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ABSTRACT

This summary presents information on the design rationale, project coordination, and findings of the Technology Applications in Basic Skills project (TABS), which was administered by the Merrimack Education Center and designed to implement programs that use the computer and related technologies to increase student competencies in the basic skills areas of writing, problem solving, and research/study skills in grades 6 through 8. The issues presented in this report include: (1) goals of the project; (2) the major milestones passed, including accomplishment of student performance objectives and curriculum development; (3) other accomplishments such as an increase in academic achievement, successful integration of computers and other instructional innovations into the classroom, and an increase in computer literacy; (4) considerations for policy, particularly curriculum development and evaluation; (5) benefits of the project; (6) replication activities; and (7) adoption costs. (DB)

TECHNOLOGY APPLICATIONS IN BASIC SKILLS (TABS)
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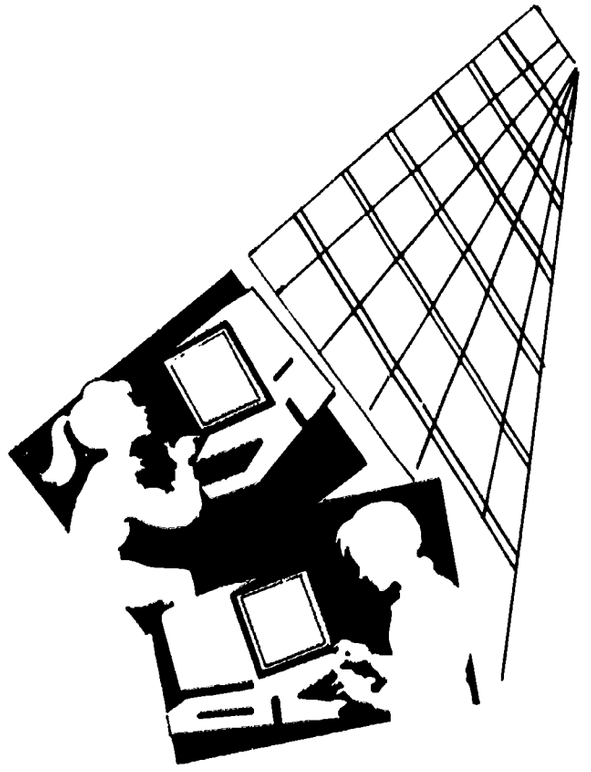
SECOND YEAR SUMMARY



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TECHNOLOGY APPLICATIONS IN BASIC SKILLS (TABS) REPORT OF FINDINGS — 1985

SECOND YEAR SUMMARY

INTRODUCTION

The Technology Applications in Basic Skills project is developing and implementing programs that use the microcomputer and related learning technologies to increase student competencies in writing, problem-solving and research/study skills in the middle school (grades 6 through 8). The purposes of the project are to: (1) develop a comprehensive process for integrating technology into the curriculum; and, (2) develop replicable programs that use microcomputers and related learning technologies to enhance instruction.

The project researched computer education with implementation guidelines and program development being the products. A three-pronged approach is demonstrated: (a) development of lessons for curriculum subject areas using technology; (b) implementation of curriculum and courses for students 6-8 taught by their trained teachers in local schools; and, (c) demonstration units, using software and technology, for tool applications taught by teachers or computer specialists. Supported by a grant from the U.S. Department of Education, the project addresses the issues associated with efforts to introduce computer technology into the instructional program of the typical junior high or middle school.

GOALS OF THE PROJECT

The ability to function in a computer and technology oriented society, in short, to be computer literate, is a goal of our school districts and for all graduates — not for some future society, but for today. Technology in the 21st century will impact on education with the development of computer instruction in public elementary and secondary education. The following statement from the U.S. Department of Education emphasizes this need for computer learning in the schools today.

> There is a widespread agreement that the use of educational computers has the potential to alter profoundly and improve the quality of instruction and learning at all levels of education.

To understand what technology is and what it can do, and to be able to work effectively with a computer when necessary, is becoming increasingly important for the school program as is a cadre of trained staff who can provide the guidance and leadership in the schools to carry out these instructional tasks. Quality of teaching, teacher preparation and inservice education have been investigated in this project to determine what can be done about the problems cited and critical concerns facing education in an information and technological society.

