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ABSTRACT

This study measured the level of implementation of computers and other technologies within teacher education method courses and noted how much computers were being utilized for developing problem solving abilities that could be used in the K-12 classroom curriculum. Surveys of Arkansas teacher educators from colleges affiliated with the National Council for the Accreditation of Teacher Education (NCATE) examined: demographics; personal use of computers and related devices; compliance with NCATE and International Society for Technology in Education (ISTE) recommendations for teacher educators to be knowledgeable about current practice related to the use of computers and technology and integrate them into their teaching and scholarship; and use of technology for realistic problem solving experiences. Results indicated that four respondent characteristics showed significant relationships with knowledge level and use (familiarity with ISTE competencies, age, rank, and tenured position). Survey responses suggested that methods instructors were using the Internet and World Wide Web for student assignments involving information access, email for communication, and word processed documents for class assignments. They were not using databased or spreadsheet applications for class assignments that would require higher order thinking and problem solving skills. (Contains 47 references.) (SM)

Utilization, Knowledge levels, and Instructional Application of Technology for Teacher Education Faculty

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Introduction

Goals 2000, the federal initiative for raising the educational standards for elementary and secondary schools, identified the need for improved communication skills, efficient and diverse access to information, use of higher-order thinking, enhanced problem-solving skills, and self-directed learning (Bitter, Thomas, Knezek, Friske, Taylor, Wiebe, and Kelly, 1997). Although these are not specifically technology skills, Bitter et al. (1997) suggested that technology can be used to effectively reach these goals.

The National Educational Technology Standards Project (Bitter et al., 1997) was sponsored by the U.S. Department of Education, the National Science Foundation (NSF), and The National Aeronautics Space Administration (NASA). Similar to the Goals 2000 initiative, their goal was to provide PreK-12 schools with a national set of standards for the specific application of technology into the classroom. A partner organization, the International Society for Technology in Education (ISTE), developed specific competencies for teachers and the use of the computer as an instructional tool. These competencies have been adopted by NCATE (National Council for the Accreditation of Teacher Education, 1996, 1997) as a qualifying standard for teacher education programs.

Most state standards now include a mandate for technology training for teacher liscensure (OTA, 1995). National accrediting agencies such as the National Council for Accreditation of Teacher Education (NCATE) include specific standards based on recommendations from several professional bodies with expertise in teaching with technology (Cooper & Bull, 1997; Ley, 1997). The NCATE standards provide competency areas for foundations in technology for all teachers, endorsement for educational computing, and endorsement for computer science at the secondary level. For accreditation purposes, colleges must provide folios that give evidence that coursework and field experiences are adequate for preparing teachers to be effective and confident in the use of and infusion of computers in their classroom instruction (Lan, 1997).

Statement of the Problem

Studies by the U.S. Department of Education (OTA, 1995) have reported that students are exiting their public school careers without the skills needed to be competitive in a technologically-oriented society. They lack the ability to "think through" the instructions for using a new software package. They are unable to initiate problem-solving within a collaborative group environment. Newly certified teachers have reported that they feel inadequate to use the computer as a teaching tool in their classroom. Even though the ratio is 1 computer for every 5 students, (Moursund & Bielefeldt, 1999) most instructional practices do not include a natural and spontaneous use of the computer for teaching.

Despite the need to prepare new teachers for a comfortable infusion of computer technology into their teaching, university faculty must make a choice between time spent on learning new software/hardware configurations and time spent in the pursuit of scholarly publication. Added to this are diminishing budgets for purchase of equipment, lack of administrative support, a need for faculty development and training, and self-efficacy issues.

According to Arthur Wise (NCATE, 1997), teacher education faculty have developed the same use of technology as K-12 classroom teachers. They consider computers and other technologies as a separate content area, one to be taught by faculty with expertise as the computer or media instructor. Teachers-in-training often take these courses late in their academic program (Vagle cited in Galloway & Blohm, 1997) and rarely are required to apply the use of technology in methods courses. There is little emphasis on the use of computer and related technologies as a tool for solving problems across content areas. In an effort to correct these deficiencies, the Task Force on Technology and Teacher Education formed by NCATE examined the issues that affect infusion of technology. Their goal is to ensure that colleges use a comprehensive, multifaceted approach for implementing technology within teacher preparation. Thus, this study has two parts. The first was to investigate whether teacher education faculty have the knowledge level and skills to infuse current technologies into methods courses, and the second, was to investigate whether they are using strategies that develop higher-order thinking for realistic problem-solving.

Literature Review

Transfer to the Workplace

The question is often asked, "will instructional strategies used in our schools transfer to the work environment?". If we support Goodlad's position that one of the purposes for schools is in the production of good citizens (1994), then we are concerned about developing computer skills that are usable within diverse problem situations. Based on this premise, NCATE standards recommend that teachers demonstrate knowledge of uses of computers in business, industry, and society.

Lowther and Morrison (1998) warn that computers are not being used in school classrooms as they would be used in the workplace. Drill-and-practice software, word processing, and games are the most common applications for student use. With the dominant role of computers in business and industry, it seems logical that students should be using computers as tools to "...answer questions, solve problems, or share ideas and results". (Lowther & Morrison, 1998, p. 33) Lowther and Morrison recommend that teachers design lessons that use spreadsheets and databases to analyze data, show comparisons, and see relationships between concepts. The strategies for using this type of software are based on collaborative, problem-based learning that is more closely identified with workplace applications.

Davis (1997) distributed surveys to 300 perspective employers who, over a period of time, visited the Cornell University campus for the purpose of recruiting new graduates. The results of his survey showed that employers are looking for people who are computer literate. Basic skills in word processing, database, and spreadsheet applications are important, but beyond familiarity with software packages, they are looking for people who can solve problems, think logically, and communicate clearly. Along with computer literacy, they are looking for employees who can, "...grasp concepts that can be applied to many situations across programs" (p. 77).

The University of Arkansas at Little Rock surveyed information technology companies in Arkansas. The study was conducted for the purpose of determining human resource needs for businesses with technology-based services within the state. The results showed "..... fewer than 500 Arkansans will be qualified to fill the job openings that high-tech companies anticipate having this year" (as cited in University of Arkansas at Little Rock, [On-line], 1999). Teachers have a responsibility to teach problem-solving within changing contexts. Students need computer skills that will transfer from problem to problem and from school to the workplace.

