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Three delivery systems for middle school computer literacy curricula

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Abstract

This graduate paper, "Three Delivery Systems for Middle School Computer Literacy Curricula," investigates three delivery systems for computer literacy curricula in a middle school setting. The computer literacy curriculum at the middle school level is constantly being updated and changed to accommodate new technology and to implement new and effective teaching methods. There are few guidelines that are available when investigating computer literacy curriculum at the middle school level, but a variety of options do exist for the delivery of whatever curriculum a teacher selects. This review examines several delivery systems for middle school computer literacy curricula and explores the strengths and limitations of each. The delivery systems investigated are cooperative learning techniques, simulations, and instructional drill and practice methods. The author also investigated how a combination of these methods can be used with young adolescents in a middle school environment.

Three Delivery Systems for Middle School Computer Literacy Curricula

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ABSTRACT

This graduate paper, "Three Delivery Systems for Middle School Computer Literacy Curricula," investigates three delivery systems for computer literacy curricula in a middle school setting. The computer literacy curriculum at the middle school level is constantly being updated and changed to accommodate new technology and to implement new and effective teaching methods. There are few guidelines that are available when investigating computer literacy curriculum at the middle school level, but a variety of options do exist for the delivery of whatever curriculum a teacher selects. This review examines several delivery systems for middle school computer literacy curricula and explores the strengths and limitations of each. The delivery systems investigated are cooperative learning techniques, simulations, and instructional drill and practice methods. The author also investigated how a combination of these methods can be used with young adolescents in a middle school environment.

Three Delivery Systems for Middle School Computer Literacy Curricula

INTRODUCTION

Computer literacy curriculum at the middle level should be delivered in a manner that is consistent with the middle level education philosophy; it should be designed with the needs of the young adolescent learner in mind. Organizations such as the National Middle School Association (NMSA), The Carnegie Council on Adolescent Development, the Edna McConnell Clark Foundation, and the Center for Early Adolescence have all attempted to clarify the developmental needs of 10 to 15 year old and recommend programs that are educationally responsive (Neudecker, 1989). The organizational structure of middle level schooling has changed dramatically in the past ten years, and with publications such as NMSA's position paper, "Middle Level Curriculum: A Work in Progress" (1995) encouraging "schools and individuals to devote time, energy, and careful thought to curriculum" (p.86), middle level educators are taking more responsibility for the creation of curriculum as well as the instructional strategies for its delivery.

The computer literacy curriculum at the middle school level needs to be constantly updated and changed to accommodate new technology and to implement new and effective teaching methods. A survey conducted by the Center for Social Organization of Schools in 1983 indicated the computer was being put to use for three main purposes: to

acquaint students with programming skills, programmed learning, and drill and practice. "Unfortunately, some of the applications were simply traditional instructional measures dressed in the titillating clothing of the new technology" (Hlebowitsh, 1988, p. 54).

The relatively recent introduction of computers, particularly in school environments, means that the most critical computer education now is the computer education of teachers, teaching about computers and teaching with computers. Current education majors believe themselves to be much less prepared to teach with computers than they are to deal with many other aspects of their teaching (Beed, 1995; Becker, 1992). Those who teach about computers (computer literacy teachers) must seek out alternative courses in technology or independently teach themselves the best techniques to use in the computer literacy classroom (Slavin,1992). Research about computer literacy curriculum at the middle level or the delivery systems used in computer education classrooms is very limited (Becker, 1992).

The curriculum at the middle level in computer literacy tends to be developed by each teacher; no national or state curriculum exists. A variety of delivery systems are being used for the delivery of whatever computer literacy curriculum a teacher selects. This review examined three of those delivery systems for middle school computer literacy curricula. The strengths and limitations of each were examined. The options investigated were cooperative learning techniques, simulations, and instructional drill and practice methods. Recommendations were

then made for the use of these delivery systems in grades 6, 7, and 8 computer literacy classrooms.