With the reductions from local budgets and Proposition 2½, there are resource limitations and lack of available expertise to look across the curriculum; thus, this project applies concentrated effort in planning, curriculum review and instructional systems design through regional sharing among three communities. Several collaborative planning activities engaged these districts in a resource exchange. The project provides supportive organizational arrangements including staff training, materials, software and technical assistance to participating school classrooms.

This project is designed to support the effective use of educational technology for school improvement at three levels:

- Teachers and students will develop new skills and competencies in computer utilization.
- All district staff will have a model to use in developing a district-wide computer instruction program.
- The integration of computer technology into the total curriculum will support school improvement efforts in basic skills.

MAJOR MILESTONES

1. This project determined where appropriate techniques or methods are able to introduce efficiency and effectiveness into classroom instruction in three curriculum areas.
2. Project staff identified successful ingredients for technology applications that may be implemented in more schools in the region, the state or across the nation.
3. Programs, curriculum packages and models were prepared and examples are identified in the Implementation Handbook. Examples of teacher inservice modules demonstrate how to plan lessons for pupils using technology applications of word processing, data bases, spreadsheets or other software packages.
4. The site coordinator/principals helped plan the project and maintain governance through monthly meetings. In the second year of the project, site coordinators were building administrators, in two cases principals, and in the third case, a computer director for the school district. The computer director was a classroom teacher prior to being appointed by the LEA as computer director K-12.

The project accomplished its student performance objectives and realized important outcomes with respect to curriculum improvement, staff development and organizational renewal. In all three project components, students participating in the program achieved significantly higher performance on basic skills tests in writing, study skills and science

attitudes. Higher scores were realized on a survey instrument indicating that the program helped students to develop positive attitudes toward computers and their use as learning productivity tools.

This project can help broaden perspectives in several ways: (a) provide perspective to recognize opportunities to transfer learning from one curriculum subject to another by using a computer tool and procedural tool skills; (b) expand capacity to respond in several ways to a single need area such as basic skills by using interactive technologies; (c) improve ways of thinking about the skill sequence in the curriculum; and, (d) provide cognitive alternatives as well as a balance of process skills for the optimum curriculum.

In addition to improved student performance, other important program accomplishments were realized. The project stimulated extensive curriculum revision in all three skill areas, with greater emphasis being placed on procedural skills and knowledge within an integrated curriculum model.

The project also undertook to recast the curriculum balancing content with procedural knowledge (e.g., the scientific method and inquiry approaches through lab activities using technology applications). The development model is documented as an aid to other districts who wish to use technology as a lever to improve their curriculum, a process that is replicable across many content and basic skills areas.

ACCOMPLISHMENTS

1. There were significant differences between the post-test scores of participating and nonparticipating students in writing, in study skills, and in science attitudes. Overall and at each grade, differences favored participating students who used the microcomputer.

2. There were significant differences between participants and nonparticipants on the Computer Opinion Survey. Student attitudes are positive towards microcomputer instruction and have a substantial effect on the impact of this type of project.

3. Participants in the Burlington writing program scored significantly higher ($p<.01$) on the written compositions than nonparticipants overall and in grades 6, 7, and 8. The differences in participants and nonparticipants on the study skills test tended toward significance. The differences between participants and nonparticipants in science showed up in science attitude and motivation.

In realizing these accomplishments the project research staff identified several principles that need to be considered in order to appropriately use new learning technologies in the schools:

1. The power of the computer can be realized more completely as a tool rather than as a teaching device, although the distinctions between the two modes are blurred in some applications.

2. New learning and information technologies are a stimulus to rethink what are the essential "basic skills" for the future. Basic skills include learning to use new technological tools to learn more productively and effectively.

3. The new learning technologies can be used most appropriately to support a process centered curriculum; that is, one focused on procedural skills and knowledge (e.g., writing, learning/study skills, and problem solving).

4. When integrating technologies, the time required to review and revise curriculum (in order to make best use of the technology) is often underestimated. Similar underestimates are made for staff development, particularly implementation support.

5. High quality instructional software to support the teaching of the basic skills addressed in this project was difficult to find. In most cases, teachers relied on general purpose tool software.

6. Technological tools (hardware and software) should be simple enough for teachers and students to use without extensive technical skill and knowledge.

7. Laboratory settings may be more appropriate than classroom settings for accomplishing the integration of tool applications, particularly where equipment is limited and scarce resources must be used for maximum potential. A lab setting also simplifies instructional management tasks for the classroom teacher.