<u>Effectiveness for Learning.</u>

There has been some debate about the effect of computers for improvement in learning (Pepi & Scheurman, 1996). Many will argue that computers are no more than motivational toys used primarily for rewards and for drill-and-practice sessions. In an effort to provide research-based statements in support of the effectiveness of computers for learning, the U.S. Department of Education contracted the Rand Organization to investigate these questions. Their report (Rand Organization, 1998) is a comprehensive investigation of schools having exemplary programs with technology-rich classrooms. The data from an investigation of these schools showed improvements in many areas. These included improvements in test scores, retention, job placement, and increased interest and enthusiasm by students. However, the data showed that not all programs had definite effects from computer-based instruction. The research team reported that the effects from these technology-rich environments were dependent on the quality of implementation. The effective use of strategies was linked with significant improvements in student achievements. The research team concluded that two major influences appear to contribute to the increasing need for the infusion of computers. The first is the importance of information technology in the workplace and need for technology-related skills for employee success. The second major influence is the " . . . growing body of research in the cognitive sciences that suggests that students learn and better retain what they learn when engaged in authentic learning tasks" (Rand, 1998, p. 11). Clearly, the instructional usefulness of computers situated within real-world problems is evident from this report.

<u>Cognitive Processes and Technology</u>

Knowledge is a personal product for each individual. As the student interacts with the environment, knowledge is represented in many forms. These include intuitive, computational, concrete, and sensory representations (Brown, Collins, & Duguid, 1989; Choi & Hannafin, 1995). Knowledge can be encoded in short-term memory, which lasts only momentarily, or encoding can place knowledge in long-term memory. Situated-learning theory suggests that knowledge encoded while learners are engaged in real-world, authentic activities is more durable. We make meaning of new information based on what we already know.

Learning is also a process of enculturation. Encounters with new information, objects, and activities mean different things to different people. When learners are engaged in an activity that is simulated to closely represent a realistic event, they use cultural knowledge to make meaning of what they are learning. The research for authentic learning activities (Cognition and Technology Group at Vanderbilt, 1990) has shown that learning is enhanced through the use of technology-based lessons situated within a realistic context.

Cognitive Apprenticeships

Cognitive apprenticeships are useful for guiding learners from their present state of knowledge to the desired state of knowledge. Instructional strategies that cognitively guide the learner at a comfortable pace are within his or her "zone of proximal development" (Vygotsky, in Ormrod, 1998, p.385). In addition, cognitive apprenticeships use cultural elements coupled with social interaction to teach concepts and skills (Brown et al., 1989; Collins, in Idol & Jones, 1991). An example of a cognitive apprenticeship would be the coaching and prompting of a student teacher by his or her cooperating teacher in the field. This may be accomplished through face-to-face interaction, or it may be via email correspondence (Thomas, Clift, & Sugimoto, 1996).

Cognitive apprenticeships provide valuable learning environments for the restructured classrooms that use peer coaches, facilitative teaching strategies, and collaborative group projects. Technology can be used to connect the learner to experts at distant sites. The literature provides many descriptive reports for the use of chatboards, online projects with agencies such as NASA (Oliver, 1997), and mentoring relationships with teachers outside the classroom.

Collins (1991) recommends the use of computers as intelligent tutoring systems for developing cognitive apprenticeships. The computer, as an intelligent tutor, is able to provide models for processes and expert performance, arenas for articulation, and exploration within microworlds. Even though Collins (1991) described these capabilities before the current level of sophistication for hypermedia, multimedia, and the World Wide Web, he was able to clearly link cognitive processes for optimal learning with specific teaching strategies such as coaching and modeling. Computers are able to generate environments that provide situated learning not possible through text and classroom simulations. Models include both world processes (such as how electrons move) and demonstrations of expert performance (such as geometry proofs or the steps for calculating long division).

One clear advantage for multimedia is the capability for presenting a procedure or a concept through oral communication while simultaneously presenting moving pictures and diagrams. The learner may then interact with the tutor through exploratory input and data manipulation. The tutor also has capabilities for demonstrating the trial-and-error process for solving a problem. False starts and revisions, strategies for correcting errors, and explanations for strategies can be included within the tutoring system.

The computer is a patient coach that can observe, over time, and offer feedback appropriate for the learner's needs. The system can be designed to fade as the learner gains more skill to solve the problem or complete the procedure. Even though somewhat impersonal, it is also entirely unbiased while providing instruction within the student's zone of proximal development.

Shared knowledge in a Community of Learners.

Email and telecommunications technology provide a broad arena for collaborative learning environments. Based on the work of Vygotsky (1962), Brown and Campione (1996) emphasized the importance of dialog for constructing new knowledge that is personally meaningful for the learner. Whether face-to-face or through electronic mail, learning is enhanced as students are able to define terms, concepts, and ideas through dialog. The use of telecommunications provides opportunities for verbal exchange with experts from distant locations, guidance from supervising faculty, and peer-support from other preservice teachers. This is possible even when conflicting schedules, inadequate transportation, and heavy workloads might prevent communication in person or by telephone. Schrum and Berenfeld (1997) list several advantages for online communication. These include greater thoughtfulness with written reflections. There is more emphasis on the content of the communication rather than the social and personal characteristics of persons involved in the dialog. In addition, there is the likelihood for greater cognitive demands using written reflections.

Elementary school teachers may be limited in their expertise for one or more particular subject areas (Brown & Campione, 1996). The knowledge base within certain schools may become relatively static and perspectives may be narrow. While telecommunications is a useful tool for accessing additional resources, it also opens a line of communication for those teachers in rural and isolated areas of the country. Those who work with special learners, in particular, find themselves distanced from colleagues and other professionals who could offer support for this often stressful and frustrating area of the teaching profession (Werner, 1996).

Jonassen (1995) suggests that we should build a community of learners in which students are "confronted with meaningful, real-world problems [where they] may apply more sophisticated repertoires of knowledge" (p.60). Jonassen believes that reflective, noncompetitive dialog results in knowledge construction, rather than knowledge reproduction. Information technologies should not be used primarily to deliver instruction but as tools for thinking and for generating a product. The power of the tool is in the collective vision that results from a community brought together.

Authentic data and ill-defined problems.