Research Questions

The following questions were asked to guide this research endeavor:

1. What are the characteristics of three of the current delivery systems that are being used in middle school computer literacy curricula?

2. What are the strengths and limitations of each of these delivery systems?

3. What delivery systems are appropriate for each grade level in a middle school, based on the developmental characteristics and needs of young adolescents?

Methodology

For this review of three delivery systems for middle school computer literacy curricula, an ERIC search was conducted at the University of Northern Iowa. In addition, education encyclopedias and technology journals were reviewed. The following descriptors were used:

- computer curriculum
- middle school computer
- junior high computer
- junior high curriculum
- middle school technology
- instructional strategies
- teaching methods
- technology
- cooperative learning
- simulations

From this search, abstracts were read to determine which items

pertained to the research questions posed by the researcher. Monographs, reports, and journal selections that contained relevant information were located, copied and read for more specific information. In addition, other relevant documents were recommended by knowledgeable professionals in technology education.

Four middle schools in Iowa were also visited. Information was complied that documented in detail both how and why teachers used computers. Notes were taken during meetings with the instructors and copies of their middle school computer literacy curricula were received. Each of these schools had a 6 - 8 grade setting.

Pertinent information also was gathered from two technology conferences and two middle level education conferences held in Iowa. At round-table discussions, educators shared their experiences delivering middle level computer literacy programs. Another source of information contributing to the recommendations described in this paper was the author's own experience as a computer literacy teacher at grade levels 6, 7, and 8 at a middle school (180 students total) in Iowa for the past 4 years.

Three delivery systems for middle school computer literacy curricula were selected for inclusion in this paper based on the preferences expressed and frequency of use as reported by the data gathered through visitations, conferences, and readings. The three delivery systems examined in depth included cooperative learning, simulations, and instructional drill and practice.

Definitions

In order to provide a common understanding and a clear means of communication, the following terms are defined:

Computer Literacy- referring to the ability to understand and use computers (Heinich, Molenda, Russell, & Smaldino, 1996, p. 228)

Computer Assisted Instruction - the student interacts directly with the computer as part of the instructional activity (Heinich et al., 1996, p. 228)

Delivery Systems- ways of providing instruction to the student

HyperStudio- a creative software package that combines word processing, sound, color, and animation

HyperCard- a software package that lets students create a story or develop a simple computer program by using word processing, sound, and graphics

Instructional Methods- the procedures of instruction that are selected to help learners achieve the objectives or to internalize the content or message (Heinich et al., 1996, p. 9)

Network- a process of linking several computers together for the sole purpose of doing one or several things. An example would be joining four computers to one printer

Data Base- an application software package that stores, sorts, looks up, and retrieves information

Spreadsheet- an application software package used to create budgets and financial forecasts which can quickly analyze and recalculate numbers

Word Processing- an application software package that helps create written reports and documents with text

Young Adolescent- a 10 to 14 year old experiencing the developmental stage of early adolescence

REVIEW OF LITERATURE

Middle level educators in the regular classroom are using creative ways to incorporate computer technology into their curriculum. It is imperative that the computer literacy teacher address the skills needed for use in the regular classroom and help to develop a positive attitude in students toward the use of computer technology as a tool. Fifty nine percent of all students in grades 1 through 12 use a computer at school (Livingston & Miranda, 1995). This is double the number reported less than ten years ago. In the next decade, the percentage of computer users at schools will undoubtably expand. The need for continuous upgrading of skills taught to middle grade students will surely be needed. The delivery systems used need to accommodate the changes which will take place in (1) the technology and (2) what is selected for inclusion in the regular middle level curriculum. The skills and attitudes developed in a computer literacy classroom can be shaped through the use of developmentally appropriate strategies and relevant tasks.

