AN ABSTRACT OF THE THESIS OF

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<u>Computer Competencies Between the Computer Specialists and</u>

<u>the Elementary Teachers</u>

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The purpose of this study was to determine if differences existed between computer specialists and computer-using teachers on the perceived level of importance of selected computer competencies for elementary teachers. The sample consisted of 102 computer specialists and 111 computer-using teachers in public elementary schools of Oregon. Data were gathered using a 24-item computer competency questionnaire validated by a Delphi panel. The instrument's reliability was 0.89. Analysis of variance and descriptive statistics were used in the analysis of data and presentation of results.

Of the 24 computer competencies, 15 were rated of great importance and nine (9) of moderate importance by specialists; ten (10) were rated of great importance and 14 of moderate importance by teachers. The results suggested that computer specialists perceived computer

competencies in (a) educational applications, (b) software, (c) implementation, and (d) information resources of greater importance for elementary teachers than (a) general applications, (b) future trends, and (c) computers in society. Teachers tend to perceive computer competencies in (a) educational applications and (b) software of greater importance for themselves than (a) implementation, (b) information resources, (c) general applications, (d) future trends, and (e) computers in society. Non-agreement between computer specialists and teachers was found predominantly in (a) educational applications, (b) implementation, (c) future trends, and (d) computers in society while agreement was predominantly in (a) software, (b) information resources, and (c) general applications competencies.

A Contrast of the Level of Importance

of Selected Computer Competencies

Between the Computer Specialists

and the Elementary Teachers

by

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Chapter 1

INTRODUCTION

Computer usage in schools has rapidly increased in the last decade. The presence of computers as a new instructional technology tends to continue to dominate instructional activities in the classroom. Bork (1987) predicted that, in the future, the computer will be the major delivery device and, in many cases, the only delivery device, for instructional activities. The complex and numerous effects of the new instructional technology are creating a tremendous impact on the schools of today. In both schools and universities, Bork laments that, in spite of the increased presence of the computer in education, computer use is still only a very small fraction of the total instructional system presented to students. He attributes the teachers' lack of knowledge of how to use computers as an important factor contributing to the problem. Mossman (1980) and Pratscher (1981) agree with this observation. Teachers with training in computer technology are urgently needed. Preparing teachers to use computers in educational settings seems to continue to be the focus in school curriculum development in teacher

training institution as well as in human resource development programs in the field. Computer skills and knowledge are needed for teachers to effectively meet the requirements brought about by the new instructional technology.

Studies have been conducted and articles have been written about the competencies teachers need to use computers in the classroom. Literacy for teachers has been a topic of debate among authorities in computer education. A common definition of computer literacy has not been arrived at, and there seems to be no consensus as to the degree of training required or the skills that are deemed essential to be computer literate (Charp, 1982). Bruwelheide (1982), in his review of literature, found no consensus among experts regarding competencies required for teachers to implement computer technology in the classroom but concluded that there was agreement on the need for teachers to become computer literate or at least to be computer-aware.

Authorities are currently no longer concerned with defining computer literacy, because the dynamic field of computer technology has developed and grown, and the needs of teachers to implement the technology have changed. Computer education specialists are now concerned with finding effective ways of integrating computers in the

different curriculum areas in the elementary schools. Educational computing has evolved from familiarization to integration. To better prepare teachers, it is necessary to update computer competencies to meet the changing needs of the instructional technology in today's classrooms. In updating computer competencies, the computer specialists and the computer-using teachers need to agree on the level of importance of these computer competencies for successful implementation.

The purpose of this study was to determine if differences existed between the computer specialists and the computer-using classroom teachers on the perceived level of importance of selected computer competencies to successfully implement the technology. Specialists and teachers need to work closely and harmoniously together in the implementation of computer education programs in the elementary schools. The results of this investigation are valuable in making curriculum decisions for preservice teachers, as well as for human resource development programs for inservice teachers and for administrative and supervisory related functions in the elementary schools.

Statement of the Problem

The central problem investigated in this study was to contrast the level of importance of selected computer

competencies between elementary computer specialists and elementary teachers in the public schools of Oregon. Answers were sought to the following questions:

1. What are the competencies needed for computer-using teachers in the public elementary schools of Oregon?

2. What is the level of importance of these competencies for elementary teachers as rated by computer specialists?

3. What is the level of importance of these competencies for elementary teachers as rated by computer-using teachers?

4. Is there a significant difference between the ratings of the specialists and the ratings of the computer-using teachers on the level of importance of the selected computer competencies for the elementary teachers?

Research Hypothesis

This investigation tested the null hypothesis: There is no significant difference between the ratings on the level of importance of selected computer competencies by computer specialists and computer-using teachers in the elementary schools of Oregon.

Definition of Terms

The following terms are defined as used in the study:

Contrast. This term refers to the method of comparing the ratings of two independent samples (computer specialists and computer-using teachers) to determine agreement or non-agreement between these two groups by using inferential statistics.

Level of importance. The level of importance perceived by the respondents is arbitrarily categorized on a five-point Likert scale to mean as follows:

1 = 'of very little importance'

2 = 'of little importance'

3 = 'of moderate importance'

4 = 'of great importance'

5 = 'of very great importance'

Computer specialists. As used in this study, it refers to the personnel in Oregon's public schools whose duties include coordinating and/or supervising teachers in computer education programs in the building, school, school district, or education service district levels.

Computer-using teachers. It refers to the teachers who use computers in teaching and are not involved in either coordinating or supervising teachers in computer education programs.

Computer education programs. This term refers to

activities related to the use of computers in instruction undertaken in the public schools.

Importance of the Study

The dynamic nature of the field of computer technology necessitates constant upgrading of the competencies of teachers to be able to successfully implement educational goals relevant to the changing technology. Johnson (1986) divided educational computing into three phases: the familiarization phase, maturation phase and the integration phase. It is in the integration phase that the computer plays an essential role in the day-to-day instructional process. In the elementary schools in Oregon, Lamon (1988) reported that teachers feel that microcomputer use has shifted from a resource or a method to that of an effective tool.

At the stage of implementation of computer education programs in the elementary schools, determining agreement between the computer specialists and the teachers on what level of importance computer competencies are expected of elementary teachers should provide a clear direction toward the development of functional goals and objectives. Insights can be drawn from the findings which can assist administrators to provide better agreement between computer specialists and teachers.

The level of importance of the selected computer competencies conceived by the computer specialists and the computer-using teachers in the classrooms is a valuable resource in the development of curricula for the preservice elementary teacher and in the professional development of the inservice elementary teacher. This study responds to the recommendation of the National Task Force on Educational Technology to redesign pre-service teacher education programs to include the effective uses of technology, including its uses in teaching for subject matter mastery (Ridley & Hull, 1986). Other countries can adopt these competencies as well. Countries around the world cited problems of poorly-prepared teachers, inadequate research in their countries and elsewhere, and too little sharing of information among countries with similar national problems (Charp, 1987). Nag(1988), the director of the Indian Institute of Technology (India), urged developing nations to prepare for the near future with educational programs that integrate computer-based education. He added that the new generation of teachers will be the determining factor in the long term. Abas (1985) found that the transfer of instructional objectives from industrialized to less industrialized nations is possible. Therefore, the findings of this study, will not only benefit Oregon elementary schools, but other elementary schools worldwide.

Chapter 2

REVIEW OF LITERATURE

The framework upon which the problem of this study has been built is based on literature from journal articles, studies conducted, books, reports, and other publications. The purpose of this chapter is to provide a synthesis of the current literature relating to computer competencies for teachers. The selected literature is presented in four major sections: (a) computer literacy, (b) computers in the elementary schools, (c) computing in other countries, (d) computer competencies for teachers, (e) agreement between computer specialists and teachers, and (f) summary.

Computer Literacy

The development of computer competencies gained attention as a result of the nationwide advocation of computer literacy among the citizenry. Although a generally accepted definition of computer literacy does not exist (Longstreet & Sorant, 1985; Hasset, 1984), it appears to be a goal that educators consider to be desirable, a foundation upon which a highly technological society will be built (Klassen, 1983). Moursund (1980) predicts that by the year 2000, 50 percent of all instruction will be

computer related. The rationale for this increasing emphasis in educational computing is that knowledge of computers will enable students to function in a technological society (Stevens, 1980). Some authors (e.g., Eisele, 1983; Luehrmann, 1980) believe that students have a right to become computer literate.

Definitions of Computer Literacy

The main disagreement on the definition of computer literacy is on the level of competency a person needs to attain to be computer literate. To some, it represents only a basic awareness of history, terminology and uses of computers (e.g., Ball & Charp, 1977; Gress,1981; Eisele, 1983; Seidel, 1980). Moursund (1983) added low level programming to this component. Others insist on a functional facility with hardware and software as problem-solving tools (e.g., Rawitsch, 1978; Bork, 1982). Still others maintain that specialized programming skills are needed in order to be computer literate (e.g., Luerhmann, 1980; Bitter, 1983). Controversy seems to be a characteristic of a rapidly changing field. Other definitions of computer literacy are focused on its role specificity (Beck, 1981; Longstreet & Sorant, 1985; Anderson & Klassen, 1981). The National Center for Education Statistics arrived at a general definition that "computer literacy may be defined as whatever a person

needs to know and do with computers in order to function competently in our information-based society" (p. 8). From a survey of experienced computer users, Marvin and Winther (1983) concluded that "computer literacy is a shifting set of skills socially defined in response to changing circumstances" (p. 97). This situation will continue to change due to increasing availability of computers to more and more people, changing technology and applications, and changing perceptions of the impact of computers in society (Hunter, 1983). Longstreet and Sorant (1985) and Uhlig (1983) believe that the need to define functional computer literacy is likely to be an ongoing process. A controversial opinion said "Stop saying computer literacy" (Harvey, 1983, p. 56), when the author meant that there is no universal and/or absolute definition of the concept.

Computers in the Elementary Schools

Several studies reviewed were surveys on the status of computer education components, such as computer use in the school, computer-assisted instruction, and computer literacy programs in the elementary school. These studies provided a background for the educational setting where computer competencies are being achieved through proper exposure and hands-on experience with computers. The three experiences with computers in schools are: (a) a general

learning aid, (b) a problem-solving device, and (c) a subject in itself (D'Souza, 1985).

The survey on instructional computing patterns in Texas schools, conducted in the spring of 1983 by researchers at the University of Texas in collaboration with the Texas Educational Agency (Anderson & Smith, 1984), included information related to hardware, courseware, student populations using computers, curriculum areas using computers, computer literacy skills for students, teacher training efforts, implementation patterns, and possible state policy actions with regard to computer use in Texas schools. Their findings which were directly related to computer literacy are the following:

1. The gifted and talented students were reported to have the highest percentage in computer usage.

2. Computer use increased with grade level.

3. Mathematics received the highest reported use, second was computer literacy, and third was language arts. Computer literacy increased in reported use across grade spans.

4. The majority of the surveyed school districts indicated that they were not requiring all students to attain computer skills. Only the district category with an average daily attendance (ADA) of 5,000 to 9,999 students reported a hierarchy of skills which started with

low level skills at the elementary grades and progressed in difficulty to the senior high grades. However, when teacher respondents were asked what computer skills their students were expected to attain, they indicated a differing level of skill at each grade level. Sixty-nine percent of the elementary school teachers indicated that their students were expected to load and run a program.

In 1985, the second National Survey of Instructional Uses of School Computers was commissioned by the Department of Education (Becker, 1987). The survey included schools comprising elementary and secondary schools, public and private. The salient findings were as follows:

1. Compared with the 1983 survey by the Department of Education, the number of computers in schools had increased by four times in the 1985 survey. Computer use time, as well as the number of students using computers, had increased twice as much.

2. One-fourth of the teachers regularly use computers with students, thirty-seven (37) percent of these were of K-6 school teachers and fifteen (15) percent were of secondary school teachers.

3. In grades K-3, whole-number arithmetic and language arts constituted 77 percent of computer use, which included the time spent in computer literacy units. Computer literacy as a specific topic or course was used

by six (6) percent in K-3, ten (10) percent in 4-8, and nine (9) percent in 9-12.

4.   Computer use in computer literacy as a specific topic or course in grades 4-6 were: six (6) percent by the low-ability students, 12 percent by the mixed-ability students, and 18 percent by the high-ability students.

For elementary schools, the actual function of computers is primarily to acquaint students and teachers with a new cultural object. No evidence was found to indicate that schoolwide student test scores have been affected by the kind and intensity of computer assisted instruction which occurs in most elementary school settings.

Nelson and Waack (1985) made a survey in Iowa public elementary and secondary schools. Conclusions drawn were that a high percentage of elementary students are being introduced to computer-assisted instruction. The frequency of such instruction peaks at the fourth grade level with an apparent de-emphasis in the higher grade levels. It was also reported that computer literacy/computer-assisted instruction awareness is an important factor in the teacher selection process.

Another survey on computer use, conducted in Cleveland, was reported by Schuttenberg, McArdle, and Kaczala (1985). The survey was made possible through the

Center for the Study of Computers in Education at the College of Education at Cleveland State University. The study compared the expectations of parents, business leaders, and educators regarding computer uses in the schools with their conception of what is actually being done. Only aspects pertinent to the study are summarized:

1. In general, parents, educators, and business people agreed on how they expect the computer to be used. The order of this use is to aid:

       a. administrators in keeping student records

       b. in drilling students in subject matter

       c. teachers in keeping student records

       d. administrative word processing

       e. in teaching new material

       f. teachers in determining

         instructional needs of students

2. Only educators and parents were asked for their conceptions of how computers were presently used. The relative order of actual use was similar to the order of expected use. However, it was noted that the expectations far exceeded the conceived reality.

3. Regarding computer competencies that students should have, the three groups held high expectations. Parents generally had higher expectations in the

elementary schools than did either teachers or business leaders.

4.   More parents than educators perceived that computers were being taught in the elementary schools on these topics: (a) use and understand basic computer terms, (b) use computer keyboards, (c) create simple programs.

5.   An important finding was that respondents felt that more should be done in schools in all areas of computer applications than they perceived was actually being done.   This finding was tempered somewhat by respondents being unaware of what is actually happening in the school with regard to computer applications and computer competencies being taught. (Fifty percent of the parents responded "don't know" to 13 items and 50% of the teachers responded "don't know" to four of the items).

Moskowitz and Birman (1985) conducted case studies for large city school districts.   One basic finding reported that for schools and school districts to move ahead with their use of computers, they needed trained teachers, some equipment, and some curriculum development. It was observed that most of the districts have developed and   adopted   K-12   computer   literacy   curricula, implementation typically beginning at the middle grades with expansion targeted for the elementary grades. In one district, a K-12 curriculum was reported to progress

through four stages: (a) computer awareness, (b) literacy excluding programming, (c) problem solving, and (d) fluency of computer technology including programming.

Kandl (1986) made an investigation covering aspects of the implementation of a computer literacy program within two intermediate schools in a school district. Among other findings, it was revealed that the program's student objectives were not being equally implemented or met within and across schools. In a similar study, on the implementation of a K-6 computer curriculum program (Erickson, 1986), it was found that there was conflict between standardizing expectations and mandatory curriculum accountability.

As more computers appear in schools, more school districts find themselves codifying goals and objectives in their computer literacy curriculum. The Cupertino School District (Kraus, 1981) developed a computer literacy curriculum which specified computer awareness objectives for the K-3 level and in grades 3-6. In another setting, the implementation of the computer program of Eula Independent School District was divided into three stages:

1. In the first stage, which started in January, 1984, all teachers participated in inservice training and students were given a six-week basic familiarity course.

2. In the second stage, the microcomputer was introduced as a support tool in various aspects of the existing curriculum and as a way of improving and strengthening instruction.

3. The third stage emphasized the use of the computer as a medium for comprehensive basic skills enhancement through computer assisted instruction (Rumage, 1987).