The Office of Educational Research and Improvement (Means & Olson, 1995) has sought to discover the effects of technology for higher-order learning. This is accomplished as classrooms are restructured to accommodate student-centered instructional strategies that use open-ended problems for developing higher levels of learning.

Studies in learning and cognition (Chi & Ceci, 1987) have found that children learn at higher levels and transfer skills to new problems when knowledge is gained from everyday experiences. Learning within context is based on the use of authentic data and ill-defined problems. While authentic data need not be manipulated through the use of technology, Means and Olson (1995) found that teachers report several distinctive areas in which technology had a strong effect.

First, for those schools connected to the Internet, there was a considerable increase in the use of outside resources. Through the use of Internet, students were able to gain knowledge from sources other than their classroom teacher which, in turn, changed the relationship between teacher and learner.

Many of the teachers reported the experience of learning along side of their students, and found that this provided new perspectives for the planning of instruction.

Through case-study analysis, Means and Olson (1995) found that the quality of students' projects and artifacts greatly improved when using technology. For example, working in pairs, students examined and reexamined word processing documents through the use of the editor and spellchecker. They were able to use the computer in a realistic application to produce a document. In addition, they were engaged in dialog and collaboration, which contributed to improved learning. Students were able to talk about the variables in the problem just as they would in a real-world work environment. In addition to collaborative dialog, students were required to manipulate data using spreadsheets and databases. Teachers reported a deeper understanding of complex tasks and attributed this to the use of data manipulation on the computer. Through the use of the software for solving problems, technical skills improved also, thus self-esteem increased.

Other research (Thorsen & Barr, 1997) has been reported in support of productivity software for instruction. Databases should be used for sorting, making queries, and organizing information. Spreadsheets are valuable tools for estimation and what-if thinking. Presentation software can be used to help students sift through large quantities of information, select what is important, and present a logical summary of the information (Davidson, Deuser, & Sternberg, 1994). The application of these tools is linked with NCATE standards that recommend the use of computers for problem-solving and data collection (National Council for Accreditation of Teacher Education, 1996).

<u>Information Processing and Problem-solving</u>

The World Wide Web (WWW) and web browser software can be used to develop cognitive processes that connect new information with prior knowledge. Because of the magnitude of the Web and the unique capabilities of hypermedia, students are able to investigate many sources of information. The ease in which students can follow a variety of search paths has the advantage of relating new information to the differences in students' prior knowledge. Kafai and Bates (1997) observed elementary students' high motivation as they searched the web to gain information literacy skills. They also developed critical thinking skills as they assessed the usefulness of a variety of sites. Through their evaluations, they determined if a particular site should be included in their annotated bibliography of sites to be published on the web for other students and teachers. Here is an example of an authentic problem that uses technology for linking prior knowledge to many sources of new information. In addition, students must form much more sophisticated knowledge structures through the evaluation and categorization activities.

Another significant advantage for the Web as an instructional tool is access to global sources of information. As a tool for authentic problems and activities situated within context, the web " . . . dissolves the artificial wall between the classroom and the real world" (Hackbarth, 1997, p. 61). By using this tool, research becomes a process rather than merely an information gathering activity (Ellsworth, 1997; Kafai & Bates, 1997;).

Rakes (1996) described resource-based learning as the interaction of students with a wide variety of resources for answering a question or solving a problem. These resources include printed text, electronic databases, and other computer-based resources such as the WWW.

The emphasis is on the process for gathering, analyzing, organizing, and evaluating information, but the outcome extends beyond information-gathering.

Hill and Hannafin (1996) observed college students as they searched the web for information. They reported that students who have some prior knowledge are more efficient in their searches. This is because there are more topic-related terms from which they can draw upon to enter as search descriptors. Novices used more low-level search strategies and yielded less productive searches. This once again relates to cognitive research, which emphasizes the importance of how knowledge is structured (Chi & Ceci, 1987; Kail & Bisanz, 1982). Interconnections among chunks of knowledge is important in how an individual processes new information and solves problems. The amount of content stored is important, but the number and pattern of links among the structures is also important. Knowledge becomes more accessible as the number of links increases and as the patterns become more sophisticated. These patterns will vary by individual and contributes to the usefulness for global electronic resources.

Modeling as a Teaching Strategy

Much of the literature reports that teachers use strategies that were observed in their own college classes and training (Blanchard, 1994; McKenzie, 1997; Robyler in Northrup, 1997). Preservice teachers use the tools and adopt the philosophies of those they observe. These include college faculty and mentoring teachers from their field experiences. Teacher education faculty have a responsibility to model teaching behaviors that research has shown to be most effective. This would include the use of computers and other emerging technologies for developing problem-solving skills and higher level thinking (Cognition and Technology Group at Vanderbilt, 1991; Jonassen, 1996).

Barron and Goldman (1994) challenge teacher education faculty to be aware of opportunities to model effective teaching strategies. They point out that the effects from college courses will be strong since these will be the most recent models of instruction in subject areas for which preservice teachers will be teaching. Student-centered, project-based courses will leave strong impressions as new teachers step into their first classrooms. Several studies were found to support the use of modeling strategies during teacher training. McKenzie and her colleagues (McKenzie, Kirby, Clay, & Davidson, 1997) sent questionnaires to selected technology trainers and media specialists in northwest Georgia. They report that student use of technology in K-12 environments models that of their teachers. The conclusions from their study suggest that modeling the use of technology is an effective strategy and should be used by the entire faculty in programs for teacher education. Blanchard (1994) investigated the effects of technology infusion into language arts and reading education. Blanchard reports that the potential for the use of technology for teaching reading and language arts will "remain untapped" (p.195) until teacher educators can model the advantages for use of technology within methods courses.

Cooper and Bull (1997) have made recommendations that they believe are necessary for the successful infusion of technology into teacher education programs. One area of emphasis is the importance of preservice teachers having opportunity to observe the use of technology in field experiences and in the strategies used within their own methods courses. The Milken Exchange on Education Technology reports that "most teachers do not routinely use technology during field experience and do not work under master teachers ....who can advise them on IT use" (Moursund & Bielefeldt, 1999, p. 2).

These and other reports suggest that an important issue in the preparation of future teachers is the provision of models that guide students in the effective use of technology. Teacher education faculty need to model the use of technology within their math, science, reading, and social studies classrooms. In addition, much of the literature reports that there is a need for education students to visit technology-rich schools and see veteran teachers who have proven records for effective use of computers within their daily teaching and classroom activities.