This review focused on the essential components of three delivery systems for middle school computer literacy curricula: cooperative learning, simulations, and instructional drill and practice. These three delivery systems were selected for inclusion in this paper based on the preferences expressed and frequency of use as revealed in the data gathered through reading, teacher interviews, conference information,

and the professional experiences of the author.

Cooperative Learning at the Computer

Cooperative learning can be a valuable delivery system for instruction in a computer literacy classroom. Slavin found more than 70 studies which evaluated various cooperative learning methods over periods of at least 4 weeks in elementary and secondary schools. Sixty studies compared effects of cooperative learning to those of traditionally taught control groups on measures of the same objectives pursued in the classes. Teachers and classes were randomly assigned to cooperative or control conditions. Sixty-two percent of the studies found significantly greater achievement in classes incorporating cooperative learning groups than in control classes (as cited in Slavin, 1992).

A combination of this delivery system, cooperative learning, and the computer, has received attention as an appropriate instructional approach to computer literacy. Heinich et al. (1996) reported that research supports the idea that students learn from each other when they work on projects as a team . "Two or three students at a computer terminal learn more as they carry on discussions while working through the assigned process" (Heinich et al., 1996, p. 11).

Dr. David Dalton of Kent State University, whose research focuses on the design and development of computer-based cooperative learning and educational reform, believes that cooperative learning and the computer can be a powerful learning duo. One of the reasons Dalton gives for structuring cooperative learning with the computer is simply the

instructional efficiency of using one computer (Maile, 1991).

Dalton's observations revealed that a student receiving information from another student is often "given explanations that are closer to their level than what a teacher can provide" (Maile, 1991, p. 1). Cognitive processes become greatly enhanced when one has to organize, verbalize, and summarize information in order to explain it. This process reinforces learning on a deeper level (Johnson, Johnson, & Stanne, 1989; Maile, 1991).

One way of using cooperative groups in the computer literacy classroom, is when the teacher conducts lessons with one computer and a 25-inch monitor at the front of the room. For example, at one school students practiced the skills required for a simulation game. The students were divided into groups of three or four to play the game against the computer. Within their groups, each person contributed to determining the "best" answer, which their spokesperson announced to the class. After it was entered into the computer, the other groups in the room were given an opportunity to agree or disagree. Afterwards, the class viewed the computer's best solution before giving the next group its turn to move. They continued in this manner until the game was over (Maile, 1991).

The five basic elements of cooperative learning should be present when using cooperative learning groups. These include (1) positive interdependence, (2) face-to-face interaction, (3) individual accountability, (4) interpersonal and small group skills, and (5) group

processing (Johnson et al., 1989). A requisite skill students need to possess is team building. The effort spent in team building, ensures that students get to know and appreciate one another, enhances the group interaction, and ultimately enhances the learning that will take place. Teachers need to emphasize team building before the students ever get to the computer and start to work together (Maile, 1991).

Software used in the cooperative learning approach should stimulate students to think about different ways of answering questions and solving problems (such as HyperStudio). Software of this type has the added bonus of showing young adolescents that not everyone can do everything well, but within the team there are the necessary skills to be successful as a group.

Advantages

Cooperative learning groups encourage students to learn the value of each other's contribution as they work together in solving problems. Students apply knowledge and use higher-level thinking and problem solving skills when placed in cooperative learning groups (Bozeman & Baumbach, 1995).

When students perceive support from group members, self-esteem is likely to increase (Johnson et al., 1989; Slavin, 1987). This delivery system helps students develop a team identity as they learn to communicate with each other and work together. Students in cooperative learning groups tend to enjoy working together and express a sense of accomplishment (Bozeman & Baumbach, 1995).

Jim Watson of the Edgewood Middle School of Eugene Oregon states, "Cooperation skills need to be taught. They need skills that will make them successful working together, along with teacher instruction, and software" (Maile, 1991, p. 1). Students need to develop skills in working and learning together because this will translate into skills needed throughout their school careers as well as when they enter the work force.