The Oregon elementary schools have kept pace with the development of computer education. Based on a recent survey by Lamon (1988), it was reported that the average number of computers for all K-6 schools in 1985 nationwide was six (6) and Oregon elementary schools had eight (8) which increased to about 12 and 13 microcomputers per school. Laboratory computers averaged 21 minutes per week for each student usage. Drill and practice on content, problem-solving, simulations, tutorials, word processing were the most common activities with computers in the school. The teaching of computer literacy was reported to be predominantly a district requirement rather than a school requirement. It was concluded that the microcomputer has shifted its popularity from a resource or a method to that of a very effective learning tool. The study conducted by Niess (1989) showed the same trend.

Among the studies reviewed, it is evident that the use of the computer in schools has evolved from awareness to mastery, from familiarization to integration, from an object of instruction to a tool for instruction. Arch (1986), Brody (1986) and Eisele (1986) agree that integrating computers into the existing curriculum is a positive approach in the development of educational computing. Considering these progressive changes, there is a need to make objectives on educational computing more relevant. Identifying teacher computer competencies with the level of importance and the level of learning will provide valid objectives for teacher education implementing educational computing activities in the classroom.

Educational Computing in Other Countries

The need to develop objectives for educational computing was found to be common among countries not only in the United States . The literature indicates computer education efforts in other countries. Abas (1985), using the Minnesota Educational Computing Consortium's set of objectives as a model for computer literacy curriculum for Junior Science Colleges in Malaysia, found the possibility of transfer of instructional objectives from industrialized to developing nations.

There is evidence of a concerted effort among all societies which is cognizant of the need for change accelerated by the influence of existing and developing technology.   Charp   (1987),   addressing   the   Second International Conference, Children in an Information Age expressed belief that the children in the different countries having access to computers in schools will pave the way to their country's modernization and future development.   Applications of technologies and their educational   systems   are   held   essential   for   future employment and economic growth.

Hoot (1987) observed the USSR's computing programs. He reported the country's plan to speed up its scientific and technical progress through students' mastery of computer technology.   A program has been devised to introduce computers into the schools.   In general, it was reported that computers are a rarity in Soviet pre-university classrooms.   The following issues were shown to be factors contributing to the Soviet educational computing lag:

1.   Lack of hardware

2.   Scarcity of good software

3.   Lack of trained teachers

4.   Political implications of exposing younger students to greater amounts of information.

India, progressing rapidly in the electronics and microcomputer industries, like other developing countries, recognizes the need to prepare the new generation for the information age. Nag (1988), the director of the Indian Institute of Technology reported on the formulation and implementation of the Computer Literacy and Studies in Schools (CLASS) project. The CLASS pilot project aimed for:

1.   students' awareness of computers and their uses;

2.   familiarizing students with the range of computer applications;

3.   students' identifying and developing applications relevant to their immediate environments; and

4.   teachers' use of the technology for instruction.

Educational computing is recognized in every country as a solid foundation for economic development. The rate of growth of computerization depends on the nation's material, as well as human, resources. The schools are the best agencies for human resource development; hence, undoubtedly, computers will soon dominate instructional activities. Are the teachers ready for its implementation? In all countries, a major problem is in training teachers on how to use computers effectively (Bork, 1983).

Computer Competencies for Teachers

The training of teachers is a concern that must be addressed. While there is an information explosion in terms of journal articles on microcomputers in education (Summers, 1985), little attention has been devoted to teacher training with computers. Authorities agree that teachers need to become computer literate, but there is no consensus as to the degree of training required (Charp, 1982). A review of the literature is essential in determining what a teacher needs to know and be able to do to successfully use computers in teaching. There is wisdom in Tyler's (1971) words:

> The world changes so rapidly that we are
> likely to think of the past as totally different.
> Hence, it is useful from time to time to examine
> the development over the years of institutions,
> issues and problems to perceive again that they
> do not spring from nowhere but have been
> emerging and progressing from time to time
> (p. 5).

Several groups and individuals have attempted to define minimum competencies which all teachers should possess in order to teach effectively in a society permeated by computers.

In 1980 the Association of Computing Machinery (ACM) developed a set of competencies which they say represents the "scope and substance of teacher training needed to integrate computing into the school" (Taylor, Poirot, &

Powell, 1980, p. 130). The listed competencies emphasized
the ability to :   (a) read and write simple computer
programs, (b) use computer programs and documentation, (c)
use computer terminology, (d) recognize problems that can
and cannot be solved using the computer, (e) locate
information on computing, (f) discuss the historical
development of computer technology, and (g) discuss moral
and human impact issues.

Beck (1981), cognizant of the need to develop a
program for a computer awareness workshop, developed a
syllabus which included two general topics: information
and computers. On the topic of information, information
systems and information collection and retrieval were
listed. On the topic of computers, communications with
a computer, computers in the marketplace, and computers
in education were the subtopics to be addressed.

In attempting to describe a computer literate
person, Braumbaugh (1982) identified competencies in terms
of one who could define, demonstrate, and/or discuss: (a)
how computers are used, (b) how computers do their work,
(c) how computers are programmed, (d) how to use a
computer, and (e) how computers affect our society.

A similar definition was presented by Bitter (1983).
A computer literate teacher should: (a) be familiar with
computer terms, (b) know how computers work, (c) be able

to enter and retrieve data, (d) know the uses of computers, (e) be able to program a computer, (f) know the future general direction of computers, and (g) understand the abuse and misuse of the computer for students to know that such problems exist. The definition describes computer use as more of an object of instruction rather than as a tool.

In the same context, Moursund (1983) claimed that programming, together with a knowledge of the limitations, applications, capabilities, and possible impact of computers in education should constitute computer-education literacy. A series of his article: Introduction to Computers in Education for Elementary and Middle School Teachers, which was published in The Computing Teacher (1981), was aimed at assisting teachers achieve a higher level of computer-education literacy.

The Texas Education Agency (1983) is one of the pioneers in formulating a more detailed list of computer competencies for teachers. Its publication entitled Essential Competencies for Educators listed fifty-five computer competencies for teachers. Specific objectives were included for each of the following ten topics: (a) educational applications, (b) implementation, (c) attitudes, (d) software, (e) programming, (f) hardware, (g) computers in society, (h) general applications, (i)

information resources, and (j) future trends. These topics imply that teachers need more than simple awareness of computers in order to be able to interact with the computer (Schall, Leake & Whitaker, 1986). These objectives have been subsequently used by other researchers like Abbott (1984) in identifying computer literacy competencies for the inservice training of regular classroom teachers in Texas.

Barger (1983) divided the elements of computer literacy into three general aspects: (a) computer structure and operation, (b) computer applications and limitations, and (c) computer programming. He tried to compromise the dispute over including programming in computer literacy objectives by defining the third element to include minimal competency in programming.

Based on the results of the survey conducted by Kull and Archambault (1984) on teacher preparation in computer education, there is indication of a felt need among teacher training institutions to include a computer component as a part of the education of teachers. The existing trend was not on training computer education specialists, but aiming the courses at teachers preparing for all areas and levels of teaching. The course content included: development of computer-assisted instructional materials, programming in BASIC and Logo, evaluation of

educational software, and educational applications of computers.

In a study conducted by Anderson and Smith (1984) with Texas school districts, results showed that the following computer competencies were considered mandatory for a teacher who uses computers in the classroom: (a) the ability to use courseware, (b) the ability to evaluate the instructional value of courseware, (c) the ability to monitor student progress when using the computer, (d) knowledge of computer terms, (e) knowledge of appropriate educational applications, (f) knowledge of methods for teaching computer literacy skills, and (g) the ability to match student needs with instructional objectives of courseware. Programming, keyboarding, using utility programs, troubleshooting with the computer, and the societal inpact of computers were considered as being "nice to know". This study indicated that the computer is recognized as more of a tool than as an object of instruction.

Using a modified Delphi technique, Moore (1984) developed a set of competency guidelines which fell within three categories : (a) general education, (b) computer education, and (c) computer science education. The general education category was basic familiarization with the computer, the second category requires the ability to

integrate computers into classroom situations, and the third category requires higher level competencies designed for the computer science education specialists for the elementary school, secondary school, and district/school coordinators.

Similar results were reported by Hoth (1985) as they applied to administrators for teacher inservice trainings: (a) an introduction to the history of computers and their impact in society; (b) knowledge of computer applications in instruction; and (c) computer programming in one or more languages.

The Illinois-Wisconsin ISACS Computer Literacy Coordinators' Committee on Computer Literacy (Grierson,1985) developed a course outline for computer literacy to include ethics, hardware, disk operating system, keyboarding, word processing, graphics and/or sound, database management, problem solving, algorithmic thinking, programming, spreadsheets, bits, bytes and bases, utility programs, simulations, robotics and artificial language, and the past, present and future of computers. They contended that for a person to be computer literate, he or she must undertand what a computer can do and must have the skills necessary to use a computer to do a variety of tasks.

Carrier, Glen and Sales (1985) developed two training programs for teachers in classroom computer use. The first program was for beginners. It was aimed at creating an atmosphere of exploration and experimentation to ensure that the basic competencies are mastered by the participants. The content includes: operation of equipment, knowledge about hardware, word processing, other materials generation packages, LOGO, types of instructional programs, and software evaluation. The second program is organized for advanced participants aimed at integrating ongoing formal training experiences with actual application in the classroom. The content in the advanced program includes: instructional design, classroom management, laboratory management, strategies for inservice training, and software evaluation.

At Loyola Marymount University in Los Angeles (Dewar, 1986) a component on computer literacy was added to the mathematics course for preservice elementary teachers. It included five parts: computer history, computer terminology, hands-on experience with a computer, instruction in the LOGO programming language, and software evaluation. Every student felt it was important for an elementary teacher to know how to use a computer.

A survey was conducted by Johnson and Hoot (1986) utilizing samples of elementary classroom teachers in two

districts. The identified computer concepts reported of most value were: (a) programming in BASIC and LOGO, (b) selection and evaluation of software, (c) integration of computers into the classroom, (d) basic information on computer hardware, (e) designing software, (f) word processing, and (g) teacher management programs.

Cognizant of the need for computer education for teachers, the University of Calgary (Canada) developed a computer course required of undergraduate students in both elementary and secondary school teaching to include three main areas in the following sequence: (a) uses of computers to teach other content, (b) programming skills, and (c) utility uses of computers by teachers. Class topics are to include introduction to computers in education, LOGO, word processing, computers in instruction, evaluating computer-assisted instruction, BASIC, utility programs, and computer literacy.

Waggoner and Goldberg (1986), using the Delphi technique, found consensus that the elementary schools will have the greatest potential for software development with the rationale that this grade level was the most open to new ideas considering that they are not tied to the subject areas. Also, the elementary level was believed to have the highest long term investment, since the young will grow up with the technology. The following were

identified to be future trends relative to courseware development and application: continued growth of personal tool software, integration of technologies, improvement in the user interface, development of data bases and improved access, and increased involvement of book publishers.

Faced with the lack of consensus on the content of computer literacy, whether it should comprise issue awareness or programming skills, Feldman (1987) proposed an alternative concept which includes four interrelated aspects of learning computing through philosophical inquiry and integration of experience. He advocates these guidelines: LOGO should be used in programming; development of metaphors should be held important on the topic on how computers work; implications and applications of computer use should be drawn and developed; and growth and communication topics should be involved in creating programming materials.

Sutphin (1987) proposed an inservice model for instructional applications of microcomputers. In the first level, knowledge is focused on conceptual understanding for computer use in education, which includes teaching about computers, teaching with computers, and managing instruction. The next level is the development of technical skills sequenced into core

level, advanced level and expert level. Competencies at
this level provide for: (a) evaluating, selecting and
using educational software, (b) computer hardware
selection and use, (c) program languages and their use,
(d) use of application programs. The third level involves
application skills. It includes application of skills and
conceptual understandings to the teacher's subject area
whether it is teaching about, teaching with or using
computers as an educational management tool.

In recent update of computer competencies for all
elementary teachers (Niess, 1989) included the following:

1. Integrate and fit the computer into the
curriculum.

2. Obey copyright laws and discuss ethical issues.

3. Use the computer as a tool.

4. Use basic computer terminology.

5. Demonstrate familiarity with hardware and
software for "troubleshooting" minor problems.

6. Demonstrate familiarity with educational
materials and use use a variety of sources of information.

7. Demonstrate knowledge of the impact of
computers in society, trends and general applications.

8. Instruct students in keyboarding.

Agreement Between Computer Specialists and Teachers

There is a dearth of materials and studies involved in contrasting the perceived level of importance of computer competencies between specialists and teachers. Available literature reviewed are included in this section.

Abbott (1984) identified computer literacy competencies for the inservice regular classroom teacher in Texas, using the Delphi technique. Consensus on the level of importance of selected computer competencies between teachers and 'experts' was determined. 'Experts' consisted of the education service center computer consultants. On the 71-item questionnaire, teachers found consensus on 49% of the items; consultants found consensus on 68% of the items; consensus by both groups was found on 32% of the items.

The results of the survey conducted by Godett (1987) revealed a basic difference in the goals of 'experts' and educators. While 'experts' placed greater emphasis on the overall impact of computers on education, educators revealed goals pertaining to applications of computers in the learning process. Recommendations included generating greater interaction between experts and educators to develop shared goals.

Anderson and Smith (1984) compared perceptions of district school personnel and teachers with regard to instructional computing patterns. The authors concluded that educators have definite opinions as to what skills are required for a teacher who wants to use computers in the classroom, but added that "perhaps, teachers should be the ones to determine what they need to know about computers" (p.15). Teachers have the ability to self-assess needs (Erickson, 1986); what is needed is for teachers, in appropriate working environments to determine important competencies (DeVault, 1985).

Concordance of microcomputer uses in education was investigated. A trend toward agreement between the computer 'experts' and the computer-using teachers, administrators, and bankers was found (Fellmy, 1984). Similarly, a survey on the status of microcomputers in Oregon elementary schools comparing principals' and primary computer-using teachers' (computer coordinators) perceptions of computer impact, concluded that both principals and primary computer-using teachers perceived student enthusiasm for the computer (Lamon, 1988).

Summary

The review of literature dealing with the rapidly developing instructional technology in the elementary

schools has established a shifting pattern on the focus of attention among educators. At the early stage of the introduction of computers into the classroom, concerns were addressed to developing awareness and familiarization with the new instructional tool. Competencies were developed on knowledge about computers and its influence in the society. The computer was regarded as an object of instruction. In later years, a marked shift was noted. The computer was no longer regarded as an object of instruction but as a tool for instruction. Integration of the computer into the curriculum has become the focus of attention among educators and administrators. Consequently, computer competencies were constantly being reformulated to meet the changing emphases on computer usage.

Chapter 3

METHODS AND PROCEDURES

This chapter describes the methods and procedures used in the study. Topics are presented in the following order:

1.   The Sample Frame and Research Sample

2.   Data Collection Instrument

3.   Data Collection Procedures

4.   Statistical Treatment

The Sample Frame and Research Sample

The Department of Education in the State of Oregon did not have any mechanism by which to identify computer specialists and computer-using teachers in the public schools. The instructional technology specialist in the Department of Education provided a partial list of computer coordinators at all levels. Fifty-three names and addresses of computer coordinators involved in the elementary schools were selected from this list. The following procedure was, therefore, devised to identify the sample. Addresses of pertinent offices were taken from the Oregon School Directory (1987).

1.   Letters to education service district superintendents were sent requesting a list of elementary

school districts with exemplary computer education programs (Appendix C).

2. From the list provided by education service district superintendents, letters to elementary school district superintendents were sent to request names of computer coordinators and elementary schools with exemplary computer education programs (Appendix D).

3. From the list provided by elementary school district superintendents, letters were sent to principals of identified elementary schools to request names of teachers who used computers in teaching (Appendix E).