The purpose of this study was to measure the level of implementation of computers and other technologies within teacher education methods courses and how well the computer is used for developing problem-solving abilities that can be used in the K-12 classroom curriculum. The following questions were generated to match the purpose stated above.

First, to what extent do faculty report the use of instructional strategies based on curriculum guidelines as stated in the Recommended Foundations in Technology for All Teachers (as cited in International Society for Technology in Education, [On-line], 1999, 2001). Second, what strategies are faculty using that support learning for realistic problem-solving that will transfer to the workplace? Third, based on the recommended competencies by the ISTE (International Society for Technology in Education, 1997, 1999, 2001) for teacher education candidates, what is the reported knowledge level and utilization of these competencies by teacher education faculty? Fourth, are faculty including strategies that provide models for technology-using teachers and field experiences that include the use of computers for instructional purposes? And fifth, is there a relationship between the instructional use of computers and certain faculty characteristics?

These characteristics include: rank (current position), tenure or nontenured status, highest degree earned, years of teaching in higher education, years of teaching in K - 12, years of teaching in business & industry, age, gender, content area for the courses taught, familiarity with ISTE standards, and affiliation with a public or private institution.

Sample

The method used to answer these questions was to survey a sample of teacher educators from the state of Arkansas. These were selected from colleges affiliated with the National Council for Accreditation of Teacher Education (NCATE). According to studies by the Milken Exchange on Education Technology (Moursund & Bielefeldt, 1999), NCATE member institutions tend to report more instructional technology integrated into the regular classroom instruction than non-NCATE institutions. A total of 14 colleges in Arkansas hold full accreditation and 2 are accredited with probation. Purposive sampling was used to identify instructors within certain disciplines. Only teacher educators with a specialty in secondary methods for foreign languages, English, science, math, or history, and educators who specialized in elementary teaching methods for classroom management, reading, language arts, science, math. or social studies were selected for the study.

Survey Instrument

Survey Items were developed by the researcher based on the review of the literature (Barron & Goldman, 1994; Bitter et al., 1997; Jonassen, 1995, 1996; Means & Olson, 1995; Lowther & Morrison, 1998; Rakes, 1996; U.S. Office of Technology Assessment, 1995), recommended standards developed by the International Society of Technology in Education (1997, 1999, 2001), and NCATE recommendations for performance based standards for teacher education programs (National Council for Accreditation for Teacher Education, 1996, 1997). In addition, the survey was pilot-tested by selected faculty from two universities. Their recommendations were used to refine the questions so that data would be useful for answering the research questions, and to prepare a concise survey which would increase the probability for a high response rate.

The questionnaire was divided into four sections. The complete survey is included in Appendices. Section I contained demographic questions such as age, years of service, gender, and specialty area. Section II contained items that were designed to measure personal use of computers and related devices. The first three items were directly linked to NCATE recommendations for teacher education faculty. The remaining two items were linked to ISTE recommended competencies for K-12 teachers. Respondents were asked to rate themselves on the frequency of use by marking 1, 2, 3, or 4 where 1 = never and 4 = frequently.

Section III contained items used to gather data for reported knowledge levels for software applications and simple hardware configurations. These items were designed to measure compliance with NCATE/ISTE recommendations for teacher educators to be "knowledgeable about current practice related to the use of computers and technology and integrate them in their teaching and scholarship" (as cited in National Council for Accreditation of Teacher Education [On-line], 1997). Respondents were asked to rate themselves on their knowledge level on a scale from 1 to 4, where 1 = none and 4 = high.

Section IV contained items designed to measure the use of technology for realistic problem-solving experiences. The first 13 items related to the use of computers and other technologies for developing problem-solving skills and higher levels of learning. Respondents were asked to rate themselves on the frequency of use for each strategy by marking 1, 2, 3, or 4 where 1 = never and 4 = frequently. The last items on the survey were related to teaching about computers in business and industry and teaching about copyright issues.

A total of 269 surveys were mailed to faculty at their college address on April 15, 1999. Mail-outs included a cover letter explaining the purpose of the survey and the importance of the study. A total of 125 usable surveys were returned. The response rate was calculated based on the number of usable responses divided by the valid number of mail-outs for a response rate of 56%.

Data Analysis

SPSS was used to calculate means and standard deviations for each of the individual survey items. In addition, cross tabulation and two-way chi-square tests were used to determine relationships among demographic variables and technology utilization. Pearson correlation coefficients were used as an index to determine the strength and direction of relationships among the reported scores from responses to items in Sections II, III, and IV of the survey. These were used to determine correspondence between reported knowledge levels and personal use and use in teaching. Pearson correlation coefficients were used as an index to determine the strength and direction of relationships among the reported scores for use of strategies for higher level thinking and software applications such as word processing, database, and spreadsheets.

Results and Discussion

Demographics

Over half the respondents were (58%) 50 years of age or older and 26% were between the ages of 40 and 49. Therefore, almost 85% of teacher education faculty who responded to the survey were over age 40. There were nearly equal numbers for male and female faculty (male, n=60; female, n=65). About half the faculty reported 1 - 10 years of teaching in K-12 environments. Only a small percentage (7.2%) taught more than 20 years in K-12. Years of teaching in higher education were more evenly spread across the distribution. A large number (42.4%) had taught 1 - 10 years, while 26% had taught 11 - 20 years. With 30% teaching over 20 years, the majority of the respondents had taught many more years in higher education than in the K-12 environment. Many of the respondents reported teaching in more than one content area. The largest representation for courses came from special education (n=47), classroom management (n=45), elementary language arts (n=41), and integrated methods courses for elementary education (n=40).

The variable holding the strongest interest for the study was faculty familiarity with ISTE standards for technology in teacher education. Twice as many respondents were *not* familiar (n=83, nonISTE) as those who were familiar (n=42, ISTE) with ISTE standards. Chi-square two-way tests were used to analyze the relationship between familiarity with the standards and the personal use, knowledge level, and use of technology in teaching. All three categories in the survey had survey items significantly related to the ISTE/nonISTE variables.

In the category for *Personal Use*, ISTE faculty reported a higher frequency of attendance at technology related conferences and more frequently read journals for learning about technologies , $X^2(3) = 21.70$, $p = .000$; $X^2(3) = 10.35$, $p = .016$. In the category, *Knowledge Levels for Compuer Skills,* only one skill showed a significant relationship with familiarity with ISTE, "...ability to use special software for downloading, compressing, and expanding files...." , $X^2(3) = 8.24$, $p = .041$.

