice courses on using the computer can do so early.

Hardware. Teachers who had a computer available in their classrooms were more positive about the program than those who had difficulty accessing computers for their students. Teachers and students alike indicated that students need more time to work on the computer. Additionally, teachers believe that more than one computer model should be available to help students generalize the skills they learn to several different models.

Objectives. Particular objectives that should be reviewed for possible revision can be located through the teachers' responses to the questionnaire and the posttest item analysis for sixth grade students.

Continued review and refinement of the program as it is implemented throughout the district should result in the best program possible for both teachers and students. The impact of the new program on the district's Instructional Computing Office should be monitored to ensure that it has the resources needed to provide services given the increased demands this program will place on its staff and other resources.

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