This procedure furnished a total list of 382 names and addresses of computer coordinators and teachers for the sample. After two weeks, a follow-up card was sent to those who did not return the questionnaire. This procedure obtained a total of 102 respondents among computer specialists and 111 respondents among computer-using teachers, with a total of 213 for both groups, representing a return rate of 64%.

Data Collection Instrument

After an exhaustive review of literature, the set of computer competencies for educators formulated by the Texas Education Agency (1983) was selected to be the core for the instrument, primarily, because it focused on

educational role rather than administrative applications. There were 55 items categorized into 10 clusters: educational applications, implications, attitudes, software, programming, hardware, computers in society, general applications, information resources, and future trends. This instrument was validated by Olson (1985); all 55 items were found to be important; and the computer competencies were found to be appropriately assigned to the various categories.

Abbott (1984) used a more precise validation by using the Delphi technique. The original 55-item computer competencies list for educators formulated by the Texas Education Agency (TEA (1983) was validated by a Delphi panel of 80 computer 'experts' and teachers who completed the task in two rounds (81% completed both rounds). Thirty-one TEA items were judged important. Four items representing the category on attitudes have been excluded because of difficulties in measuring psychological constructs. A total of twenty-seven items were included in the initial instrument (Appendix A).

Considering the dynamic nature of computer technology, the initial instrument intended for this study was further revalidated by a Delphi panel of eight (8) members. In the selection of the Delphi panel, important considerations on the nature of this present study have been

made.   It is critical to the effectiveness of a program to gather the opinion of the 'experts' who will be actually teaching or administering the program.   Mitchell (1971), however, considers that a mix of panelists will minimize professional bias which occurs when only 'experts' are used. A crosssection of the different groups involved in education was, therefore, considered in the selection of panel members.   The Delphi members (Appendix B) were chosen from various groups related to education which included computer specialists, computer-using teachers, school board members, teacher educators and parents who possessed a working knowledge of computers.   The eight (8) members of the panel were recruited by nomination and selected through telephone interviews.

The Delphi procedure was modified to suit the purpose of the study. As a matter of form, Delphi procedure requires several iterations before consensus among members is reached.   However,   to prescribe an optimal survey structure is difficult considering the interrelationships among purpose, participants, and procedures (Weatherman & Swanson, 1974).   After one round, a set of 24 computer competencies was judged by the Delphi panel to be important based on a rating scale with a continuum of 1 - 6 (ranging from very unimportant to very important) for the elementary teacher.

From this validated instrument, the final
questionnaire used to gather data was restructured so that
each of the 24 items was rated by the respondent on a five-
point Likert scale where:

> 1 = 'of very little importance'
>
> 2 = 'of little importance'
>
> 3 = 'of moderate importance'
>
> 4 = 'of great importance'
>
> 5 = 'of very great importance'

Data Collection Procedures

The questionnaire consisted of a set of 24 computer
competencies which was sent to the 382 computer specialists
and computer-using elementary teachers following the
procedures outlined by Dillman (1978). Included in the
mailing was a cover letter explaining the purpose of the
study and instructions for completing and mailing the
completed questionnaire (Appendix F). Three weeks after the
initial mailing, a follow-up card (Appendix G) was sent to
non-respondents reminding them to return the completed
questionnaire. One hundred two (102) computer specialists
and 111 computer-using elementary teachers returned the
completed questionnaire, representing a total of 213
respondents for the two groups.

Statistical Treatment

Data were analyzed by using Statgraphics Version 2.6 software (1986). The reliability coefficient for the instrument was computed using the procedure developed by Hoyt and Stunkard (1952). An example of the matrix and the formula are shown in Appendix H. Descriptive statistics and analysis of variance were used when appropriate in the analysis of data to answer the research questions. The alpha level was set at .05 to test hypothesis of no difference between means. However, the exact p - values were reported to permit the reader to impose his/her decisions and interpretation on the reported findings (Hopkins & Glass, 1978).

Chapter 4

ANALYSIS AND INTERPRETATION OF DATA

This chapter is divided into two sections. The first section provides the validation and reliability analysis of the instrument and the second section presents the analysis of data answering the research questions.

Instrument Validation and Reliability Analysis

Content validity was established through a modified Delphi technique using an eight-member panel (Appendix B) chosen from various groups concerned with education to judge the level of importance of each of 27 selected computer competencies (Teacher Education Agency, 1983). A previous validation was completed by Abbott (1984). From a continuum of 1 - 6 (ranging from very unimportant to very important), 24 items were considered important competencies. A second round was not necessary because the ratings represented a consensus among the members of the Delphi panel. For the purpose of the study, consensus was considered reached when 75% of the judges rated an item not lower than 3 when the mean rating was 3.5 or higher.

To establish the reliability of the instrument, the procedure developed by Hoyt and Stunkard (1952), which was subsequently employed by researchers with a similar design

(Samahito, 1984; Starmach, 1988), was used. Analysis of variance methodology was used in this procedure to produce an estimate of the internal consistency of the scores which were judgmentally assigned by the respondents. The resulting reliability coefficient for the instrument, utilizing data from 50 randomly selected respondents, was 0.89 (Computations in Appendix H).

Analysis of Data

Inferential statistics utilizing analysis of variance as well as descriptive statistics using mean and rank order were used in the analysis of data and presentation of results. Data analysis is presented in the order of the research questions formulated in the statement of the problem.

Computer Competencies Needed for Elementary Teachers

Research question #1 dealt with determining the computer competencies needed for the elementary teachers in the public schools. The Delphi panel was used to determine the computer competencies important for the elementary teachers. Twenty-four items taken from a list of 27 items (Appendix A), were judged by the panel members to be important. A mean of 3.5 or higher was considered important and a mean lower than 3.5 was considered unimportant. A

list of these computer competencies with the respective mean

ratings is presented in an ordered arrangement in Table 1.

Table 1

Computer Competencies Needed for Elementary Teachers

as Judged by Delphi Panel

Competencies	Mean	Comment

The teacher should be able to:

1. Identify various options for using computers in an instructional setting for teaching and classroom management, such as: computer assisted instruction, computer managed instruction, problem solving, test scoring, word processing, data-base management. — 5.25 Important

2. Use computer courseware to individualize instruction and increase student learning. — 5.25 Important

3. Respond appropriately to common error messages when using software. — 5.25 Important

4. Characterize the use of the computer as an object of instruction, as an instructional medium, and as a problem-solving tool. — 5.13 Important

5. Use at least one quality evaluative procedure to appraise and determine the instructional worth of a variety of computer software. — 5.00 Important

6. Plan for effective pre- and post-computer inter-action activities for students (for example, de-briefing after a science simulation. — 4.88 Important

(Continued)

(Table 1, continued)

	Competencies	Mean	Comment
7.	Load and run a variety of computer software packages; i.e., instructional and data management.	4.88	Important
8.	Demonstrate appropriate uses of computer technology for basic skills instruction.	4.75	Important
9.	Differentiate between instructional computer applications such as drill-and-practice, tutorial, simulation, and problem-solving.	4.75	Important
10.	Apply and evaluate the general capabilities of the computer as a tool for instruction.	4.63	Important
11.	Locate and use a variety of sources of evaluative information about software.	4.63	Important
12.	Describe appropriate instructional arrangements for computer-based learning experiences (for example, physical arrangements and groupings).	4.63	Important
13.	Evaluate and assess information regarding computer uses in education, and use that information to plan for appropriate instructional uses.	4.50	Important
14.	Demonstrate an awareness of the major types of applications of the computer such as information storage and retrieval, simulation, decision making, computation, and data processing.	4.13	Important
15.	Respond appropriately to changes in curriculum and teaching methodology caused by new technological developments.	4.13	Important

(Table 1, continued)

	Competencies	Mean	Comment
16.	Describe how computers can assist the individual.	3.88	Important
17.	Demonstrate an awareness of computer usage in fields such as: health, law enforcement, education, business and industry, transportation, communications, military.	3.86	Important
18.	Recognize that a computer gets instructions from software written in a programming language.	3.75	Important
19.	Explain various applications of computer technology for business, industry, leisure and home management.	3.71	Important
20.	Describe the impact that technological developments have on various career options.	3.71	Important
21.	Discuss some of the positive and negative consequences in computer use in today's society, for example, machine dependence vs machine independence; depersonalization vs personalization; increase vs decrease in job availability.	3.71	Important
22.	Describe ways computers can assist in decision making.	3.63	Important
23.	Define the elements of a district plan for computer-based instruction, and define the role of the individual teacher in supporting that plan.	3.63	Important
24.	Summarize future projections and trends in computer technology.	3.50	Important
25.	Demonstrate an awareness of state of the art developments in technology and their potential applications to education.	3.25	Unimportant

45

(Table 1, continued)

Competencies	Mean	Comment
26. Describe what producers of instructional materials are doing to integrate computers with other electronic and print media.	3.00	Unimportant
27. Demonstrate an awareness of the different programming languages suitable for science, business, industrial, and educational applications.	2.13	Unimportant

The 24 identified computer competencies important for elementary teachers were subsequently included in the questionnaire for gathering data in this study.

Level of Importance of Computer Competencies by Specialists

What is the level of importance of these competencies among computer specialists? This research question was answered by computing the mean rating assigned by computer specialists for each of the competencies. A range from 1.00 to 1.49 was considered of very little importance; 1.50 to 2.49 was considered of little importance; 2.50 to 3.49 was considered of moderate importance; 3.50 to 4.49 was considered of great importance and 4.50 to 5.00 was considered of very great importance. In the presentation of data, individual items were clustered according to the Texas Education Agency's categorization. The purpose of clustering was to group common elements representing a

meaningful whole such that each category contained items most homogeneous within the group and, at the same time, groups heterogeneous between themselves. A wholistic presentation of each group in the research report provides a clearer picture of computer competency trends than when the individual items are presented fragmentally. At the same time, decisions could be made within each of the clusters or categories (Ganske & Hamamoto, 1984). Table 2 shows the mean rating and level of importance for each of the computer competencies in each of the seven (7) categories, as well as the overall mean in each category. However, for purposes of further analysis, ranks for the means of all items are displayed in Appendix I.

Table 2

Level of Importance of Computer Competencies for

Elementary Teachers as Rated by Computer Specialists

Competencies	Mean	Level of Importance
The teacher should be able to:		
Educational Applications	4.05	Great
1. Characterize the use of the computer as an object of instruction, as an instructional medium, and as a problem-solving tool.	4.16	Great

(Continued)

(Table 2, continued)

Competencies	Mean	Level of Importance
2. Identify various options for using computers in an instructional setting for teaching and classroom management.	4.12	Great
3. Use computer courseware to individualize instruction and increase student learning.	4.10	Great
4. Differentiate between instructional computer applications.	4.04	Great
5. Apply and evaluate the general capabilities of the computer as a tool for instruction.	3.82	Great
Software	3.66	Great
1. Load and run a variety of computer software packages.	4.14	Great
2. Respond appropriately to common error messages when using software.	3.88	Great
3. Use at least one quality evaluative procedure to appraise and determine the instructional worth of a variety of computer software.	3.71	Great
4. Locate and use a variety of sources of evaluative information about software.	3.47	Moderate
5. Recognize that a computer gets instructions from software written in a programming language.	3.10	Moderate
Implementation	3.64	Great
1. Demonstrate appropriate uses of computer technology for basic skills instruction.	3.82	Great

(Continued)

(Table 2, continued)

Competencies	Mean	Level of Importance
2. Plan for effective pre- and post-computer interaction activities for students.	3.75	Great
3. Define the elements of a district plan for computer-based instruction, and define the role of the individual teacher in supporting that plan.	3.68	Great
4. Describe appropriate instructional arrangements for computer-based learning experiences.	3.30	Moderate
Information Resources	3.55	Great
1. Evaluate and assess information regarding computer uses in education, and use that information to plan for appropriate instructional uses.	3.55	Great
General Applications	3.36	Moderate
1. Describe how computers can assist the individual.	3.75	Great
2. Demonstrate an awareness of the major types of applications of the computer.	3.63	Great
3. Describe ways computers can assist in decision making.	3.15	Moderate
4. Explain various applications of computer technology for business, industry, leisure and home management.	2.89	Moderate
Future Trends.	3.36	Moderate
1. Respond appropriately to changes in curriculum and teaching methodology caused by new technological developments.	3.88	Great

(Table 2, continued)

Competencies	Mean	Level of Importance
2. Summarize future projections and trends in computer technology.	2.83	Moderate
Computers in Society	3.14	Moderate
1. Describe the impact that technological developments have on various career options.	3.36	Moderate
2. Demonstrate an awareness of computer usage in various fields.	3.12	Moderate
3. Discuss some of the positive and negative consequences in computer use in today's society.	2.93	Moderate

Categories or clusters representing the selected computer competencies are the following: (a) educational applications, (b) software, (c) general applications, (d) computers in society, (e) implementation, (f) information resources, and (g) future trends. The data show that competencies involving educational applications were perceived to be of great importance (M = 4.05) to the elementary teacher by computer specialists. All of the five items in this category were rated of great importance.

Competencies categorized in software were rated by computer specialists to be of great importance (M = 3.66) for the elementary teacher. The integration of the computer in the classroom as a learning tool can only be achieved

through the use of appropriate software. Computer specialists tend to emphasize competencies in software use, selection and evaluation, in the same manner as use, selection and evaluation of teaching materials is considered necessary to teaching. Therefore, it is of great importance for the elementary teachers to be able to use, select and evaluate courseware (Lacina, 1984).

Competencies in <u>implementation</u> were rated by computer specialists to be of <u>great importance</u> (M = 3.64) for the elementary teacher. It is not surprising to find that computer specialists consider implementation competencies to be of great importance. As coordinators and supervisors of computer programs, the computer specialists need to seek the cooperation of the teachers to achieve set program goals. Developing competencies in computer implementation among teachers facilitates the attainment of program goals.

The competency representing <u>information resources</u> was rated by the computer specialists to be of <u>great importance</u> (M = 3.55) for the elementary teacher. Information explosion is a characteristic of the modern age. Evaluating and assessing information regarding computers in education is a necessary task for an elementary teacher in making wise decisions in using such information in instructional situations. Information may include messages communicated face-to-face like seminars and conversations, or it may be

involve a more formal medium through published articles and reading materials. In both cases, the elementary teacher needs to develop skills for review, evaluation and synthesis of these new materials as it tends to become more critical as information continues to expand.

The growth of literature pertaining to computers in education, indicates an overwhelming growth and diversity of articles appearing in various journals. While it suggests considerable interest in microcomputers in education, it also presents some cause for alarm (Summers, 1985). Elementary teachers, therefore, need to develop competencies in selecting useful information.

General applications competencies were rated by computer specialists to be of moderate importance (M = 3.36) for the elementary teacher. It appears that computer specialists tend to deemphasize the importance of competencies on computer awareness and familiar- ization. The development of computer education has shifted from using the computer as an object of instruction to using the computer as a tool for instruction (Lamon, 1988).

The competencies comprising future trends were found to be considered by computer specialist to be of moderate importance (M = 3.36) for elementary teachers. However, item #1, was rated as of great importance for elementary teachers. This finding suggests that immediate concerns

related to instruction were deemed to be of great importance by the specialists. Item #2 refers to a general concern which could explain the rating of a lower level of importance.

The development of educational computing undergoes three stages: (a) the familiarization stage, (b) the maturation stage, and (c) the integration stage (Johnson, 1986). The computer specialists' rating on the competencies on future trends suggests an awareness that elementary teachers need to gain insight into these technological developments to be able to respond effectively to changes in curriculum and teaching methodology.