In the category, *Use in Teaching*, several items were associated with familiarity with ISTE. Items related to the use of a database applications for making comparisons among concepts and for organizing information showed significant values for chi-square, $X^2(3) = 9.05$, $p = .029$ and $X^2(3) = 14.77$, $p = .002$, respectively. Over half of the ISTE faculty reported moderate (24%) to frequent (29%) use of a database for organizing information in a lesson activity, compared to a smaller percentage of the nonISTE faculty who reported only moderate (23%) use of this strategy.

Chi-square was significant, $X^2(3) = 11.24$, $p = .01$, for the item related to the use of multimedia for producing content-related projects as a teaching strategy, though very low frequency of use by either group was reported for this item. Nearly half of the nonISTE faculty (47%) reported *never* using scanners and other digital equipment compared to ISTE faculty (48%) who reported, at least, a moderate use of scanners or digital cameras for teaching ($X^2(3) = 8.46$, $p = .04$).

Chi-square was significant, $X^2(3) = 11.46$, $p = .009$, relating ISTE with the use of simulation software that allows students to have real-world experiences not possible within the regular classroom. ISTE faculty reported moderate (26%) to frequent (9%) use of simulation software, compared to nonISTE faculty who reported *never* (51%) or seldom (38%) using simulation software with their teaching.

Chi-square was significant, $X^2(3) = 8.82$, $\underline{p} = .03$, which related teaching computer-uses in business, industry, and society with familiarity with ISTE. For the nonISTE faculty, 22% reported teaching about computer-uses compared to 40% of the ISTE faculty who reported moderate to frequent use of these concepts in their teaching. A similar item, "lessons which include awareness of the ethical and legal uses of computers", was significantly related to familiarity with ISTE. The chi-square was significant, $X^2(3) = 15.90$, $\underline{p} = .003$, which indicates that familiarity with ISTE was positively associated with teaching these concepts in their courses. Only 5% of the nonISTE faculty frequently teach these concepts, whereas 24% of the ISTE faculty frequently teach about the legal and ethical uses of computers.

Two-way chi-square tests for independence showed significant positive relationships between age and reported *knowledge levels for computer skills.* The strongest relationships were evident in the reported knowledge for *basic troubleshooting techniques; installation of a variety of software packages, and connecting devices such as printers, scanners*, etc. (ages 30 - 49). Ages under 30 and over 50 showed no significant relationship with any of the items in the Knowledge category.

In the category for Use in Teaching, faculty age 40-49, showed a significant relationship between this age and the use of database and spreadsheet applications in their teaching.

For the variable, tenure track, there was a significant, positive relationship between tenure track positions and two of the categories. First, *knowledge level for connecting scanners, printers, and modems was higher for tenure track* *faculty and second, use of presentation software for class, workshops, conferences*, etc. was used more frequently by tenure track respondents.

Chi-square revealed a significant relationship ($X^2(12) = 30.27$, $\underline{p} = .003$) between levels of rank and the reported use of assistive technology. The use of adaptive assistive devices with students with special needs was reported more frequently by full professors (26% for moderate use) than for associate (10%) or assistant professors (7%) for moderate use. Rank was also significantly related to skills in the *installation of a variety of software, and connecting devices* with the rank of assistant professor and associate professor. Very low levels of knowledge were reported for instructors and full professors.

Chi-square revealed a significant negative relationship ($X^2(12) = 27.56$, $\underline{p} = .006$) between number of years teaching in higher education and use of database applications for *comparing and contrasting a variety of concepts*. There was a low use of database applications for all groups. Those faculty (59%) having taught 20+ years in higher education reported the lowest frequency of use for database in their teaching.

Chi-square tests were significant, $X^2(12) = 27.47$, $\underline{p} = .007$, showing a positive relationship between number of years taught in K -12 and reported use of multimedia software for lesson activities. Those with no years (83%) teaching in K - 12 reported *never* using multimedia software in lesson activities.

Pearson correlation coefficients showed a strong positive relationship between the use of applications such as database, spreadsheet, and web browsers (WWW) for problem-solving strategies. The data show that faculty are using the Internet for gathering information and open-ended problems. Strategies using database files for making comparisons were related to the use of spreadsheet for organizing large amounts of information and for making predictions. The use of word processing for generating booklets and reports was not significantly related to strategies for making predictions. The strength of these correlations suggest that faculty who use database and spreadsheet applications for comparing concepts and problem-solving also use these applications for organizing information and making predictions. Based on the correlation coefficients, the use of word processing was not significantly related to the use of spreadsheets for making predictions; therefore, there is little evidence to suggest frequent use of word processing for the purpose of writing narrative results from problem-solving activities.

In the Table below, means have been summarized for survey items related to application of technology in instruction. Scores were ranked from 1 to 4 with 1 indicating *none* or *never* and 4 indicating *high* or *frequently*. The means show that faculty reported frequent use of Internet and email, use of World Wide Web for problem-solving, and word processing for generating books and reports. The reported use of database and spreadsheets applications for instructional activities was lower when compared to reported use of Internet and word processing. Ranked scores for other strategies such as the use of simulations, multimedia software and the use of digital equipment were below the median score of 2.0. The data show that reporting faculty from Arkansas are integrating computers into their instruction within three main areas, (1) use of email and

Internet, (2) use of World Wide Web for problem-solving, and (3) use of word processing to generate booklets, reports, and newsletters.