Cooperative learning at the computer may also represent a cost-efficient alternative to individual instruction (Dede, 1983). Students placed in groups of two or more, help limit hardware and software costs by at least 50%. In addition, cooperative learning groups reduce student isolation and inhibits the tendency to revert to a lecture-mode, lock-step instructional approach (Bitter & Gore, 1986)

Limitations

Students placed in small groups to work on a common task at the computer, will not necessarily facilitate learning or cooperation. The young adolescent who does not feel comfortable in a cooperative learning environment, probably needs more individualized attention (Bozeman & Baumbach, 1995). Students must be given a reason to interact (Slavin, 1987). Cooperative learning without a well-defined group incentive structure is unlikely to succeed in individual achievement. There must be efforts to encourage and nurture intergroup interaction.

Students must be listeners, encouragers, supporters, builders, and

contributors. Young adolescents may not possess these skills yet, so it may be a concern. Along the way students must also learn some of the basic truths about life. For example, life isn't 50-50. There's always give and take. (Lamb & Johnson, 1995, p. 149)

Carl Hayden High School in Phoenix, Arizona documented the following difficulties which arose and things to consider when using cooperative learning in a computer science classroom:

- Some students do not come regularly and do not do their their share of the group.
- Decide, in advance, what to do with students who do not attend regularly.
- A few students do not work well in groups.
- Groups may have difficulty with time management.
- Development of effective assignments is difficult.
- Group skills development and evaluation is time consuming.

(Bozeman & Baumbach, 1995, p. 75).

Simulations

Simulations focus on explanation and discovery learning. Simulations do not necessarily have a fixed or correct solution, and the route to the solution may vary (Watson, 1994). The use of simulations dates back to the early 1800s when they were used to analyze war strategies (O'Neil & Robertson, 1992).

Types of Simulations

Three kinds of simulations exist (O'Neil & Robertson, 1992) and each serve different educational purposes: (1) all-machine (2) all-people, and (3) people-machines.

All-Machine Simulations. All-machine simulations are completely computerized and the computer makes all of the decisions, strategies, and responses. People only provide the initial data. This kind of simulation is usually used in research and planning, and not in computer literacy classes.

All-People Simulations. All-people simulations use a model in which no machines are used. People role play the simulation based on the assigned roles, environmental conditions, resources, and imposed constraints given by the author of the simulation.

People-Machine Simulations. People-machine simulations are more commonly seen in computer literacy classrooms. Machine simulations and management simulations are the two major types. Machine simulations are most likely to be used for skill training such as in flight simulators or as in popular computer games in which students aim their cannons using angles of trajectory to hit a target. Management simulations are designed for role playing using personal skills with a focus on managing or leading in a situation. An example of this is the popular "Oregon Trail" (Minnesota Educational Computing Consortium, 1989) simulation.

Tech 2000 SmartLab Simulation Laboratory

Boynton Middle School (a pseudonym) in Iowa, with 400 students, is helping students to be more involved in the learning process. During a personal visit to the school it was observed that cooperative learning, simulations, team teaching, and technology have transformed this school into a veritable think tank of industrial and visual arts.

In a nine-week program, students work in a Tech 2000 SmartLab (1990) each day for 50 minutes. This state of the art environment uses island-like labs where students learn in conditions that simulate high-wage, highly skilled jobs. SmartLab, a computer-managed network, gives students access to and control of content, applications, and information in the area of robotics, computer-aided manufacturing, systems simulation, word processing, and publishing. The cost of the project was $50,000 and was funded through private donations.

Students move from each computer station engaged in learning activities such as experimenting with satellite technology, drafting, rocketry, aerodynamic testing, simulated flight, robotics, multi-media productions and superconductivity. Teachers utilizing this technology move away from lecture and note taking toward instilling excitement into learning. "Learning centers allow teachers to play a more of a coaching role, moving around the classroom and providing individual help to students when they need it " (Heinich et al., 1996, p. 11).