Competencies representing computers in society were rated by computer specialists to be of moderate importance (M = 3.14) for the elementary teacher. All three items in this category were rated to be of moderate importance. These items suggest computer awareness. The trend has gone far beyond the awareness stage. During the first years of computer education implementation, it was evident that the focus of attention and a matter of debate was whether computer education should be composed of competencies in knowledge about computers or skills in programming (Barger,1983; Moursund, 1983; Bitter,1983; Braumbaugh, 1982; Beck,1981; Taylor, Poirot, & Powell, 1980). In more recent years, competencies associated with computers in society has

been considered of least importance (Lacina, 1984) and for science teachers, computers and society were not essential competencies (Ellis & Kuerbis, 1985).

These findings manifest the computer specialists' awareness of the trend of the growth and development of computer programs in the elementary schools. In summarizing the findings on the specialists' ratings of the importance of the selected computer competencies for the elementary teacher, the following were shown to be of great importance: (a) educational applications, (b) software, (c) implementation, and (d) information resources, ranked in order from highest to lowest in mean rating. The following categories were rated of moderate importance for the elementary teacher: (a) general applications, (b) future trends, and (c) computers in society, ranked from highest to lowest in their mean ratings. Niess's (1989) study reflected a similar trend.

Level of Importance of Computer Competencies by Teachers

Research question #3 pertained to the level of importance of the selected computer competencies for the elementary teacher as rated by the computer-using elementary teachers. The specific computer competencies have been clustered into general categories based on the Texas Education Agency (1983) categorization. Table 3 presents the mean ratings and level of importance of the selected

computer competencies for the elementary teacher. Ranks for the means of all competencies are shown in Appendix J.

Table 3

Level of Importance of Computer Competencies for

Elementary Teachers as Rated by Teachers

Competencies	Mean	Level of Importance
The teacher should be able to:		
Educational Applications	3.75	Great
1. Identify various options for using computers in an instructional setting for teaching and classroom management.	3.84	Great
2. Use computer courseware to individualize instruction and increase student learning.	3.83	Great
3. Characterize the use of the computer as an object of instruction, as an instructional medium, and as a problem-solving tool.	3.79	Great
4. Differentiate between instructional computer applications.	3.72	Great
5. Apply and evaluate the general capabilities of the computer as a tool for instruction.	3.58	Great
Software	3.50	Great
1. Load and run a variety of computer software packages.	3.95	Great
2. Respond appropriately to common error messages when using software.	3.91	Great

(Continued)

(Table 3, continued)

Competencies	Mean	Level of Importance
3. Use at least one quality evaluative procedure to appraise and determine the instructional worth of a variety of computer software.	3.26	Moderate
4. Recognize that a computer gets instructions from software written in a programming language.	3.24	Moderate
5. Locate and use a variety of sources of evaluative information about software.	3.14	Moderate
Implementation	3.32	Moderate
1. Demonstrate appropriate uses of computer technology for basic skills instruction.	3.76	Great
2. Define the elements of a district plan for computer-based instruction, and define the role of the individual teacher in supporting that plan.	3.35	Moderate
3. Plan for effective pre- and post-computer interaction activities for students.	3.24	Moderate
4. Describe appropriate instructional arrangements for computer-based learning experiences.	2.94	Moderate
Information Resources	3.31	Moderate
1. Evaluate and assess information regarding computer uses in education, and use that information to plan for appropriate instructional uses.	3.31	Moderate

(Continued)

(Table 3, continued)

Competencies	Mean	Level of Importance
Information Resources	3.31	Moderate
1. Evaluate and assess information regarding computer uses in education, and use that information to plan for appropriate instructional uses.	3.31	Moderate
General Applications	3.14	Moderate
1. Describe how computers can assist the individual.	3.59	Great
2. Demonstrate an awareness of the major types of applications of the computer.	3.29	Moderate
3. Describe ways computers can assist in decision making.	2.95	Moderate
4. Explain various applications of computer technology for business, industry, leisure and home management.	2.72	Moderate
Future Trends	3.00	Moderate
1. Respond appropriately to changes in curriculum and teaching methodology caused by new technological developments.	3.53	Great
2. Summarize future projections and trends in computer technology.	2.47	Moderate
Computers in Society	2.87	Moderate
1. Describe the impact that technological developments have on various career options.	3.05	Moderate
2. Demonstrate an awareness of computer usage in various fields.	2.82	Moderate
3. Discuss some of the positive and negative consequences in computer use in today's society.	2.73	Moderate

Educational Applications

Of the seven categories or clusters of computer competencies, educational applications was rated highest by the teachers' group. Each of the computer competencies in this category was rated as of great importance for the elementary teacher with an overall mean of 3.75. This observation suggests that teachers recognize their main concern of the use of the computer for classroom management and instructional purposes. At the elementary level, Anderson and Smith (1984) reported that the majority of the teachers (84%) rated teaching with computers as an application which was frequently or always used in Texas schools. Similarly, in Lamon's (1988) survey of the use of microcomputers in the elementary schools in Oregon, he reported that the teacher's time was more educationally productive if used in trying out a program in preparation for students using it than for administrative purposes.

Integrating or infusing computers into the curriculum was conceived to be a positive step in the development of instructional computing (Eisele, 1986) and, although it has been a slow process, recognizing the need for change was an indicator of the acceptance of microcomputers in public schools (Hadley, 1987).

Software

Computer competencies regarding software were rated by computer-using teachers to be of great importance (M = 3.50)

for elementary teachers.   Individual ratings of these
competencies show some differences. The uses of software
(items #1 and #2) were rated as of _great importance_, while
information related to the use of
software (items #3, #4, and #5) were rated as of _moderate
importance_. This observation shows that computer-using
teachers hold priority on acquiring skills in the actual
use of software over acquiring related information on
software. Readers of _Classroom Computer Learning_ agreed
with this finding when they responded to a survey with their
opinion that computer literacy should focus on the use of
tool programs and education software (UMI, 1986).

Implementation

        As a corollary to the instructional use of computers,
teachers are cognizant of their role in computer education
in a broader sphere than in the limited use in teaching
subject areas. Computer competencies in _implementation_ was
rated by teachers to be of _moderate importance_ (M = 3.32)
for the elementary teacher. However, item #1 was rated of
great importance (M = 3.76). This observation was expected
since this competency is directly related to instruction.

Information Resources

        The competency representing _information resources_ was
rated by computer-using elementary teachers of _moderate
importance_ (M = 3.31) for the elementary teacher. This
result was expected, as it was previously observed in the

information aspect of <u>software</u>

competencies (item #4) being rated of <u>moderate importance</u>.

Similar interpretations are presented in that the teachers

tend to be primarily concerned with actual use of computers

rather than related information about computers.

<u>General Applications</u>

<u>General applications</u> competencies were rated by

computer-using teachers to be of <u>moderate importance</u> (M =

3.13) for elementary teachers. However, item #1 was rated

to be of <u>great importance</u> (M = 3.59). The reason for this

could be that "the individual" is primarily the student and

that students need to understand immediate reasons why they

need to use computers to be motivated to use the technology.

General information on computer applications (items #2, #3,

and #4) tended to be of secondary concern for teachers.

<u>Future Trends</u>

Directions for future trends appear to be evident as

a concern for elementary teachers. The competency

representing <u>future trends</u> was rated as moderately important

(M = 3.00). It can be noted, however, that item # 1 was

rated of <u>great importance</u> (M = 3.53). This competency is

basically related to responding to curriculum aspects

influenced by rapid technological developments, so it was

expected that teachers would consider it of great

importance. Item # 2 is concerned with general computer

trends. It is not surprising that teachers would consider

the competency to be of lesser importance. Contrary to expressed skepticism on the success in launching computer literacy programs in schools (Laney, 1985), the fear of the program's being transitory (Gress, 1981) or a passing fad, and earlier confusion on what competencies to develop to be computer literate (Johnson & Hoot, 1986; Mojowski, 1985; Hoth, 1985; Feldman, 1987), this finding seems to materialize positive future projections within the educational setting.

Computers in Society

Competencies representing computers in society were rated by computer-using teachers to be of moderate importance (M = 2.87) for elementary teachers. This observation is indicative of the shift of computer concerns from awareness (Milner, 1980; Hoth, 1985) to integration of the technology into the curriculum. This observation has been documented in recent literature (Johnson, 1986; Hadley, 1987; Abbott, 1984; Brody, 1986)

To summarize the findings pertaining to teachers' ratings on the level of importance of selected computer competencies, the following categories were rated to be of great importance for elementary teachers: (a) educational applications and (b) software, ranked from
highest to lowest mean rating. The following categories were rated to be of moderate importance for elementary teachers: (a) implementation, (b) information resources,

(c) general applications, (d) future trends, and (e) computers in society, ranked from highest to lowest mean rating.

Contrast Between Ratings of Specialists and Teachers

Research question #4 dealt with determining significant differences between the ratings of the computer specialists and the computer-using teachers on the level of importance of the selected computer competencies for the elementary teacher. The null hypothesis tested was: There is no significant difference between the ratings of the computer specialists and the computer-using teachers on the level of importance of each of the selected computer competencies for the elementary teacher. One-way analysis of variance was used to test the hypothesis at .05 significance level. Each table in this section presents the data by clusters or categories.

Educational Applications

The category educational applications is composed of five items. Descriptive statistics and the results of the F - test are presented in Table 4.

Table 4

Means and p - values on the Ratings of Specialists

and Teachers on the level of Importance of Computer

Competencies in Educational Applications

Competencies	Mean Rating		
	S	T	p
The teacher should be able to:			
1. Characterize the use of the computer as an object of instruction, as an instructional medium, and as a problem-solving tool.	4.16	3.79	.003*
2. Identify various options for using computers in an instructional setting for teaching and classroom management.	4.12	3.84	.029*
3. Use computer courseware to individualize instruction and increase student learning.	4.10	3.83	.034*
4. Differentiate between instructional computer applications.	4.04	3.72	.006*
5. Apply and evaluate the general capabilities of the computer as a tool for instruction.	3.82	3.58	.058
Total	4.05	3.75	

S = Specialists   * = significant at .05 level
T = Teachers
p = Probability

Data show that there was a significant difference

between the ratings of the computer specialists and

Figure 1

Contrast Between Mean Ratings in
Educational Applications Competencies
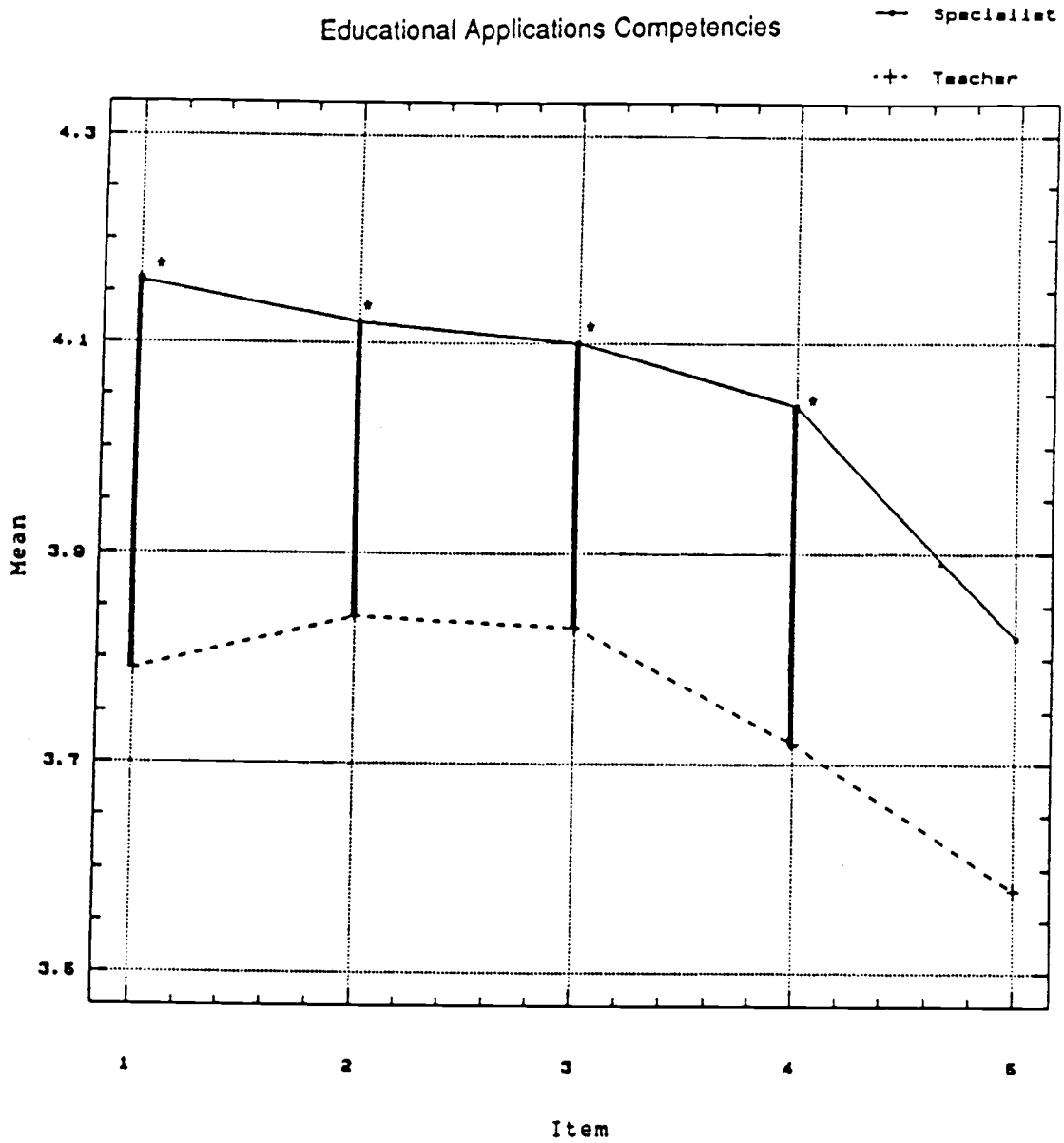
* = significant at .05

the computer-using teachers on the level of importance of the computer competencies in <u>educational applications</u> at an alpha level of .05. The overall mean for specialists is 4.05 and the overall mean for teachers is 3.75. Results of the data analysis for items #1, #2, #3, and #4 revealed significant differences between the two groups of respondents. Data in item #5, however, show that the difference was not significant .05 level. The null hypothesis, therefore, was rejected for items #1, #2, #3, and #4 and was not rejected for item #5. Figure 1 depicts the rejection pattern.

While both groups rated each of the five competencies in this category to be of <u>great importance</u> for the elementary teacher, significant differences in the assigned numerical ratings imply that specialists have higher expectations of these computer competencies for elementary teachers than the elementary teachers themselves. This could be attributed to the difference in level of knowledge of computers between the specialists and the teachers. It has been found by Luning (1985) that as the teacher's knowledge of computers increases, the teacher's opinion of the level and type of use of computers in the classroom also increases.

<u>Software</u>

Data on the contrast between computer specialists' ratings and computer-using teachers' ratings on the level

of importance of <u>software</u> competencies for elementary
teachers are presented in Table 5. There are five items
in this category.

Table 5

Means and <u>p</u> - values on the Ratings of Specialists

and Teachers on the level of Importance of Computer

Competencies in Software

| Competencies	Mean Rating		
	S	T	p
The teacher should be able to:			
1. Load and run a variety of computer software packages.	4.14	3.95	.132
2. Respond appropriately to common error messages when using software.	3.88	3.91	.836
3. Use at least one quality evaluative procedure to appraise and determine the instructional worth of a variety of computer software.	3.71	3.26	.002*
4. Locate and use a variety of sources of evaluative information about software.	3.47	3.14.	022*
5. Recognize that a computer gets instructions from software written in a programming language.	3.10	3.24	.398
Total	3.66	3.50	

S = Specialists   * = significant at .05 level
T = Teachers
p = Probability

Data on computer competencies related to software seem

to indicate a general agreement between computer specialists and computer-using teachers on the level of importance for elementary teachers as indicated by the significance level ($p > .05$) and both groups rated this category to be of <u>great importance</u>. Individually, items #1, #2, and #5 seem to indicate agreement between the specialists and teachers. It is also noted that in item #2, the teachers rated this particular competency slightly higher than did the specialists. Figure 2 shows the pattern of these results.