Item Means for Use in Teaching Ranked In Descending Order of Frequency

Survey Items Related to How You Teach with Technology	N = 125 M	SD
Internet and /or email to locate information about the teaching profession	3.51	.79
Internet to locate a variety of resources to solve an open-ended problem	3.40	.77
word processing to generate booklets, reports, or newsletters related to students' subject area	3.22	1.02
student generated lesson plans that integrate the use of the computer into their teaching strategies	2.60	1.08
database or spreadsheet program to organize large amounts of information	2.16	1.05
database program for comparing and contrasting a variety of concepts related to subjects they plan to teach	2.03	.99
electronic portfolios or webpages as a method for assessment and students' self-evaluation	1.94	.97
projects that use scanners or digital cameras	1.92	.91
use of software for drill-and-practice within students' subject area	1.81	1.19
use of tutorial software that teaches concepts linked with students' subject area	1.78	.89
use of simulation software that allow students to have real-world experiences not possible within the regular classroom environment	1.77	.87
spreadsheets for making predictions and generating more than one solution to a problem	1.63	.83
multimedia software such as *Hyperstudio* . . . for projects related to students' content area	1.62	.84

Scores were ranked from 1 to 4 with 1 indicating none or never and 4 indicating high or frequently

Conclusions and Recommendations

Research in learning and cognition has presented evidence in support of open-ended and authentic problems to improve problem-solving skills. Representatives from business and industry express concerns about new employees who are unable to solve problems independently. One purpose for this study was to investigate the frequency for the use of strategies that develop problem-solving skills. Based on the reported use by respondents, *instructional strategies for comparing and contrasting concepts and for making predictions* was infrequent. Those who reported a moderate use for problem-solving strategies included the use of database and spreadsheet applications. However, there were no strong correlations between the use of these applications and word processing. This would suggest that few culminating activities that extend beyond data manipulation were planned. There was little evidence to suggest that instruction required students to draw conclusions and express these in written narratives.

Only a small percentage of the respondents indicated teaching methods courses in math or science. This may be the reason for the low correspondence between use of database/spreadsheets for making predictions and use of word processing. It may be common practice in science and math classrooms for students to collect and manipulate data, then calculate formulas to reach mathematical outcomes. Results from this study suggest that methods instructors, in all content areas, should examine the benefits for extending assignments beyond mere collection and analysis of data. Included in the assignments should be strategies that require students to generate their conclusions for a narrative report.

Research in the use of online projects for elementary and secondary students (Oliver, 1997; Windschitl, 1998) have reported that students gather and enter data into spreadsheets but representative samples from these studies did not sort and manipulate data well enough to report their conclusions from the information collected. It appears that methods classrooms, from this study, may have similar limitations.

There has been some increase in reported use for email and web browsers for teacher educators in Arkansas. In a regional report by the Southeast Islands and Regional Technology Consortium (Office of Educational Research and Improvement, 1998), only 11% of Arkansas teacher education faculty frequently used the World Wide Web for solving open-ended problems and to locate information about the teaching profession.

The data from this study showed over 50% of Arkansas methods instructors responded with frequent use of the web for solving open-ended problems. For the use of email, Southeast and Islands Regional Profile (SEIR) reported (ITRC, 1998) a low use of email for the Arkansas sample. At the time of the SEIR study, limited access may have been a barrier, and the result was a lower use in their instruction. For this study, 66% of the respondents reported a frequent use of "Internet or email to locate information about the teaching profession". Although increased use for this strategy is a positive trend that complies with ISTE recommendations, consideration should be given to the use of Internet as a tool for problem-solving. For maximum instructional benefit, distinction should be made between resources for online collaboration, discussion threads, listservs, and email compared to less personalized resources available through websites. In addition, instruction should be planned that includes utilization of World Wide Web as a source of information for building cognitive links, providing a rich network of ideas and concepts useful for constructed learning.

Similar cognitive strategies can be used with hypermedia or multimedia. The data showed a low use of multimedia software such as *Hyperstudio* or *Kidpix*, however there is a relationship between years of teaching in K - 12 and frequency of use. Even though reported use was low for all groups, those who taught 11 - 20 years in elementary or secondary education reported a more frequent use. Experiences with children and youth seem to be related to use of multimedia. Perhaps these faculty, reporting a more frequent use, remember the motivational benefits for the interactive audio and video capabilities of multimedia. In addition to motivation, multimedia projects provide opportunities for students to personalize their learning by producing original artifacts with newly learned concepts and reflects individual differences in the students.

There are other benefits for the use of multimedia, tutorials, simulation software, and drill-and-practice. Multimedia tutorial software can be used to provide multiple resources for open-ended learning environments. Teachers are no longer considered the only source of information and the solitary voice of authority in the classroom. Similar to open-ended learning, tutorial software can be used for learning activities for constructivist environments by providing additional sources of information. Simulations can be used to provide situated learning activities that place the learner within a real-world situations that will easily transfer to the workplace environment. Drill-and-practice software, tutorials, and simulations received low scores for frequency of use. Many faculty may not be aware of current research in the use of drill-and-practice as an effective tool for cognitive processes requiring recall and automaticity in certain skills. Future studies could investigate knowledge levels for these specific types of software, and how they can be used to actually increase learning. Faculty development may be needed to increase awareness for the use of technology as it relates to cognitive processes for recall, automaticity, transfer, and problem-based learning and relate this to faculty attitudes and value for this type of technology.

There were clear relationships between knowledge levels and frequency of use with certain personal characteristics of the respondents. The following profile describes those who responded to the survey. Most of the respondents were at mid-life or older. Most of their teaching experiences were in the academic environments rather than K - 12, and very few reported having experiences training in business and industry. Most had a doctorate and were in tenure track positions. The majority of the respondents were not familiar with ISTE. The courses most frequently taught were classroom management, special education for secondary and elementary children, language arts, and social studies.

Since over half of the respondents were not familiar with ISTE, future studies may examine faculty development opportunities related to NCATE recommendations for technology. Faculty may be aware of technology standards as recommended for NCATE accreditation purposes, but may not relate these to specific skills and knowledge levels defined in the ISTE standards. It may also be beneficial for more studies that link specific ISTE competencies with current studies in cognition and learning. Many faculty may still perceive technology as a separate and unique area of study. They may not conceptualize computers as an integral part of the entire curriculum.

Age, years of teaching, and rank also were factors. Beginning at age 30, the level of knowledge and frequency of use increases with years of teaching, age, and rank, but begins to decline as faculty pass age 49 and advance to full professor. This suggests that, for methods instructors in Arkansas, accumulated years of service may not be linked with the active pursuit of technology-related research for teacher education. The literature reports that most faculty are limited in the amount of time that can be dedicated to learning new technology. Service and traditional research pursuits place limitations on the amount of time available for learning new software and hardware needed for integration into their courses. Tenure and promotion committees need to include recognition for innovative instructional uses of technology as an incentive for professional development. Administrative support is also needed and should provide adequate access to labs, hardware, and software libraries. NCATE Accreditation guidelines stipulate access to hardware, software and periodic review of the available resources.