Advantages

Many advantages to the delivery system used in the Tech 2000

SmartLab were observed. For one, the students at Boynton Middle School were challenged and could see immediate application. The classroom atmosphere was relaxed and comfortable. Teacher input in this case was spontaneous and generous, with short instructions and directions. Students reported seldom being bored because they soon would rotate to a new location and the teacher reported they seldom became frustrated because assistance was readily available.

Simulation centers have the advantages of convenience, safety, and controllability over real experiences. They are good precursors to real experiences and they are useful for giving students experiences that would not otherwise be possible (Allessi & Trollip, 1991; Lepper & Chabay, 1985). "Centers encourage students to take responsibility for their own learning and allow them to learn at their own pace, thus minimizing the possibility of failure and maximizing the likelihood of success" (Heinich et al., 1996, p. 321).

Lepper and Chabay cited research supporting the use of computer-based simulations. Computer-based simulations "offer learning environments that: (a) produce high levels of intrinsic motivation; (b) encourage self-directed, learner-controlled exploration of an intellectually rich and diverse goal space; and (c) provide the child with immediate, clear and informative feedback" (1985, p. 222) .

The cost of simulations can be an advantage or a limitation. As an advantage the cost for training simulations is usually much less than training on a real system. For instance, the use of flight training

simulators by the Department of Defense costs 8% to 10% of the actual cost if a multi million dollar jet were used (O'Neil & Robertson, 1992). This would also be true in the school setting. Allowing children to simulate an experience such running a business on the computer would cost less per pupil than financing each student to establish their own business. But O'Neil and Robertson (1992) note, "the cost of many simulators makes their use solely for instructional purposes prohibitive" (p. 1219).

Another advantage to the use of simulations is that they often require less time to complete from beginning to end. About one half of the time is required when training using a simulator. Weather, equipment availability, and personnel are either not a factor or are more easily scheduled (O'Neil & Robertson, 1992).

Limitations

Cost as an advantage or limitation is contextually related. A significant limitation to the rotation laboratory (simulation) delivery system at Boynton Middle School for many schools would be the cost of the hardware and software required to run the SmartLab. Although less expensive that the actual experiences being provided for each student, the cost of $50,000 is usually a significant amount for many schools to invest in a computer literacy program of this nature.

A limitation to the purchase of the Tech 2000 SmartLab system is the concern that it will be outdated. If a simulation from 10 years ago existed on the computer for "popping popcorn," a person would probably

not be tossing the popcorn bag into the microwave for three minutes on high. What will happen when new technologies change, but the simulation does not allow the participant to utilize the most current techniques? Upgrading, and even the replacement of simulations within the rotational pattern, needs to be taken into account when investing in this type of system.

Management may also be a concern. It helps if the teacher is good at classroom organization and management. When the students are working at their centers, the teacher serves as a facilitator. The teacher must be able to give the students enough independence to learn from through the system, but not so much so that the students are unsupervised or can not receive accurate assistance from the teacher when it is necessary. Educators must also realize that a great deal of time must be spent in designing the work areas, setting up the centers, and collecting and arranging materials.

Another limitation of simulations is the degree to which the simulation represents the physical and psychological environment in a real-world situation. Artificial cues can assist in making the simulation a high level experience, but unintentional miscues may hinder the intended response. "The student may learn inappropriate responses, which, when applied in the real system, would severely affect the operator's performance" (O'Neil & Robertson, 1992, p. 1219).

Instructional Drill and Practice

Some schools provide a computer literacy classroom setting where all students practice on the same concepts and skills at the same time. The use of instructional drill and practice, which includes the three components of demonstration, guided practice, and independent practice (Rosenshine, 1987), is a common practice in many middle school settings. Students are lead through a series of examples to increase dexterity and fluency in a skill such as word processing (Heinich et al., 1996; Hlebowitsh, 1988). A three-step process appears to be most frequently used:

> The first step is demonstration of what is to be learned. This is followed by guided student practice in which the teacher leads the students in practice, checks for student understanding, provides prompts, and provides corrections and repetitions when necessary. When the students are firm in their initial learning, the teacher then moves them to independent practice where the students work with less guidance. The objective of the independent practice is to provide sufficient practice so that students demonstrate quickness and competence. (Rosenshine,1987, p. 258).