Items #3 and #4 indicate non-agreement between the two groups of respondents, showing significant differences ($p \leq .05$). These two items deal with evaluation of software. Specialists tend to expect teachers to develop higher levels of competencies in the evaluation of software, while teachers expect a lower level of importance of this competency for themselves. The reason could be attributed to the lesser exposure of teachers to software compared to the specialists, such that specialists become more aware of the necessity of teachers to be able to evaluate software to be used. On the part of the teacher, at this early stage of integrating the computer into the curriculum, they tend to be more concerned on how to use the software and most likely rely on the judgment of computer specialists to recommend suitable software for the teacher's classroom use. Other reasons could be attributed

Figure 2

Contrast Between Mean Ratings in

Software Competencies

* = significant at .05
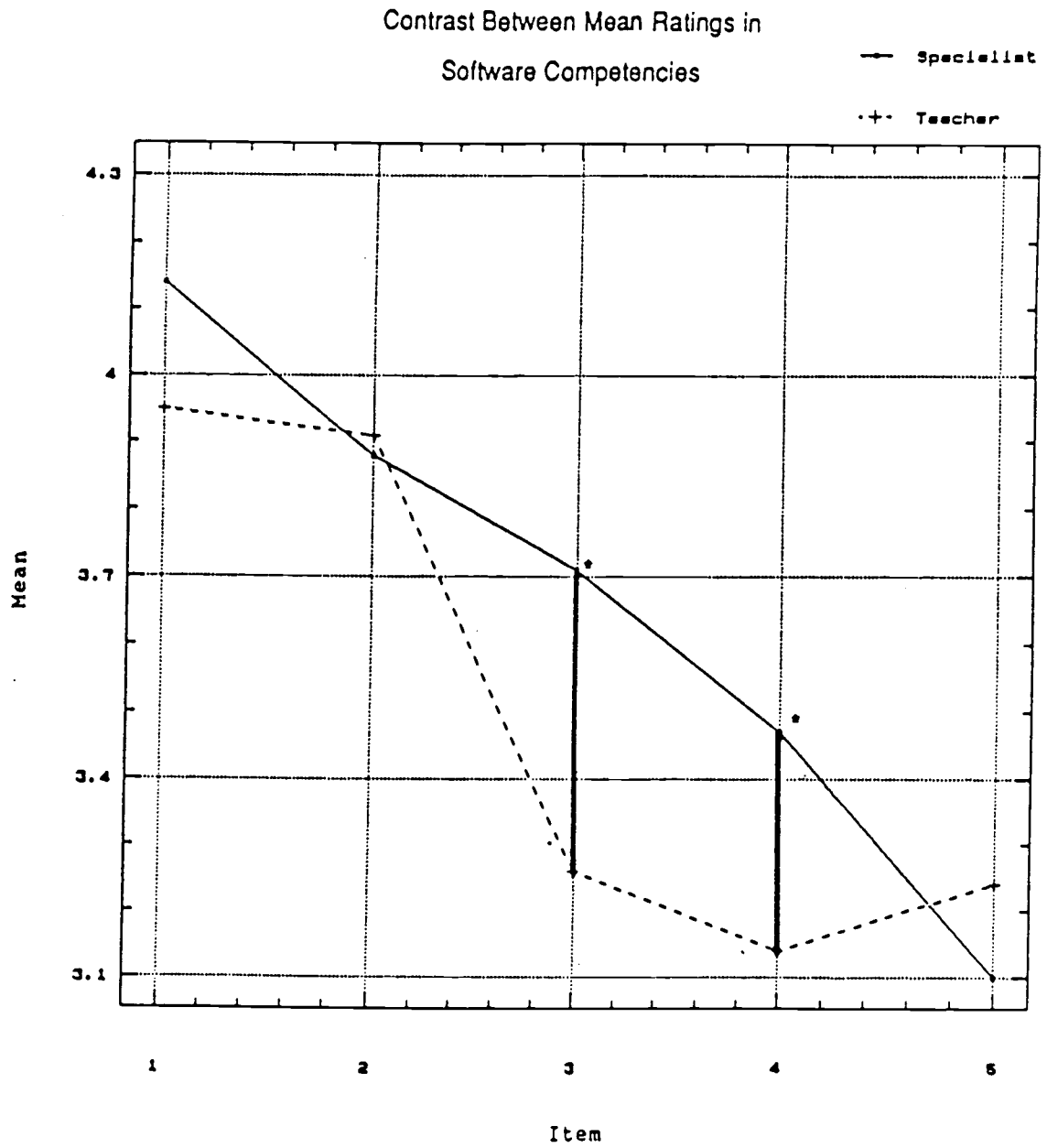
to lack of time, as they are already overloaded with other teaching responsibilities (Lamon, 1988).

Implementation

The set of competencies on computer implementation involves a broader scope of knowledge and skills than the use of computers limited to instructional functions. Data in this category were analyzed to contrast ratings on the level of importance assigned by computer specialists and computer-using teachers for the elementary teacher. Table 6 reports descriptive statistics and the results of the analysis of variance comparing the ratings of the two groups of respondents. Figure 3 presents the pattern of the results.

Table 6

Means and p - values on the Ratings of Specialists

and Teachers on the level of Importance of Computer

Competencies in Implementation

Competencies	Mean Rating		
	S	T	p
The teacher should be able to:			
1. Demonstrate appropriate uses of computer technology for basic skills instruction.	3.82	3.76	.602
2. Plan for effective pre- and post-computer interaction activities for students.	3.75	3.24	<.001*
3. Define the elements of a district plan for computer-based instruction, and define the role of the individual teacher in supporting that plan.	3.68	3.35	.018*
4. Describe appropriate instructional arrangements for computer-based learning experiences.	3.30	2.94	.012*
Total	3.64	3.32	

S = Specialists   * = significant at .05 level
T = Teachers
p = Probability

Data in Table 6 show that there was a significant

difference (p < .05) between the ratings of the specialists

and the ratings of the teachers on the level of importance

of the majority of the selected computer competencies for

elementary teachers in this category. The overall average

Figure 3

Contrast Between Mean Ratings in

Implementation Competencies

Item

* = significant at .05
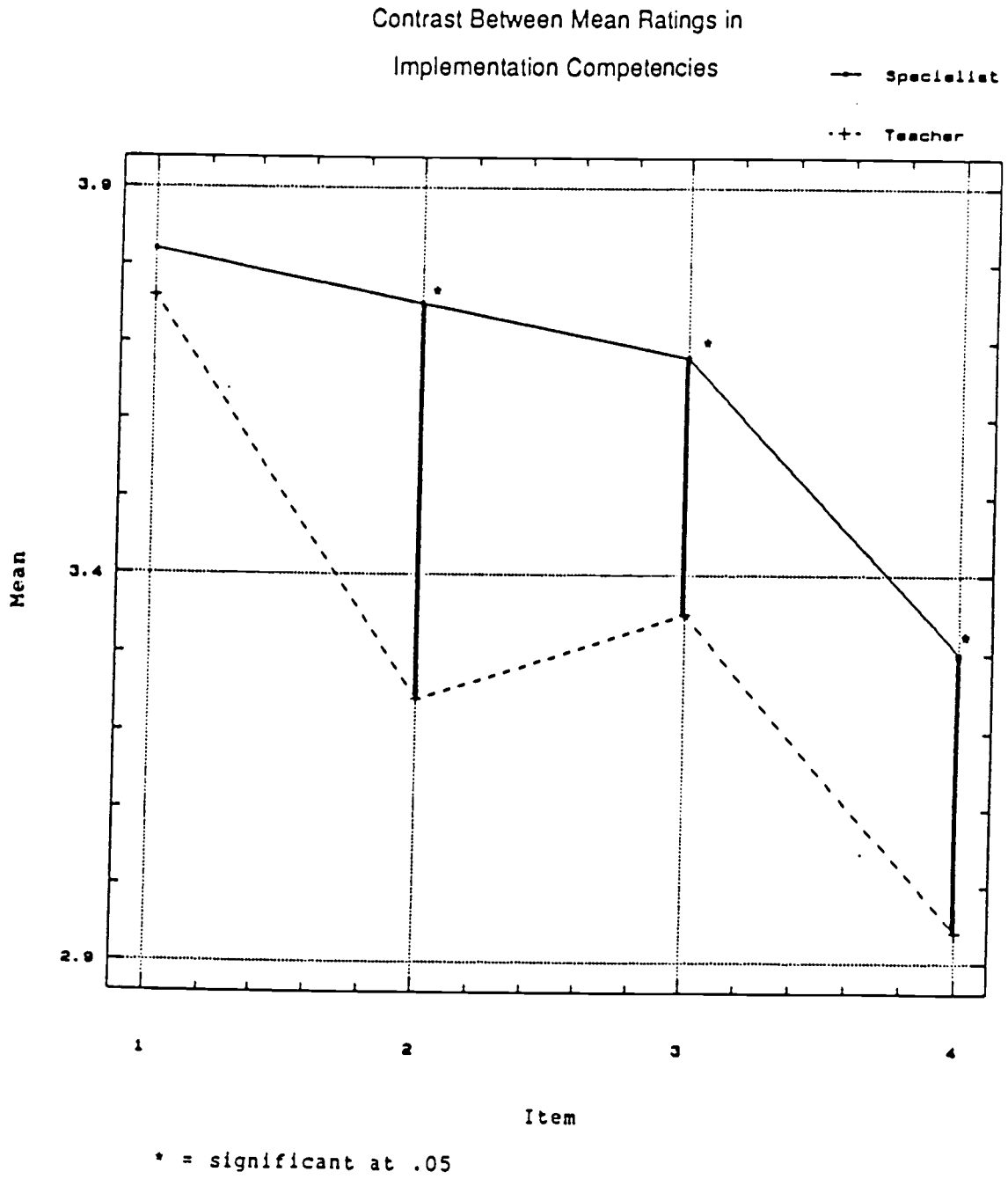
rating by the specialists (M = 3.64) means that the competencies representing the category on <u>implementation</u> were of <u>great importance</u> for elementary teachers and the overall rating by the teachers (M = 3.32) means that these competencies are of <u>moderate importance</u> for the elementary teachers. The apparent disagreement between the two groups of respondents may be attributed to the nature of their roles in the implementation of computer programs. Computer specialists assume the responsibility of coordinating and supervising teachers to implement plans and attain goals set for computer programs. Computer-using teachers, rely on the computer specialists to do the greater part of the implementation of computer programs may be the underlying factor related to these differing ratings.

Analyzing data on individual items in this category will help clarify or determine the trends regarding the computer <u>implementation</u> competencies. Data in item #1 indicate agreement between the specialists and the teachers on the level of importance of this competency for elementary teachers (<u>p</u> > .05). At the same time, both groups of respondents rated this competency to be of <u>great importance</u> for the elementary teacher. The reason for this may be that they both see the importance of using computers for basic skills instruction. The data on the rest of the items in this category (item #2, item #3, and item #4) indicate that there are significant differences between the

specialist and the teacher ratings on the level of
importance of these particular competencies for the
elementary teacher. The general characteristics of the
latter competencies indicate a non-basic need for regular
classroom instruction which could explain why teachers did
not consider them to be of greater importance for
themselves. Planning and evaluation are main concerns for
computer specialists and their ratings on these
competencies tend to reflect their area of greatest
interest.

Information Resources

The competency representing information resources is
discussed in the following text. Table 7 presents the
pertinent data on the contrast between the specialists'
ratings and the teachers' ratings on the level of
importance of this computer competency for elementary
teachers. Figure 4 shows the pattern of the results.

Table 7

Means and p - values on the Ratings of Specialists

and Teachers on the level of Importance of Computer

Competencies in Information Resources

Competencies	Mean Rating		
	S	T	p
The teacher should be able to:			
1. Evaluate and assess information regarding computer uses in education, and use that information to plan for appropriate instructional uses.	3.55	3.31	.077
Total	3.55	3.31	.077

S = Specialists
T = Teachers
p = Probability

Comparing the means of ratings between the two groups of respondents by categorical levels of importance, the specialists rated the competency on information resources to be of great importance (M = 3.55) while teachers rated the same competency to be of moderate importance (M = 3.31). Statistically, there was no significant difference between the ratings of the two groups of respondents on the level of importance of the competency on information resources (p > .05). These data indicate that, while the ratings fell within different ranges, specialists agreed with teachers on the level of importance of acquiring information resources competencies by elementary teachers.

Figure 4

Contrast Between Mean Ratings in

Information Resources Competencies

Mean
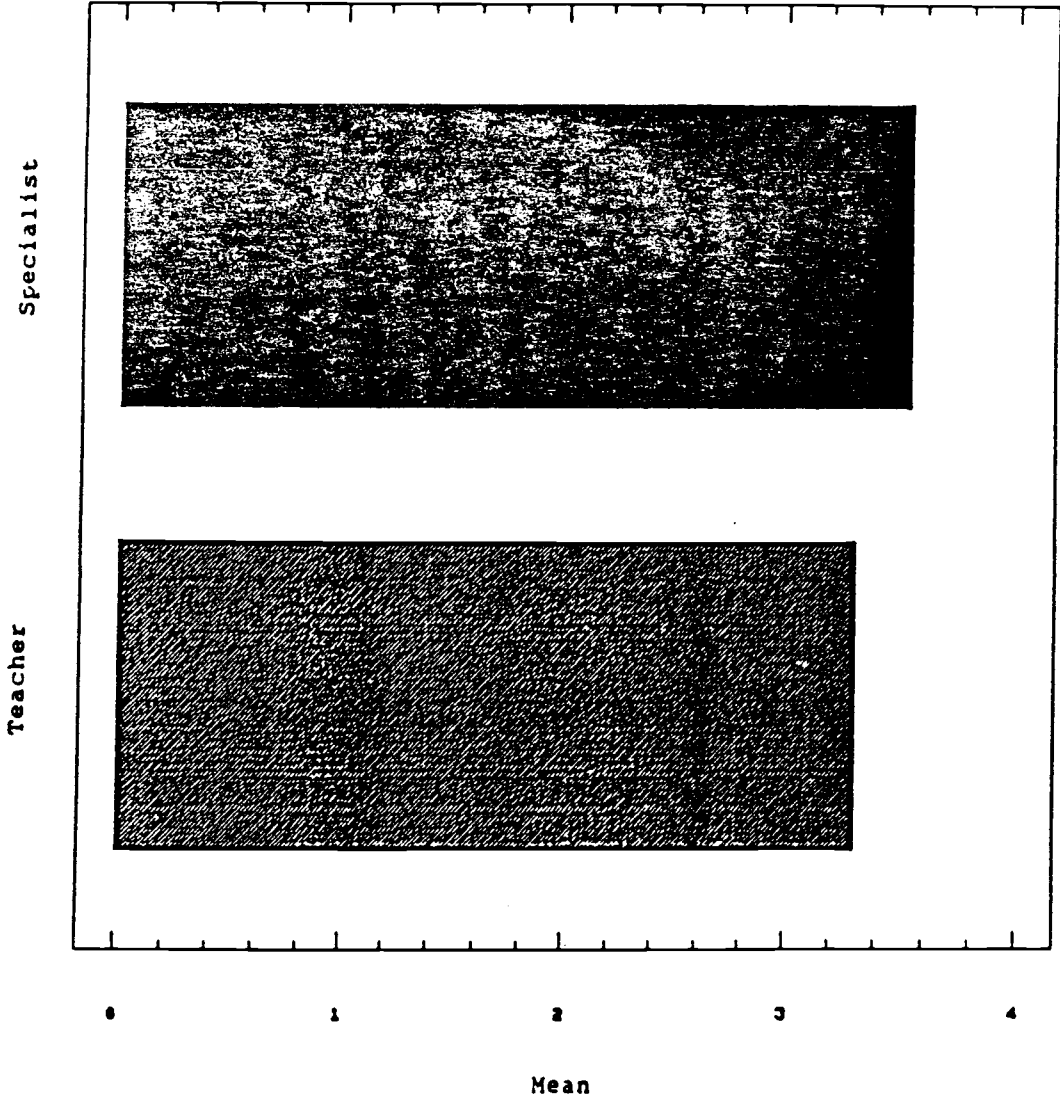
<u>General Applications</u>

The next category is <u>general applications</u>. Data on the contrast between specialists' ratings and teachers' ratings on the level of importance of general applications competencies for elementary teachers are presented in Table 9. This category is composed of four specific competencies. The pattern of the results are shown in Figure 5.