In conclusion, the characteristics of the respondents that showed significant relationships with knowledge level and use were familiarity with ISTE competencies, age, rank, and tenured position. The data show that a tenured assistant professor between the ages of 40 and 49 who is familiar with ISTE technology recommendations would most likely have a higher knowledge level and use of computers in their methods instruction than other faculty from the Arkansas sample.

The sample of Arkansas faculty, who were self-reporting in their knowledge levels and frequency of use, limited the conclusions drawn from this study. In order to gain more information pertaining to the reasons for lack of use, possible barriers, and lack of access, the study should be extended to include interviews with open-ended questions. Focus groups that represent a sample from both high and low level users of technology should be selected.

The scale used for ranking responses to the survey items also limited the study. A replication of the study should use a scale that defines the ranking more precisely. The lowest level (*none* or *never*) and the highest level (*high* or *frequently*) were identified, however, interpretation of the responses would be more accurate if the value for 2 were defined as *seldom* or *low* and the value for 3 defined as *often* or *moderately high* and indicated on the survey form.

The analysis of the responses for the item related to assistive technology was limited since the term *assistive technology* was not clearly defined. Educators within the field of special education would be more interested in the reported use and knowledge levels for specific devices and software designed for special learners. This item may have been vague which resulted in responses for less frequent use even though there was a high number of respondents who indicated special education as their specialty area for teaching. Survey questions should be developed that would gain information specific to physical and cognitive disabilities. Even though this would be considered a broad and diverse program within teacher education, ISTE recommendations do not specify a particular area of special education for the use of assistive technology.

The results from this study suggest that older, tenured faculty should remain active in professional organizations that provide current research and information that supports the application of technology to instruction. Those at the rank of assistant professor, reporting higher knowledge levels and frequency of use for computers in their teaching, should look for professional development opportunities that will help them remain knowledgeable in an area of education that will only continue to challenge users with new innovations.

Familiarity with ISTE was clearly linked with frequency of use and knowledge levels. The strong relationship between familiarity with technology standards and the application of those standards in one's teaching and professional activities seems to be a benefit for membership in technology-related organizations. The research arenas that are encouraged and sponsored by these organizations provide faculty with current information for an area of education that changes rapidly and offers support for those with low end skills and little time for training and development.

Survey responses suggest that methods instructors are using the Internet and the World Wide Web for student assignments involving information access, email for communication, and word processed documents for class assignments. They are not using database or spreadsheet applications for class assignments that would require higher order thinking and problem solving skills. Those with teaching experience in the K12 environment were more likely to use multimedia software in their coursework; however, the use of this type of software was clearly deficient by the majority of instructors who responded to the survey. There is a need for methods instructors to examine course materials for concepts related to the social and legal issues in technology in education. One such important area of study is copyright and students' use of intellectual property. In addition, teacher education programs should investigate strategies for modeling the use of computers in the K12 classroom and for their own class presentations. Survey responses also indicate that assistant professors, age 40-49 in tenure track positions show a stronger tendency to use computers for their scholarly activities and show more technology related skills than younger or older colleagues. There were no significant differences reported by academic discipline, gender, or affiliation with public versus private institutions.

Finally, faculty who are familiar with national standards such as those recommended by ISTE, show a greater use of technology in their coursework and are characterized by more initiative for adopting technology in education. Based on these outcomes, it is recommended that faculty evaluation forms include assessment of teaching strategies that use extended activities for higher level learning as well as data manipulation. Instruction should also include extended activities for organizing information, drawing conclusions, and making predictions. Database, spreadsheet, and Internet resources would provide the tools needed for the complex activities recommended for problem-solving, and transfer of learning. Faculty evaluation should also consider the number and quality of field experiences that recruit and select supervising teachers that model these strategies.

References

Barron, L. C., & Goldman, E. S. (1994) . Integrating technology with teacher preparation. In B. Means, (Ed.), Technology and education reform: The reality behind the promise (pp. 81-109) . San Francisco, CA: Jossey-Bass, Inc.

Bitter, G., Thomas, L., Knezek, D. G., Friske, J., Taylor, H., Weibe, J., & Kelly, M. G. (1997) . National educational standards: Developing new learning environments for today's classroom. NASSP Bulletin,81(592), 52-57.

Blanchard, J. (1994) . Teacher education and the integration of technology: a reading and language arts perspective. Journal of Information Technology for Teacher Education,3(2), 187-198.

Brown, A. S., & Campione, J. C. (1996) . Psychological theory and the design of innovative learning environments: On procedures, principles, and systems. In L. Schauble & R. Glasser, (Eds.), Innovations in learning: New environments for education (pp.289-325). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Brown, J. S., Collins, A., & Duguid, P. (1989) . Situated cognition and the culture of learning. Educational Researcher, (Jan-Feb), 32-42.

Butterfield, E. E., & Nelson, G. N. (1989) . Theory and practice of teaching for transfer. Educational Technology Research and Development, 37, 5-38.)

Chi, M. & Ceci, S. J. (1987) . Content knowledge: Its role, representation, and restructuring in memory development. In H. W. Reese (Ed.), Advances in child development and behavior (p. 91-142). Orlando, FL: Academic.

Cognition and Technology Group at Vanderbilt, (1990) . Anchored instruction and its relationship to situated cognition. Educational Researcher, (Aug/Sept), 2-9.

Collins, A. (1991) . Cognitive apprenticeship and instructional technology. In L. Idol & B. F. Jones (Eds.), Educational values and cognitive instructional implications for reform (pp. 121-138). Hillsdale, NJ: Lawrence Erlbaum Associates.

Cooper, J. M., & Bull, G. (1997) . Technology and teacher education: Past practice and recommended directions. Action in Teacher Education, XIX(2), pp. 97-106.

Davidson, J. E., Deuser, R., & Sternberg, R. J. (1994) .The role of metacognition in problem solving. In J. Metcalfe & A. P. Shimaura (Eds.), Metacognition: Knowing about knowing (pp. 207-226). Cambridge, MA: MIT.

Davis, P. (1997) . What computer skills do employers expect from recent college graduates? T.H.E. Journal, 25(2), 74-78.

Ellsworth, J. B. (1997) . Curricular integration of the World Wide Web. TechTrends, March, 24-30.