In many classes in which drill and practice is the prevalent delivery system, the computers are networked. Usually about 15 to 30 microcomputers are connected to a teacher monitor in the front of the room. In a networked classroom, teachers have direct eye contact with

each learner, they are able to check the student's work from the teaching monitor, materials can be "sent to" the students, and tests can be administered from the teacher's station on a one-to-one basis. Textbooks, workbooks, and teacher's guides are frequently used as supplements to the networked activities.

Advantages

The primary advantages of the instructional drill and practice concept is that in most cases, each student has their own computer and the student has some sense of autonomy. A student can experiment and develop at their own level without the influence of others. Although the topic or skill remains constant, instructional drill and practice delivery systems allow the student to experiment and develop at their own pace, "thus reducing the likelihood of student frustration over the pace of instruction" (Duke, 1987, p. 549).

The course work is usually clearly laid out in an instructional drill and practice classroom, so the teacher uses a teacher's guide and does not need to do a great deal of planning. The teacher is likely to have better management of the classroom environment because students are (1)isolated at separate computers, (2) given essentially the same assignments, and (3) expected to complete each one before going on to the next job.

Limitations

The limitations to this method of delivery is that it is usually routinized from one year to the next. It leaves little room for teacher or

student creativity. Instructional drill and practice "fails to provide a context for wider knowledge applications, often supporting educationally hollow exercises in an 'electronic workbook' format" (Hlebowitsh, 1988, p. 55). Critical thinking skills and reasoning are seldom strengthened.

Other criticisms of the instructional drill and practice model include the following:

> Frequently the time spent in demonstration is too short; the students do not receive enough guided practice; the teacher does not circulate, correct student errors, and reteach where necessary; and frequently, too much time is allocated to student independent practice and too little time to demonstration and guided practice. (Rosenshine, 1987, p. 259)

CONCLUSIONS AND RECOMMENDATIONS

Instructional methods and techniques should be chosen based upon several criteria: student characteristics and learning abilities, the content, instructor style and knowledge, equipment availability and cost , the educational philosophy of the school, and the purpose of the educational process (Allessi & Trollip, 1991; Tennyson & Rothen, 1979). When considering delivery systems for computer literacy classes, it is necessary to identify the developmental levels of the students for which computer education is to be provided. Each developmental level that a student enters requires different physical, intellectual, social and emotional needs be met. The educator must keep this in mind when

selecting software that is developmentally appropriate. Middle school students are beginning to see things in new ways. Students are beginning to move from concrete to abstract in their thinking (Schurr, Thomason, & Thompson, 1995). Young adolescents need opportunities to express to the external world who they are on the inside (Scales, 1991). Computer literacy curricula can often serve as an outlet for students when expressing new feelings and ideas.

"Students should have maximum opportunity for hands-on experience during class time. The instructor needs to be knowledgeable, but low key and flexible so that the threat of failure does not hang in the air" (Becker, 1984, p.31). Once students have been turned loose, they will progress at different levels. This is where the instructor must have "patience, perseverance and understanding" (Becker, 1984, p.32). The computer is so attractive to a young adolescent; they are seldom fearful of working ahead of others, so their questions and problems arise at different times.

Instructional practices must be adapted by analyzing student needs and attempting to present students with only those teaching materials needed (Holland as cited in Tennyson & Rothen, 1979). The remainder of this paper will take a look at a combination of delivery systems that can be incorporated into a middle school setting. It is designed to challenge the student and to create an environment of success and creativity. The following guidelines were designed for a computer lab setting with a differentiated curriculum for grades six,

seven, and eight.