Table 8

Means and <u>p</u> - values on the Ratings of Specialists and Teachers on the level of Importance of Computer Competencies in General Applications

| Competencies | Mean Rating | | |
	S	T	p
<u>The teacher should be able to</u>:			
1. Describe how computers can assist the individual.	3.75	3.59	.227
2. Demonstrate an awareness of the major types of applications of the computer.	3.63	3.29	.012*
3. Describe ways computers can assist in decision making.	3.15	2.95	.132
4. Explain various applications of computer technology for business, industry, leisure and home management.	2.89	2.72	.239
Total	3.36	3.14	

S = Specialists   * = significant at .05 level
T = Teachers
p = Probability

Figure 5

Contrast Between Mean Ratings in

General Applications Competencies

— Specialist

·+· Teacher

* = significant at .05

Comparing the overall mean rating of the specialists to that of the overall mean rating of the teachers, no differences are evident in terms of level of importance. Both groups of respondents rated the level of importance of the competencies representing general applications to be of moderate importance (M = 3.36 for specialists and M = 3.14 for teachers). There appears to be agreement between the two groups that the importance of the competencies for general applications for teachers is moderate. Findings of Schuttenberg et al. (1985) tend to suggest that in the classroom, more should be done in all areas of computer application.

Future Trends

Data on the competency representing the category future trends is shown in Table 9. Figure 6 presents the pattern of the results.

Table 9

Means and p - values on the Ratings of Specialists

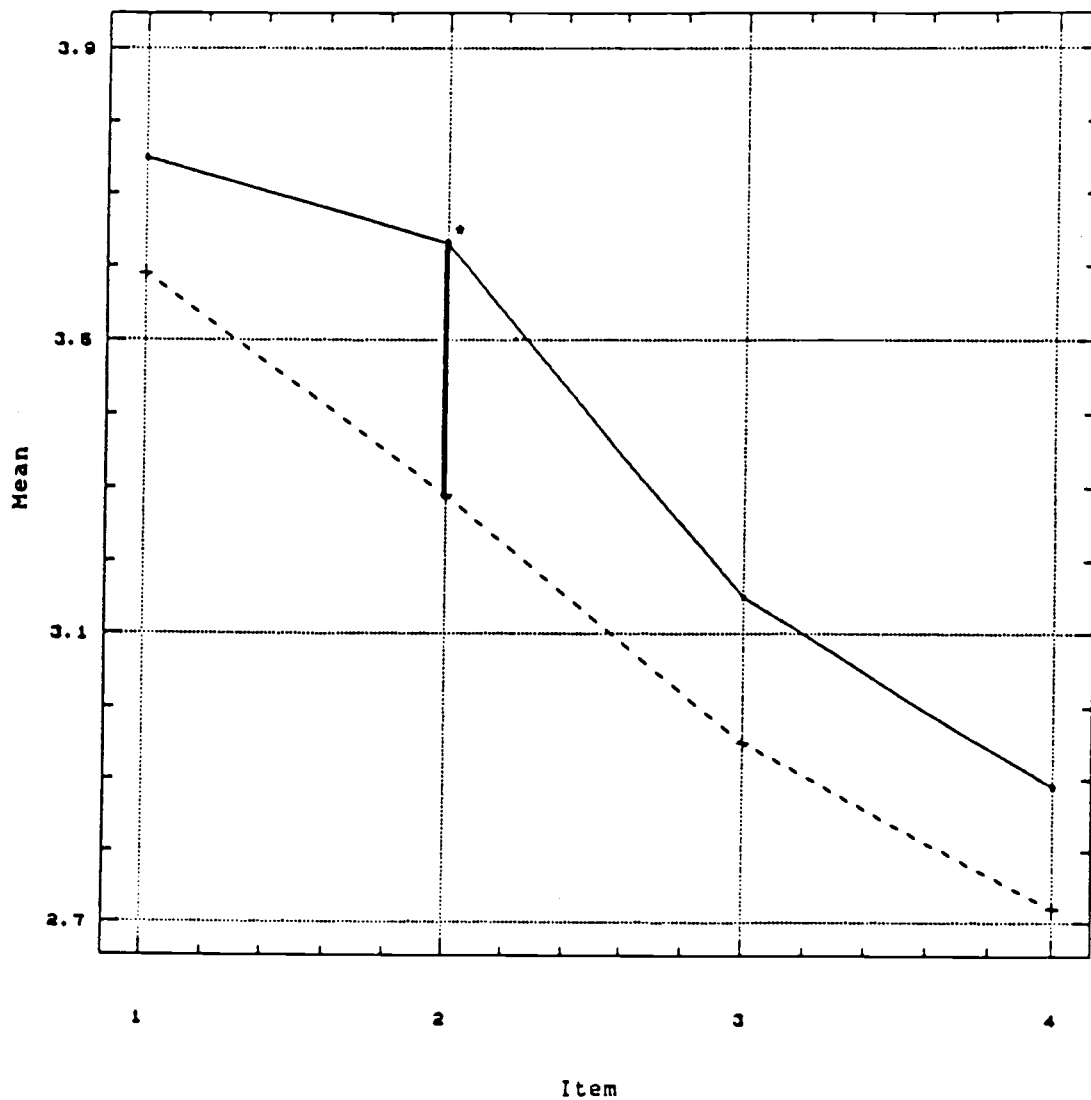and Teachers on the level of Importance of Computer

Competencies in Future Trends

Competencies	Mean Rating		
	S	T	p
The teacher should be able to:			
1. Respond appropriately to changes in curriculum and teaching methodology caused by new technological developments.	3.88	3.53	.009*
2. Summarize future projections and trends in computer technology.	2.83	2.47	.011*
Total	3.36	3.00	

S = Specialists   * = significant at .05 level
T = Teachers
p = Probability

Table 9 presents the results of the analysis of variance of data gathered on the competency on _future trends_. The analysis indicated a significant difference between the ratings of the specialists and the ratings of the computer-using teachers on the level of importance of the computer competency _future trends_ for elementary teachers (p < .05). While the ratings of both groups of respondents were within the categorical level of

Figure 6

Contrast Between Mean Ratings in
Future Trends Competencies

Item
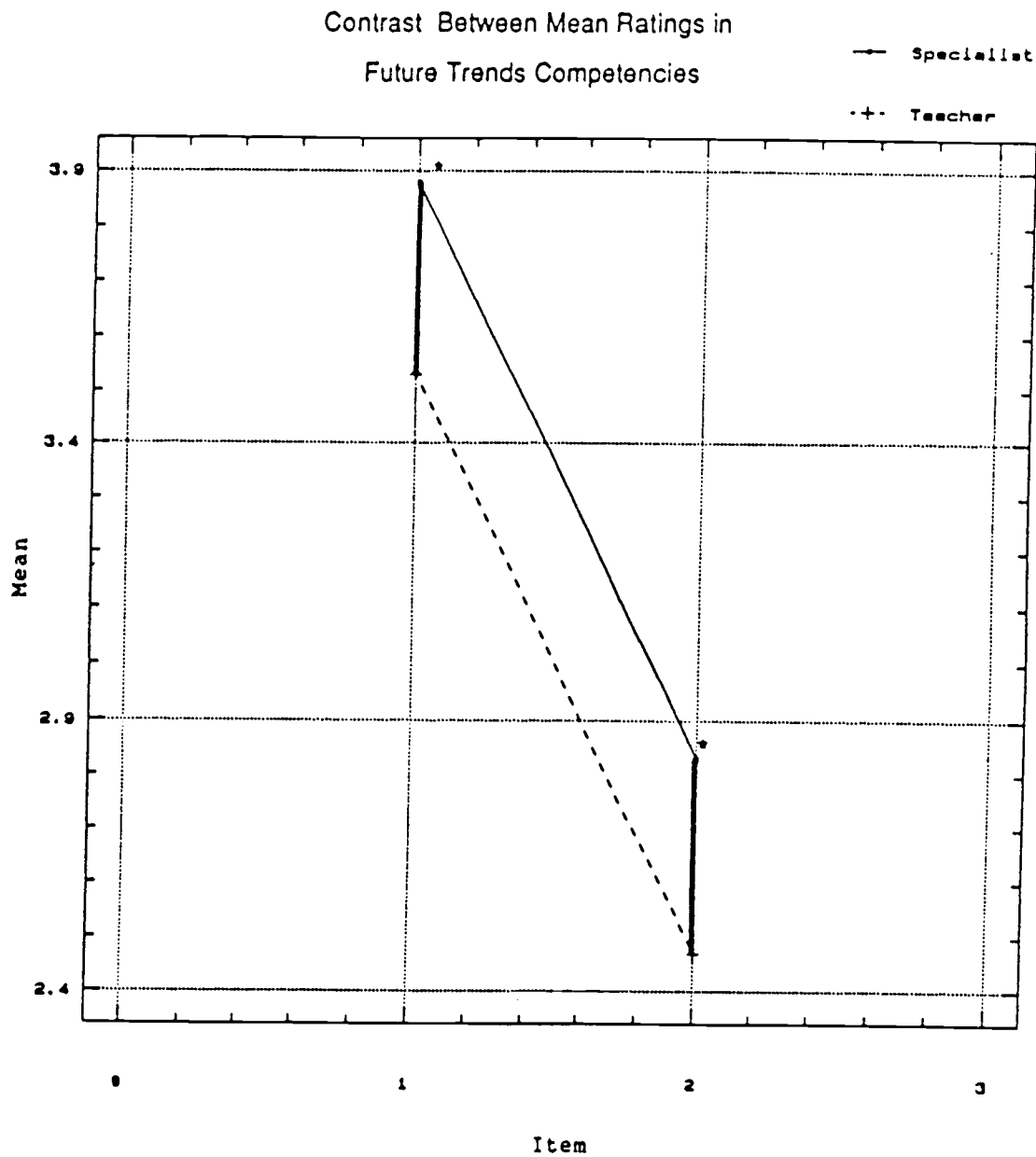
* = significant at .05

great importance, the F - test revealed significant differences on the ratings assigned by the samples. It can be inferred that computer specialists have significantly higher levels of expectations on the level of importance of this competency for elementary teachers than did the teachers themselves.

Computers in Society

Issues on computers in society has been the focus of attention in computer literacy since the early 1980's. Reorientation of the goals of computer education programs has been a product of continuously monitoring educational efforts to relevantly approach the issues on the development of the new technology. Table 10 shows pertinent data on the competencies representing computers in society. Figure 7 presents the pattern of the results.

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Table 10

Means and p - values on the Ratings of Specialists

and Teachers on the level of Importance of Computer

Competencies in Computers in Society

Competencies	Mean Rating		
	S	T	p
The teacher should be able to:			
1. Describe the impact that technological developments have on various career options.	3.36	3.05	.039*
2. Demonstrate an awareness of computer usage in various fields.	3.12	2.82	.043*
3. Discuss some of the positive and negative consequences in computer use in today's society.	2.93	2.73	.163
Total	3.14	2.87	

S = Specialists   * = significant at .05 level
T = Teachers
p = Probability

     Three computer competencies represent the category on

computers in society.   The overall mean rating by

specialists (M = 3.14) on the level of importance of the

competencies in computers in society as well as the overall

mean rating by teachers (M = 2.87) are within the range

of moderate importance (2.50 - 3.49). Computer specialists

Figure 7

Contrast Between Mean Ratings in
Computers in Society Competencies

* = significant at .05
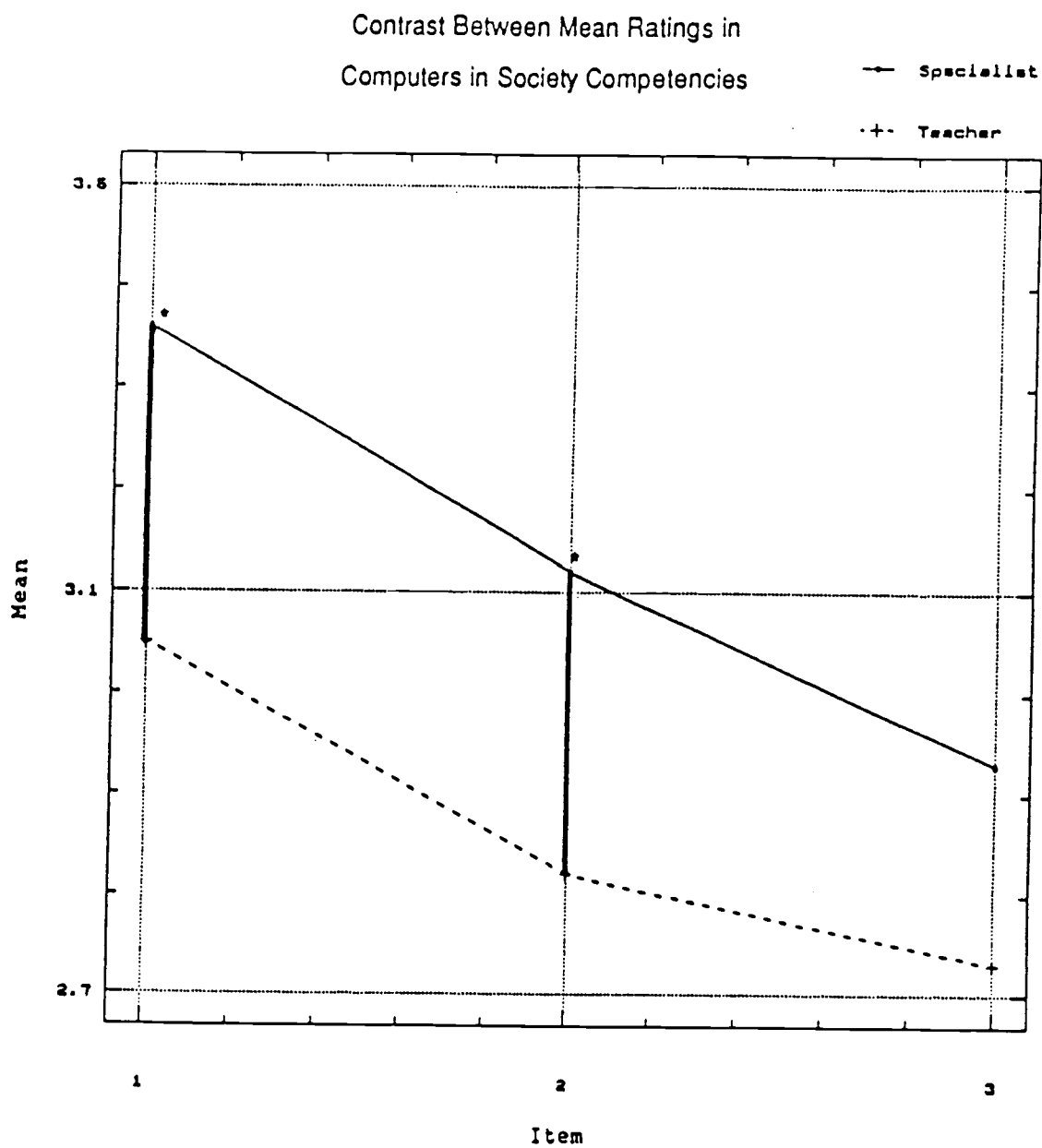
as well as the teachers themselves, tended to agree that competencies regarding computers in society are of moderate importance for the elementary teacher.