8. Instructional management and grouping modes have a substantial impact on the ease and effectiveness of program implementation.

9. Full-scale introduction of new learning and information technologies will likely require new organizational structures in the schools, particularly in addressing such factors as staffing, scheduling, and allocation of instructional resources.

10. Determining the unique contributions of technology to improved student performance is difficult and costly. If the tools are used appropriately, they become "transparent" and their impact is hard to isolate. Documentation and evaluation of various implementation methods may prove to be easier to accomplish and more useful to teachers and administrators.

Computers provide an opportunity for small group instruction that is not available in the large group, lecture mode. Flexible grouping modes provide for interaction among students which will benefit the learning process. Program strategies used in implementing this project include:

1. small group sessions with students using microcomputer tool applications; e.g., data base, spread sheet word processing;

2. use of objectives and lesson plans prepared in modular format by the participating teachers against which program progress can be measured;

3. student, peer group interaction and direction by the teachers in classroom and lab settings;

4. a research evaluation design for measuring progress and achievement gains for students, including appropriate program monitoring and evaluation instruments.

This project introduced procedural facilitation, magnified by the power of the microcomputer, a technique that has grown out of the body of research investigating the tool uses of the computer. This procedural approach allows the student the opportunity to approach tasks differently and apply more sophisticated strategies—strategies that involve the higher level aspects of the thought process. Given the nature of the program, the findings likely are generalizable to students at all grades where procedural skills are taught and computers are available.

CONSIDERATIONS FOR POLICY

The Technology Applications Project was able to use new learning technologies to improve basic skills performance and to restructure the curriculum in writing, learning/study skills, and problem solving. In addition, the participating students indicated a positive attitude toward technology applications, seeing the computer as a learning productivity tool. The introduction of the technology into the curriculum served as a stimulus to examine and refine basic skills instruction. From this experience, we have derived the following implications for policy-makers.

1. New learning and information technologies can serve as catalysts for many long-sought improvements in instruction, as well as provide support. They can also:
    - help students to master learning-to-learn skills and become independent learners in each subject.
    - help students achieve skill and knowledge mastery more efficiently, leaving more time for teachers to introduce "new" basic skills such as problem solving, critical reasoning, etc.

- support new instructional scheduling and grouping practices to accommodate differing student needs and teacher specializations.
- cause educator to restructure the curriculum, particularly through an increased emphasis on general and discipline-specific process skills and knowledge, and on cross-discipline learning activities.

2. Increased emphasis in software selection needs to be correlated with restructuring of the curriculum, not merely matched to its ability to perpetuate outmoded content and pedagogy.

3. The increasing use of general purpose software tools in several curriculum areas suggests a re-examination of existing and proposed computer literacy programs.

4. Student performance gains resulting from the use of computers in curriculum areas are likely generalizable to the new emerging and more interactive technologies (e.g., interactive videodisc).

Integration of the technology throughout the curriculum creates a step-function difference in the way we do business, not just an automation of what we are doing now. In addition, it provides a reconceptualization and reprioritization of what schools should do to prepare students to learn more effectively and productively and to prepare for careers.

BENEFITS OF THIS PROJECT

As a result of participation in this, teachers and principals have been provided frameworks and templates that can be used to reconsider the most appropriate tasks of the middle school and staff roles for those persons involved in curriculum development. The individual school has the primary responsibility for implementing computer technology within the curriculum. Creative planning and leadership strategies were also provided.

Realizing that institutional invigoration and curriculum revitalization are long-range tasks, the central office supports the functions of coordinating efforts, sharing resources, stimulating thinking, and bringing community needs to the fore.

Through the various staff development activities, the teachers were able to spend increased time and effort on issues of what to teach and why -- the most serious questions to ask about the curriculum in the middle school. Renewed attention was drawn to goals in the content areas and using skill applications. These areas have been measured and we have a full accounting of the substance (knowledge and skills), goals and purpose of the middle school curriculum. Curriculum development is viewed as a total process in which balance and consistency are aimed for.

The resource intensity provided by this effort to plan and implement collaborative approaches to curriculum and instruction greatly aided the school's daily operations. The initiative and creativity required to use technology should not be underestimated; teachers and their principals are to be commended for this gigantic effort.