Galloway, J. P., & Blohm, P. (1997) . Planning for technology in the 21st century:Perspective, knowledge, commitment and process. Paper in Proceedings of the International Conference of the Society for Information Technology and Teacher Education, Orlando, Florida, 1997. (ERIC Document Reproduction Service No. ED 412 921)

Goodlad, J. I. (1994) . Educational renewal: Better teachers, better schools. NY: Jossey Bass.

Hackbarth, S. (1997) . Integrating web-based learning activities into school curriculums. Educational Technology, May-June, p. 59-72.

Hill, J. R., & Hannafin, M. J. (1996) Cognitive strategies and the use of hypermedia information system. (ERIC Document Reproduction Service No. ED 397 799)

International Society for Technology in Education (1997, May) . National standards for educational technology. Eugene, OR: Author.

International Society for Technology in Education (1999) . National standards for educational technology. [On-line] Available: www.iste.org/Standards/NCATE/Intro.html

ISTE Recommended Foundations in Technology for All Teachers (2001). [On-line] Available: http://www.iste.org/standards/ncate/found.html

ITRC (1998). Integration of technology in preservice teacher education programs: the Southeast and Islands regional profile.
[On-line] Available: www.itrc.ucf.edu/other/seirtec/research.html

Jonassen, D. H. (1995). Supporting communities of learners with technology: A vision for integrating technology with learning in schools. Educational Technology, July-August, 60-63.

Jonassen, D. H. (1996).Mindtools:Computers in the classroom. Englewood Cliffs, NJ: Merrill.

Kafai, Y., & Bates, M. J. (1997) . Internet web-search instruction in the elementary classroom: Building a foundation for information literacy. School Library Media Quarterly, Winter, 103-111.

Lan, J. J. (1997) . Meeting technology challenges in teacher education:Responses from schools and colleges of education. Paper presented at the Annual Meeting of the American Association of Colleges for Teacher Education in Phoenix, AZ, 1997. (ERIC Document Reproduction Service No. ED 403 255)

Ley, K. (1997) . Facing NCATE review or just looking for technology standards? Techtrends 42(4), 41-42.

Lowther, D. L., & Morrison, G. R. (1998) . The NTeQ Model: A framework for technology integration. TechTrends, 48(2). 33-38.

McKenzie, B. K., Kirby, E., Clay, M. N., & Davidson, T. J. (1997) . Redesigning technology training programs: What is and what could be. Paper presented at Association for the Advancement of Computing in Education (AACE) in Charlottesville, VA, 1997. (ERIC Document Reproduction Service No. ED 412 921)

Means, B., & Olson, K., (1995) . Technology's role within Constructivist classrooms. Report for the Studies of Education Reform program of the Department of Education's Office of Educational Research, Office of Research, Contract No. RR91172010. (ERIC Document Reproduction Service No. ED 383 283)

Morrison, G. R., Lowther, D. L., & DeMeulle, L. (1998) . Integrating computer technology into the classroom. Englewood Cliffs, NJ: Merrill Publishing.

Moursund, D., & Bielefeldt, T. (1999, Spring). Will new teachers be prepared to teach in a digital age?: A National Survey on Information Technology in Teacher Education. (Available Milken Exchange on Education Technology, 1250 Fourth Street, Fourth Floor, Santa Monica, CA 90401-1353)

National Council for Accreditation of Teacher Education (1997) . Technology and the new professional teacher: Preparing for the 21st century classroom investigation. Report for the Committee on Science and the Committee on Economic and Education Opportunities, 104th Congress. (Available ERIC Document Reproduction Service No. ED 386 155)

National Council for Accreditation of Teacher Education.(1996) . Quality assurance for the teaching profession [Brochure]. Washington, D.C.: author.

NCATENEWS, 1997. [Online] Available:http://NCATE.ORG/specfoc/techrpt.html

Northrup, P. T. (1997) . Instructional technology benchmarks for teacher preparation. In: Proceedings of Selected Research and Development Presentations at the 1997 National Convention of the Association for Educational Communications and Technology, Albuquerque, NM, February 14-18, 1997 (ERIC Document Reproduction Service No. ED 409 858)

Office of Technology Assessment, U.S. Congress, (1995) . Teachers & technology: Making the connection. Special report to the joint hearing before Congress. [Online] Available: http://www.rand.org/publications/)

Oliver, K. M., (1997) . Getting online with K-12 Internet projects. TechTrends,42(6), 33-40

Ormrod, J. E. (1999) . Human learning (3^{rd} ed.). Upper Saddle River, NJ: Merrill.

Pepi, D., & Scheurman, G. (1996) . The emperor's new computer: A critical look at our appetite for computer technology. Journal of Teacher Education, 47(3), 229-236.

Rakes, G. C. (1996) . Using the Internet as a tool in a resource-based learning environment. Educational Technology, Sep-Oct., 52-56.

Rand Organization (1998) . The use and effectiveness of educational technology today. (Special Report for the U.S. Department of Education No. MR-682) [Online] Available: http://www.ncate.org/projects/tech/TECH.HTM

Schrum, L., & Berenfeld, B. (1997) . Teaching and learning in the information age. Boston: Allyn and Bacon.

Thorsen, C. D., & Barr, R. D. (1997) . Computer competencies for teacher educators. Paper in Proceedings of the International Conference of the Society for Information Technology and Teacher Education, Orlando, Florida, 1997. (ERIC Document Reproduction Service No. ED 412 921)

Thomas, L., Clift, R., & Sugimoto, T. (1996) . Telecommunication, student teaching, and methods instruction: an exploratory investigation. Journal of Teacher Education, 46(3), 165-174.

University of Arkansas at Little Rock Information Technology Report (March, 1999) . Information Technology Task Force Committee Report [On-line] Available: http://www.ualr.edu/~itreport/

Vygotsky, L. (1962) . Thought and language. (E. Hanfmann & G. Vakar, Trans.) Cambridge, Massachusetts: M.I.T. Press. (Original work published 1934)

Werner, J. (1994) . Reaching out to the world:Training teachers to integrate telecommunications into special education classrooms. Paper in Proceedings of the Annual Conference of the American Council on Rural Special Education, Austin, Texas, 1994. (ERIC Document Reproduction Service No. ED 369 595)

Windschitl, M. (1998) . The WWW and classroom research: What path should we take? Educational Researcher, 27(1), 28-33.

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