To summarize the results and discussion pertaining to the contrast between the ratings of the specialist and the teachers on the level of importance of the selected computer competencies for the elementary teacher, Figure 8 presents the pattern of the mean ratings on the seven categories. Significant differences were predominantly observed in (a) educational applications, (b) implementation, (c) future trends, and (d) computers in society. No significant differences were predominantly observed in (a) software, (b) information resources, and (c) general applications. Overall, ratings on 13 out of 24 selected computer competencies resulted in significant differences and ratings on 11 out of 24 were found not significantly different.

Figure 8

Contrast Between Mean Ratings of

Specialists and Teachers

—•— Specialist

·+· Teacher

Category
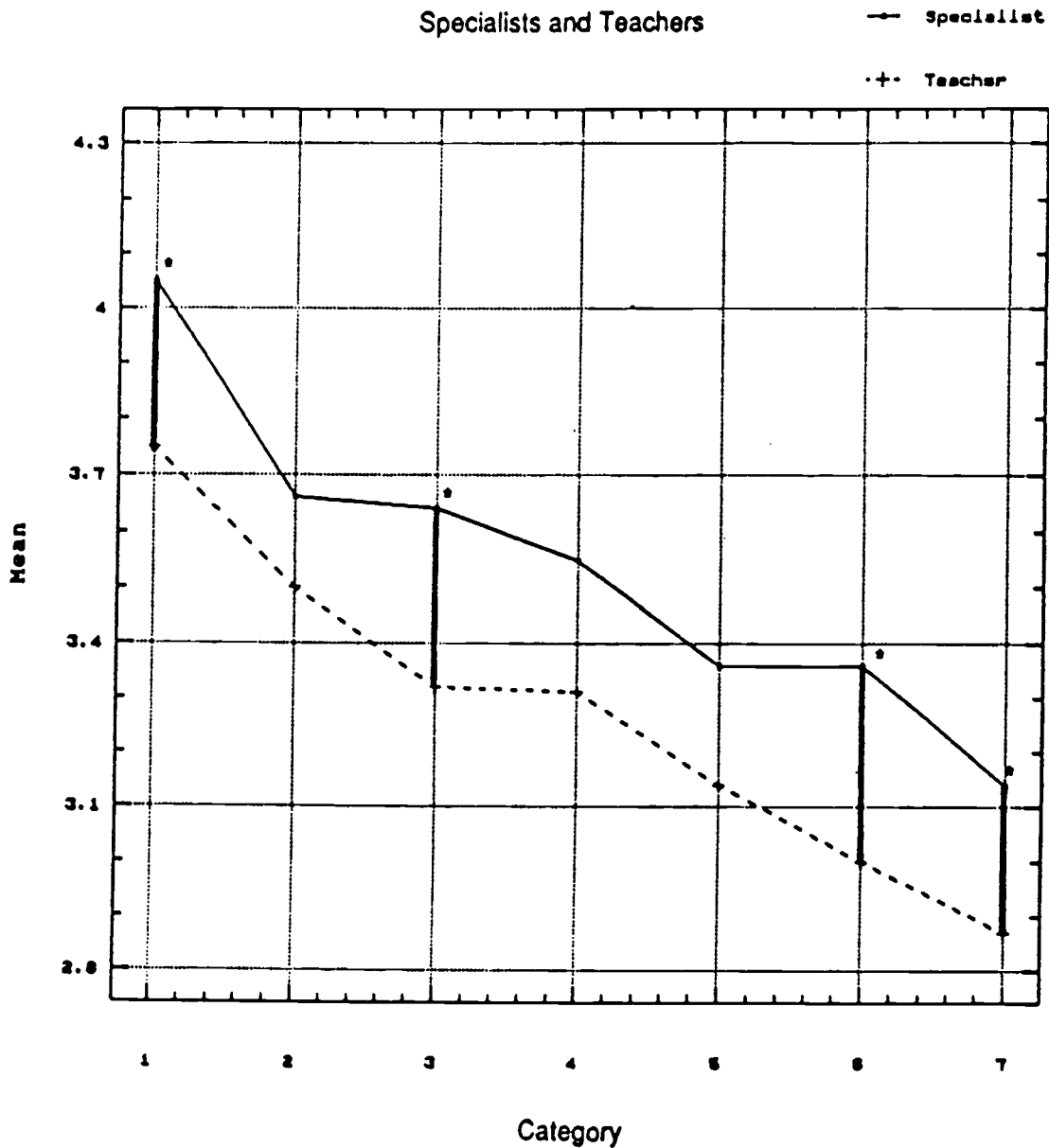
1 - Educational Applications
2 - Software
3 - Implementation
4 - Information Resources

5 - General Applications
6 - Future Trends
7 - Computers in Society

Chapter 5

SUMMARY, CONCLUSIONS AND IMPLICATIONS

This chapter summarizes the major findings of the study. Conclusions were drawn from the findings, and implications were derived from these conclusions.

Summary

The major purpose of this study was to compare the level of importance of selected computer competencies for elementary teachers as perceived by computer specialists and teachers. Results are summarized into three aspects: (a) ratings of specialists, (b) ratings of teachers, and (c) differences between the ratings of the two groups of respondents. Data were analyzed by using descriptive statistics and analysis of variance.

A. Ratings of Specialists

Fifteen out of 24 selected competencies were perceived to be of great importance and nine (9) were found to be of moderate importance. The results are presented.

The computer specialists perceived the following competencies to be of great importance for the elementary teacher:

Educational Applications:

1. Characterize the use of the computer as an object of instruction, as an instructional medium, and as a

problem-solving tool.

2.   Identify various options for using computers in an instructional setting for teaching and classroom management.

3.   Use computer software to individualize instruction and increase student learning.

4.   Differentiate between instructional computer applications.

5.   Apply and evaluate the general capabilities of the computer as a tool for instruction.

Software:

6.   Load and run a variety of computer software packages.

7.   Respond appropriately to common error masseges when using software.

8.   Use at least one quality evaluative procedure to appraise and determine the instructional worth of a variety of computer software.

Implementation:

9.   Demonstrate appropriate uses of computer technology for basic skills instruction.

10. Plan for effective pre- and post-computer interaction activities for students.

11. Define the elements of a district plan for computer-based instruction, and define the role of the individual teacher in supporting that plan.

Information Resources:

12. Evaluate and assess information regarding computer uses in education, and use that information to plan for appropriate instructional uses.

General Applications:

13. Describe how computers can assist the individual.

14. Demonstrate an wareness of the major types of applications of the computer.

Future Trends:

15. Respond appropriately to changes in curriculum and teaching methodology caused by new technological developments.

The following computer competencies were perceived by the computer specialists to be of moderate importance for the elementary teacher:

Software:

1. Locate and use a variey of sources of evaluative information about software.

2. Recognize that a computer gets instructions from software written in a programming language.

Implementation:

3. Describe appropriate instructional arrangements for computer-based learning experiences.

<u>General Applications</u>:

4.   Describe ways computers can assist in decision making.

5.   Explain various applications of computer technology for business, industry, leisure and home management.

<u>Future Trends</u>:

6.   Summarize future projections and trends in computer technology.

<u>Computers in Society</u>:

7.   Describe the impact that technological developments have on various career options.

8.   Demonstrate an awareness of computer usage in various fields.

9.   Discuss some of the positive and negative consequences of computer use in today's society.

B. Ratings of Teachers

Results from the ratings of teachers are summarized. Ten (10) out of 24 selected competencies were found to be of great importance and 14 were shown to be of moderate importance.

The following competencies were determined to be of great importance for the elementary teacher.

<u>Educational Applications</u>:

1.   Characterize the use of the computer as an object of instruction, as an instructional medium, and as a

problem-solving tool.

2.   Identify various options for using computers in an instructional setting for teaching and classroom management.

3.   Use computer software to individualize instruction and increase student learning.

4.   Differentiate between instructional computer applications.

5.   Apply and evaluate the general capabilities of the computer as a tool for instruction.

Software:

6.   Load and run a variety of computer software packages.

7.   Respond appropriately to common error messages when using software.

Implementation:

8.   Demonstrate appropriate uses of computer technology for basic skills instruction.

General Applications:

9.   Describe how computers can assist the individual.

Future Trends:

10.   Respond appropriately to changes in curriculum and teaching methodology caused by new technological developments.

The following competencies were perceived by the teachers to be of moderate importance for themselves:

<u>Software</u>:

1.   Use at least one quality evaluative procedure to appraise and determine the instructional worth of a variety of computer software.

2.   Locate and use a variey of sources of evaluative information about software.

3.   Recognize that a computer gets instructions from software written in a programming language.

<u>Implementation</u>:

4.   Plan   for   effective   pre-   and   post-computer interaction activities for students.

5.   Define   the   elements   of   a   district   plan   for computer-based instruction, and define the role of the individual teacher in supporting that plan.

6.   Describe appropriate instructional arrangements for computer-based learning experiences.

<u>Information Resources</u>:

7.   Evaluate   and   assess   information   regarding computer uses in education, and use that information to plan for appropriate instructional uses.

<u>General Applications</u>:

8.   Demonstrate an awareness of the major types of applications of the computer.

9.   Describe ways computers can assist in decision making.

10. Explain various applications of computer technology for business, industry, leisure and home management.

Future Trends:

11. Summarize future projections and trends in computer technology.

Computers in Society:

12. Describe the impact that technological developments have on various career options.

13. Demonstrate an awareness of computer usage in various fields.

14. Discuss some of the positive and negative consequences of computer use in today's society.

C. Differences Between the Ratings of the Specialists and the Teachers

When the specialists' and the teachers' ratings on the level of importance of the computer competencies were contrasted, significantly higher ratings ($p < .05$) were observed from the specialists. F-tests revealed that 13 out of the 24 selected competencies were rated differently in terms of the level of importance for the elementary teacher. The following are the pertinent competencies which were rated higher by the specialists than by the teachers:

Educational Applications:

1. Characterize the use of the computer as an object of instruction, as an instructional medium, and as a problem-solving tool.

2. Identify various options for using computers in an instructional setting for teaching and classroom management.

3. Use computer software to individualize instruction and increase student learning.

4. Differentiate between instructional computer applications.

Software:

1. Use at least one quality evaluative procedure to appraise and determine the instructional worth of a variety of computer software.

2. Locate and use a variey of sources of evaluative information about software.

Implementation:

1. Plan for effective pre- and post-computer interaction activities for students.

2. Describe appropriate instructional arrangements for computer-based learning experiences.

General Applications:

1. Demonstrate an awareness of the major types of applications of the computer.

<u>Future Trends</u>:

1. Respond appropriately to changes in curriculum and teaching methodology caused by new technological developments.

2. Summarize future projections and trends in computer technology.

<u>Computers in Society</u>:

1. Describe the impact that technological developments have on various career options.

2. Demonstrate an awareness of computer usage in various fields.

Conclusions

The following conclusions can be drawn from this study:

1. Computer specialist prioritize the development of computer competencies for the elementary teacher in the aspects of educational applications, software, implementation, information resources over competencies in general applications, future trends and computers in society.

2. Computer-using teachers prioritize the development of computer competencies for themselves in the aspects of educational applications, and software over competencies

in implementation, information resources, general applications, future trends and computers in society.

3. Differences between the specialists and the teachers in the perceived level of importance of the selected competencies for the elementary teacher predominantly occur in the aspects of educational applications, implementation, future trends, and computers in society.

Implications

There is an evident commonality in the trend of ratings between specialists and teachers. The figures generally presented parallel lines representing the ratings of either group of respondents. This observation indicates similar priorities of specialists and teachers on the level of importance of the selected computer competencies. However, significant differences were found in the ratings of most of these competencies which implies that specialists have higher expectations of what computer competencies teachers need to develop.

Specialists have higher expectations of teachers than teachers expect of themselves. Such a situation harbors disharmony between partners in the implementation of computer education programs. Realignment of expectations will bring about a more effective way of attaining educational goals. It was observed by Luning (1985) that

perceptions of teachers on the use of computers were influenced by the level of knowledge that they have acquired. Results indicate that teachers need training on immediate needs on using computers and software. For teachers to be able to meet the demands of the infusion of the new instructional technology into the regular classroom activities, competencies in the areas of educational applications and software are necessary. The growing emphasis on the use of instructional software makes it imperative that teachers should be able to evaluate existing software to deliver quality education to the students. Inservice training programs should be geared toward the development of competencies of elementary teachers along the identified competencies where there were apparent gaps of expectations between specialists and teachers. These identified competencies tend to concentrate on using the computer as an instructional tool, the mechanics of dealing with the computer to be able to respond to common error messages, and using software in a variety of applications directly related to teaching. Different levels of training may be offered to meet the needs of more advanced teachers in the use of the technology.

Differences between the perceptions of teachers and specialists reflect the differing levels of experience for teachers in computer use. Preservice training institutions

should respond to minimize these differences in terms of curriculum development in teacher education programs so that projections of the competency needs of teachers may be based on present needs. Trends indicate that, after the familiarization stage, integration has materialized. Instructional software are being used in the schools. Future projections indicate that development of software will be the area of concern in the elementary schools. Teachers will be able to manipulate and create programs to suit their individual needs. Considering the dynamic nature of computer technology, teacher training programs need to respond to recommendations from research in determining the content of computer education curricula.

For school administrators, the differences between the teachers and specialists on the level of importance of computer competencies should provide baseline information on what expectancies need to be realigned. Results of this research show that using the computer for educational applications and software utilization are the priority needs. Differences between the perceptions of specialists and teachers should be addressed by redefining immediate goals from time to time as teachers' activities and progress in the integration of computer are being closely monitored by the specialists.

Teachers and coordinators should bridge the gap between their expectations by the specialists working

closely with the teachers and providing advanced training as needed. At a stage when decision, implementation, and confirmation of educational use of computers are the issues, information and communication become the prime factors in the adoption of an innovation (Summers, 1985).

Finally, this research being a survey and is exploratory in nature, will provide insights to future researchers in developing more indepth studies to determine factors related to non-agreement between specialists and teachers in their perceptions of competencies and content not only for computer education but for other educational curricula as well.

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APPENDICES

Appendix A

LETTER TO DELPHI PANEL AND INITIAL INSTRUMENT

252 NW Kings Boulevard
Corvallis, Oregon 97330
November 17, 1988

James Sanner
Department of Education
700 Pringle Parkway SE
Salem, Oregon 97310-0290

Dear Sir:

Thank you for agreeing to serve as a DELPHI panelist in the study that I am conducting to determine the level of importance of a set of computer competencies for the elementary teacher. The purpose of the DELPHI process is to revalidate the set of competencies developed by the Texas Education Agency to be used as instrument for the collection of data from elementary grades computer specialists and computer-using classroom teachers. The results of the study will determine if there is agreement between the two groups in the level of importance of the computer competencies. This will be a valuable input in the ongoing implementation of computer technology in teaching.

The DELPHI panelist will react individually and independently on the instrument. I will serve as the liaison for the work. It is anticipated that only two iterations will be required before consensus is gained. Consensus among the panel members will be considered adequate when 75% of you agree on the content of the instrument.

I will appreciate very much if you could return the completed instrument not later than November 30, 1988. Thank you very much for the list of computer specialists.

Sincerely,

CAPPIA TAQUEBAN
Graduate Student, Oregon State University

THE INITIAL INSTRUMENT

COMPUTER COMPETENCIES FOR THE ELEMENTARY TEACHER

DIRECTIONS: Please evaluate each of the computer competencies on the level of importance for the elementary teacher. Circle the number on the scale.