Implementation issues were studied and many barriers to implementation were overcome. The scope of this program included many

critical issues of software and hardware selection and the various options for utilizing software/hardware within the curriculum subjects (such as a laboratory, an open classroom environment, etc.). An ambitious agenda was set forth, one that is designed to remain relevant as we explore the science curriculum in greater depth and as we examine new and emerging technologies in greater depth (e.g., videodisc).

These developmental efforts have focused not solely on computers but also on instruction and teacher training. Efforts of those towns desiring to adopt these practices must reflect the goals and priorities established within other ongoing curriculum reform efforts. What is known about effective teaching and learning, cognitive principles and the like, must be the guiding beacon through this implementation.

Curricular strands are now in place where once there was only "computer literacy," keyboarding, or programming. This project has identified a core of skills in using computer applications that will be published in a technology handbook so that progress can be monitored as students learn particular skills and benefit from a variety of activities in their school career.

Existing demands for limited equipment have forced the schools to restrict usage to the priorities of this project. As other equipment is added schools can focus added services on a particular grade level (word processing in grades three through six, for example) and expand into other subjects for additional students (e.g., study skills *and* problem solving for all students in science courses).

With the training and experience provided through this project, many teachers have developed increasingly sophisticated uses of well-designed lessons and projects that they are now ready to teach to others. This

experience should be captured as we disseminate these methods throughout the Merrimack Valley. Adoption proposals are even now being prepared.

Applications software (word processors, research and analysis tools such as data base or spread sheet) are the primary targets for pupil instruction in the middle school. Using these tools to further reflective thinking and higher order thinking skills is essential to the growth of the school program. Thus, the skills to be acquired by our students and techniques used by their teachers can take advantage of this rich new resource and resource intensity for productivity and efficiency in learning.

Beyond increasing student access to computers, the project has also increased the number of teachers trained to use computers. Teachers have developed their interests in computers and have gained greater skill in using them in the classroom. This has fortunately been forwarded as skill and attitude differences/improvements for their pupils.

REPLICATION ACTIVITIES

The project has two major components that can be replicated in other school sites. The teacher training component provides detailed descriptions of three training elements: curriculum revision, technology applications, and implementation support. The curriculum component has two elements: a set of instructional units for incorporating the program into the existing language arts curriculum; and recommendations that teachers can use to incorporate technology applications into their basic skills instruction. Both components are supported by a *Handbook* for undertaking the integration of technology applications into the school curriculum. The hardware and the software employed in the project are readily available in most school districts throughout the country.

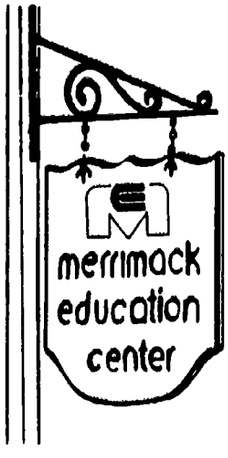
A one-week (30 hours) training program is required; if teachers are already using a procedural approach to teaching in the three skill areas, the required training is 15 hours. Implementation support needs to be provided to teachers during their conduct of classroom and lab activities. A site coordinator arranges regular sessions for all teachers to work on implementation issues.

ADOPTION COSTS

Adoption costs are based upon a microcomputer lab of 12 Apple IIe microcomputers, monitors and three printers (with essential cables) and 1 disk drive per Apple microcomputers. In a lab setting, two extra cables and one additional disk drive will serve replacement purposes in the event of damage. Figure 1 presents estimates of adoption costs by classroom and student.

Figure 1
ADOPTION COSTS

	Teacher/Classroom	Student	Equipment
Guidebooks — 8 @ $20	$ 160		
Training — 5 days @ $250 (includes materials)	1,250		
Release Time — 5 days @ $30/8	1,200		
Software/Materials Software Milliken		$ 840	
Lab (disks, paper, materials, etc.		1,170	
Student Folders		165	
Microcomputer Equipment			$12 Stations (Apple computers) & printers @ $1000
TOTALS	$2,610	$2,175	$12,000
	(Per Teacher: $326)	(Per Student: $8)	



MEC is an education service agency for twenty-two school districts in the Merrimack Valley of Massachusetts and a charter member of AASA/AAESA, the organization of regional service agencies.

A Lighthouse Technology Model of the National Diffusion Network, U.S. Department of Education

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