Sixth Grade

At the 6th grade level students are acquainted with keyboarding. In some school systems, students are introduced to keyboarding during their upper elementary years (grades 4 and 5). Sixth graders are continuing to refine their ability to develop and publish their own research projects and creative writing articles. Keyboarding and formatting skills in collaboration with other disciplines help students produce their best work . There are many textbooks and software products that are available that illustrate proper procedures for keyboarding and formatting final drafts. A combination of instructional drill and practice, and cooperative learning are frequently appropriate delivery systems at this level.

A nine week session in an exploratory environment is recommended for sixth graders. At this age, students are interested in learning and obtaining as much information as possible. A semi-structured environment that encourages proper technique and format, such as instructional drill and practice, is necessary. It is important to note here that the idea of having all the knowledge and skills necessary to resolve significant problems or situations is impossible. Demonstration and drill methods help develop their skills in keyboarding.

Seventh Grade

When the young adolescent reaches the 7th grade, their interest turns to more independence and freedom. The 7th grade delivery

system for middle school computer curriculum ought to be lively, so a rotation (simulation) delivery system tends to be more appealing. Opportunities should abound for making, doing, and creating things through multiple and creative forms of expression (Beane, 1993). This is the time when educators should introduce programming software that gives the student a sense of resourcefulness and imagination. Software programs such as HyperCard (Apple,1990) and HyperStudio (Broderbund, 1993) are designed to let students draft and compose their own projects with special effects, sound and animation. The keyboarding and formatting skills that were acquired at the 6th grade level are being utilized. It is a less structured curriculum which lets students be their own author and gives them more freedom of self expression. Students can articulate and compose at the computer using creative and critical thinking skills.

Eighth Grade

At the 8th grade students are looking for application and utilization. Important knowledge and skills are necessary for extending self and social meaning (Beane, 1993). Thus, the 8th grade computer literacy curriculum must promote such knowledge and skills or else it works against the best interests of these young learners. Instructional drill and practice alternated with a rotation (simulation) delivery system tends to be most appropriate for the 8th grader.

At this point, students need to revisit keyboarding disciplines and look further into such areas as data base and spreadsheet applications.

Young adolescents at this age level are developing characteristics of maturity and their intellectual needs require a program to satisfactorily answer the question "how can this help me?" or "why do we need to learn this?" Searching for completeness and meaning along with a need to problem solve are characteristics of this age level (Beane, 1993). A combination of demonstration and the use of student-generated ideas, helps young adolescents see the need for word processing, data bases, desk top publishing, and spreadsheets.

Recommendations for Further Study

The following recommendations for further study should be considered for future research projects.

(1) Surveys should be conducted of Iowa teachers to determine what delivery systems in a middle level computer classroom are most appropriate for young adolescents.

(2) A study should be conducted determining the scope and sequence of middle level computer literacy curriculum in the state of Iowa.

(3) The effectiveness of each delivery system in relation to student achievement in computer literacy should be conducted.

(4) Conduct an extensive literature review of all delivery systems for potential use with the middle school computer literacy curricula.

Conclusion

Educators should determine what delivery systems are most appropriate based on student needs. While there are similar needs

common to all young adolescents, varying factors can determine which needs are more important to individual schools and students. A computer literacy curriculum must be flexible and adaptable to meet the changes and needs of young adolescents. Three of the delivery systems of a computer literacy curriculum have been examined. Because of social, intellectual, physical and emotional changes that a young adolescent experiences, a delivery system in computer literacy must be carefully selected to encourage learning. A combination of delivery systems should be utilized to accommodate individual differences.

REFERENCES

Allessi, S., & Trollip, S. (1991). Computer-based instruction: Methods and development (2nd ed.). Englewood Cliffs, NJ: Prentice Hall.

Beane, J. (1993). A middle school curriculum: From rhetoric to reality (2nd ed.). Columbus, OH : National Middle School Association.

Becker, H. (1984). Computers in schools today: Some basic considerations. American Journal of Education, 10, 23-37.

Becker, H. J. (1992). Computer education. In M. C. Alkin (Ed.), Encyclopedia of Educational Research (6th ed.) (pp. 232-235). New York City, NY: Macmillan International.

Beed, P. (1995). Survey of recent UNI graduates. Unpublished manuscript.

Bitter, G., & Gore, K. (1986). Curricular implications of a computer for every student. Computers in the Schools, 3, 15-21.

Bozeman, W., & Baumbach, D. (1995). Educational technology: Best practices. Princeton Junction, NJ: Eye on Education.

Dede, C. (1983). The future of computers in education: The likely evolution of computer use in the schools. Educational Leadership, 40, 22-24.

Duke, D. L. (1987). Environmental influences. In M. J. Dunkin (Ed.), The International Encyclopedia of Teaching and Teacher Education (pp. 548-552). Elmsford, NY: Pergamon.

Heinich, R., Molenda, M., Russell, J., D., Smaldino, S. (1996). Instructional media and technologies for learning (5th ed.). Englewood Cliffs, NJ: Prentice Hall.

Hlebowitsh, P.S. (1988). Technology in the classroom. The Clearing House, 62, 53-56.

HyperCard. (1990). Cupertino, CA: Apple Computer, Inc.

HyperStudio. (1993). Novato, CA: Broderbund Software, Inc.

Johnson, R.T., Johnson, D.W., & Stanne, M.B. (1989). Comparison of computer-assisted cooperative, competitive, and individualistic learning. American Educational Research Journal, 23, 382-392.

Lamb, A. & Johnson, L. (1995). Cruisin' the information highway: Internet in the K-12 classroom. Evansdale, IN: Vision To Action.

Lepper, M. & Chabay, R. (1985). Intrinsic motivation and instruction: conflicting view on the role of motivational processes in computer-based education. Educational Psychologist, 20, 217-230.

Livingston, A. M. & Miranda, S. (1995). The condition of education. Washington, D.C.: National Center for Education Statistics.

Maile, M. (1991). Cooperative learning at the computer. Solutions, 3, 1-5.

Minnesota Educational Computing Consortium. (1983). Oregon Trail. Minneapolis, MN: Author.

National Middle School Association. (1995). Middle level curriculum: A work in progress. Middle Level Educator, 14, 85-86.

Neudecker, T. (1989). Computer-intensive classroom. Technological Horizons in Education Journal, 16, 61-65.

O'Neil, H. S. & Robertson, M. (1992). Cooperative learning. In M. C. Alkin (Ed.), Encyclopedia of Educational Research (6th ed.) (pp. 1216-1221). New York City, NY: Macmillan International.

Rosenshine, B. (1987). Direct instruction. In M. J. Dunkin (Ed.), The International Encyclopedia of Teaching and Teacher Education (pp. 258-263). Elmsford, NY: Pergamon.

Schurr, S., Thomason, J., & Thompson, M. (1995). Teaching at the middle level. Lexington, MA: Heath.

Slavin, R. E. (1987). Cooperative learning and the cooperative school. Educational Leadership, 45(3), 7-13.

Slavin, R. E. (1992). Cooperative Learning. In M. C. Alkin (Ed.), Encyclopedia of Educational Research (6th ed.) (pp. 235-237) New York City, NY: Macmillan International.

Tech 2000SmartLab. (1990). Plymouth, MI: EduQuest Resource Center.

Tennyson, R. D., & Rothen, W. (1979). Management of computer-based instruction: Design of an adaptive control strategy. Journal of Computer-Based Instruction, 5, 63-71.

Watson, D. M. (1994). Computer-assisted learning. In T. Husen (Ed.), International Encyclopedia of Education (2nd ed.) (pp. 988-992) Tarrytown, NY: Pergamon.