Competencies	VERY UNIMPORTANT.....IMPORTANT					
	1	2	3	4	5	6

The teacher should be able to:

1. Characterize the use of the computer as an object of instruction, as an instructional medium, and as a problem-solving tool........... 1 2 3 4 5 6

2. Identify various options for using computers in an instructional setting for teaching and classroom management, such as: computer assisted instruction, computer managed instruction, problem solving, test scoring, word processing, data-base management........... 1 2 3 4 5 6

3. Differentiate between instructional computer applications such as drill-and-practice, tutorial, simulation, and problem-solving........ 1 2 3 4 5 6

4. Apply and evaluate the general capabilities of the computer as a tool for instruction........ 1 2 3 4 5 6

5. Use computer courseware (software) to individualize instruction and increase student learning................................. 1 2 3 4 5 6

6. Recognize that a computer gets instructions from software written in a programming language.. 1 2 3 4 5 6

7. Load and run a variety of computer software packages; i.e., instructional and data management.................................... 1 2 3 4 5 6

8. Respond appropriately to common error messages when using software.................... 1 2 3 4 5 6

9. Describe how computers can assist the individual..1 2 3 4 5 6

10. Demonstrate an awareness of the major types of applications of the computer such as information storage and retrieval, simulation, decision making, computation, and data processing......... 1 2 3 4 5 6

11. Explain various applications of computer technology for business, industry, leisure and home management.............................. 1 2 3 4 5 6

12. Demonstrate an awareness of the different programming languages suitable for science, business, industrial, and educational applications..................................... 1 2 3 4 5 6

13. Describe ways computers can assist in
    decision making.................................. 1 2 3 4 5 6

14. Describe the impact that technological
    developments have on various career options...... 1 2 3 4 5 6

15. Demonstrate an awareness of computer usage in
    fields such as: health, law enforcement,
    education, business and industry,
    transportation, communications, military......... 1 2 3 4 5 6

16. Discuss some of the positive and negative con-
    sequences in computer use in today's society, for
    example, machine dependence vs machine independ-
    ence; depersonalization vs personalization;
    increase vs decrease in job availability......... 1 2 3 4 5 6

17. Use at least one quality evaluative procedure
    to appraise and determine the instructional
    worth of a variety of computer software.......... 1 2 3 4 5 6

18. Locate and use a variety of sources of
    evaluative information about software............ 1 2 3 4 5 6

19. Define the elements of a district plan for com-
    puter-based instruction, and define the role of
    the individual teacher in supporting that plan....1 2 3 4 5 6

20. Demonstrate appropriate uses of computer
    technology for basic skills instruction.......... 1 2 3 4 5 6

21. Plan for effective pre- and post-computer
    interaction activities for students (for example,
    de-briefing after a science simulation).......... 1 2 3 4 5 6

22. Describe appropriate instructional arrangements
    for computer-based learning experiences (for
    example, physical arrangements and groupings).... 1 2 3 4 5 6

23. Evaluate and assess information regarding
    computer uses in education, and use that
    information to plan for appropriate
    instructional uses............................... 1 2 3 4 5 6

24. Respond appropriately to changes in curriculum
    and teaching methodology caused by new
    technological developments....................... 1 2 3 4 5 6

25. Describe what producers of instructional
    materials are doing to integrate computers
    with other electronic and print media............ 1 2 3 4 5 6

26. Summarize future projections and trends in
    computer technology.............................. 1 2 3 4 5 6

27. Demonstrate an awareness of state of the art
    developments in technology and their potential
    applications to education........................ 1 2 3 4 5 6

COMMENTS/SUGGESTIONS:

Appendix B

LIST OF DELPHI PANEL MEMBERS

James Sanner, Instructional Technology Specialist
Department of Education
700 Pringle Parkway SE
Salem, Oregon 97310-0290

William Lamon, Professor
University of Oregon
Department of Teacher Education
Eugene, Oregon 97403

Jack Turner, District Computer Coordinator
Eugene School District
200 N Monroe Street
Eugene, Oregon 97402-0122

Dave Moore, ESD Instructional Computing Coordinator
Linn-Benton Education Service District
905 4th Ave. SE
Albany, Oregon 97321-3199

Molly Bloomfield, Chairman, School District Board
3105 NW Roosevelt Drive
Corvallis, Oregon 97330

Diane Price, Elementary Teacher
Philomath Elementary School
P.O. Box 71
Philomath, Oregon 97370-0115

Jackie Miles, Elementary Teacher
Harding Elementary School
510 NW 31st St.
Corvallis, Oregon 97330

Michelle Mahana, Parent
23719 Tatum Lane
Monmouth, Oregon 97341

Appendix C

LETTER OF REQUEST TO SUPERINTENDENTS OF EDUCATION
SERVICE DISTRICTS

252 Kings Boulevard
Corvallis, Oregon 97330
November 21, 1988

The Superintendent
Washington Service District
17705 NW Springville
Portland, OR 97229-1707

Dear Sir:

The use of computer technology in the classroom is growing rapidly. In the process of implementation of this new technology, it is vital to determine if the the teachers and the coordinators agree on certain directions. Are the computer competencies for the elementary teacher conceived to be of the same level of importance by both coordinators and teachers? Results of such research will be a valuable input to the ongoing implementation of computer technology in teaching.

In order to conduct this research it is crucial that qualified respondents to this investigation be identified. In this connection, I would like to request a list of school districts with elementary schools offering exemplary programs in the use of computers in instruction and computer coordinators in your service district.

Your cooperation is greatly appreciated.

Sincerely,

Cappia Taqueban
Graduate Student, Oregon State University

Appendix D

LETTER OF REQUEST TO SCHOOL DISTRICT SUPERINTENDENTS

Department of Psychology
Oregon State University
Corvallis, Oregon 97331

December 5, 1989

The Superintendent
Eugene School District
200 N Monroe Street
Eugene, OR 97402-0122

Dear Sir/Madam:

The use of computer technology in the classroom is growing rapidly. In the process of implementation of this new technology, it is vital to determine if the teachers and the coordinators agree on certain directions. Are the computer competencies for the elementary teacher conceived to be of the same level of importance by both coordinators and teachers? Results of this research will be a valuable input to the ongoing implementation of computer technology in teaching.

To conduct this research it is necessary that we identify qualified respondents to this investigation. Your district has been chosen as a source of respondents. In this connection, I would like to request a list of the elementary schools in your district implementing computer education programs.

Your cooperation is greatly appreciated. Thank you very much and happy holidays!

Sincerely,

Cappia Taqueban
Project Director

Appendix E

LETTER OF REQUEST TO ELEMENTARY SCHOOL PRINCIPALS

Department of Psychology
Oregon State University
Corvallis, Oregon 97331

January 9, 1989

Dear Sir/Madam:

The use of computer technology in the classroom is
growing rapidly. In the process of implementation of this
new technology, it is vital to determine if the teachers and
the coordinators agree on certain directions. Are the
computer competencies for the elementary teacher conceived
to be of the same level of importance by both coordinators
and teachers? Results of this research will be a valuable
input to the ongoing implementation of computer technology
in teaching.

To conduct this research it is necessary that we
identify qualified respondents to this investigation. Your
school has been chosen as a source of respondents. In this
connection, I would like to request a list of the top five
teachers in your school who use computers in teaching. They
will be asked to rate the level of importance of each of the
24 selected computer competencies in a mailed questionnaire.

Your cooperation is greatly appreciated. Have a
prosperous New Year!

Sincerely,

Cappia Taqueban
Project Director

Appendix F

LETTER TO COMPUTER SPECIALISTS AND TEACHERS
AND THE QUESTIONNAIRE

Department of Psychology
Oregon State University
Corvallis, Oregon 97331

January 30, 1989

Dear Fellow Teacher:

The use of computer technology in the classroom is growing rapidly. In the process of implementation of this new technology, it is vital to determine if teachers and coordinators agree on certain directions. I am conducting a study to determine if there is agreement between the teachers and the computer coordinators regarding the level of importance of computer competencies for the elementary school teacher.

In this connection, I would like to ask you to rate the level of importance of each competency necessary for the elementary school teacher. Please share your expertise with me. It should take you only 10 minutes to complete this 24-item questionnaire. Please finish at your earliest convenience and fold the completed questionnaire so that the return address shows. Staple the folded questionnaire and please post it at your earliest possible time.

Your cooperation is greatly appreciated.

Sincerely,

Cappia Taqueban
Project Director

QUESTIONNAIRE

Name (Optional)_____

School _____

Percentage of working day concerned with coordinating/supervising teachers

on computer education programs. _____

Percentage of working day concerned with teaching with computers. _____

COMPUTER COMPETENCIES FOR THE ELEMENTARY TEACHER

DIRECTIONS: Please evaluate each of the computer competencies on the level
of importance for the elementary teacher. Circle the number on the
scale where:

        1 = of very little importance
        2 = of little importance
        3 = of moderate importance
        4 = of great importance
        5 = of very great importance

Competencies	LEVEL OF IMPORTANCE				
	1	2	3	4	5

The teacher should be able to:

1. Characterize the use of the computer as an object
    of instruction, as an instructional medium, and as
    a problem-solving tool............................. 1 2 3 4 5

2. Identify various options for using computers in an
    instructional setting for teaching and classroom
    management, such as: computer assisted instruction,
    computer managed instruction, problem solving,
    test scoring, word processing, data-base management..1 2 3 4 5

3. Differentiate between instructional computer
    applications such as drill-and-practice, tutorial,
    simulation, and problem-solving..................... 1 2 3 4 5

4. Apply and evaluate the general capabilities of the
    computer as a tool for instruction................. 1 2 3 4 5

5. Use computer courseware to individualize
    instruction and increase student learning.......... 1 2 3 4 5

6. Recognize that a computer gets instructions from
    software written in a programming language......... 1 2 3 4 5

7. Load and run a variety of computer software
    packages; i.e., instructional and data management... 1 2 3 4 5

8. Respond appropriately to common error messages
    when using software................................ 1 2 3 4 5

9. Describe how computers can assist the individual.... 1   2   3   4   5

10. Demonstrate an awareness of the major types of applications of the computer such as information storage and retrieval, simulation, decision making, computation, and data processing.................... 1   2   3   4   5

11. Explain various applications of computer technology for business, industry, leisure and home management.. 1   2   3   4   5

12. Describe ways computers can assist in decision making.1   2   3   4   5

13. Describe the impact that technological developments have on various career options...................... 1   2   3   4   5

14. Demonstrate an awareness of computer usage in fields such as: health, law enforcement, education, business and industry, transportation, communications, military... 1   2   3   4   5

15. Discuss some of the positive and negative consequences in computer use in today's society, for example, machine dependence vs machine independence; depersonalization vs personalization; increase vs decrease in job availability........................ 1   2   3   4   5

16. Use at least one quality evaluative procedure to appraise and determine the instructional worth of a variety of computer software...................... 1   2   3   4   5

17. Locate and use a variety of sources of evaluative information about software......................... 1   2   3   4   5

18. Define the elements of a district plan for computer-based instruction, and define the role of the individual teacher in supporting that plan........... 1   2   3   4   5

19. Demonstrate appropriate uses of computer technology for basic skills instruction....................... 1   2   3   4   5

20. Plan for effective pre- and post-computer interaction activities for students (for example, de-briefing after a science simulation 1   2   3   4   5

21. Describe appropriate instructional arrangements for computer-based learning experiences (for example, physical arrangements and groupings..)............... 1   2   3   4   5

22. Evaluate and assess information regarding computer uses in education, and use that information to plan for appropriate instructional uses................... 1   2   3   4   5

23. Respond appropriately to changes in curriculum and teaching methodology caused by new technological developments... 1   2   3   4   5

24. Summarize future projections and trends in computer technology... 1   2   3   4   5

COMMENTS/SUGGESTIONS:

Appendix G

FOLLOW-UP CARD

Department of Psychology
Oregon State University
Corvallis, Oregon 97331

February 13, 1989

Dear Fellow Teacher:

Last month, you were sent a questionnaire which was designed to determine conceived level of importance of computer competencies for the elementary teacher. As of this date your completed questionnaire has not been received.

Your response is essential to securing accurate representation of the computer coordinators/teachers in the State. Please return the completed questionnaire before February 27, 1989. If you have already returned your questionnaire please accept my sincerest appreciation.

Thank you very much for your cooperation.

Sincerely,

Cappia Taqueban

Appendix H

COMPUTATIONS FOR THE RELIABILITY OF THE INSTRUMENT

A. ANOVA Matrix

Items Rated		1	2	3	Scores Per Respondent 4	5	6	7............50
1	3	2	3	4	4	4	3...........4
2	4	4	3	3	4	3	4...........3
3	4	3	5	5	3	4	3............3
4	3	3	5	5	3	3	4...........3
5	4	3	5	5	3	4	3...........3
.	.	.	.	.	.	.	....
.	.	.	.	.	.	.	....
24	2	3	3	3	1	1	3...........3

B. ANOVA Table

Source of Variation Level	Sum of Squares	d.f.	Mean Square	F-ratio	Sig.
MAIN EFFECTS	158.38667	23	6.8863768	8.809	.0000
Respondent	158.38667	23	6.8863768	8.809	.0000
RESIDUAL	919.36000	1176	.7817687		
TOTAL (CORR.)	1077.7467	1199			

C. Reliability Coefficient

$$r = \frac{\text{Mean sq.of respondents} - \text{Mean sq.of residual}}{\text{Mean square of respondents}}$$

$$= \frac{6.8863768 - .7817687}{6.8863768} = \frac{6.1046081}{6.8863768} = 0.886476$$

Appendix I

RANK OF MEANS OF COMPUTER COMPETENCIES
RATED BY SPECIALISTS

Rank	Mean	Competencies
		The teacher should be able to:
1	4.16	Characterize the use of the computer as an object of instruction, as an instructional medium, and as a problem-solving tool.
2	4.14	Load and run a variety of computer software packages; i.e., instructional and data management.
3	4.12	Identify various options for using computers in an instructional setting for teaching and classroom management, such as: computer assisted instruction, computer managed instruction, problem solving, test scoring, word processing, data-base management.
4	4.10	Use computer courseware to individualize instruction and increase student learning.
5	4.04	Differentiate between instructional computer applications such as drill-and-practice, tutorial, simulation, and problem-solving.
6.5	3.88	Respond appropriately to common error messages when using software.
6.5	3.88	Respond appropriately to changes in curriculum and teaching methodology caused by new technological developments.
8.5	3.82	Apply and evaluate the general capabilities of the computer as a tool for instruction.
8.5	3.82	Demonstrate appropriate uses of computer technology for basic skills instruction.
10.5	3.75	Describe how computers can assist the individual.
10.5	3.75	Plan for effective pre- and post-computer interaction activities for students (for example, de-briefing after a science simulation.
12	3.71	Use at least one quality evaluative procedure to appraise and determine the instructional worth of a variety of computer software.
13	3.68	Define the elements of a district plan for computer-based instruction, and define the role of the individual teacher in supporting that plan.
14	3.63	Demonstrate an awareness of the major types of applications of the computer such as information storage and retrieval, simulation, decision making, computation, and data processing.

Rank	Mean	Competencies

The teacher should be able to:

15	3.55	Evaluate and assess information regarding computer uses in education, and use that information to plan for appropriate instructional uses.
16	3.47	Locate and use a variety of sources of evaluative information about software.
17	3.36	Describe the impact that technological developments have on various career options.
18	3.30	Describe appropriate instructional arrangements for computer-based learning experiences (for example, physical arrangements and groupings).
19	3.15	Describe ways computers can assist in decision making.
20	3.12	Demonstrate an awareness of computer usage in fields such as: health, law enforcement, education, business and industry, transportation, communications, military.
21	3.10	Recognize that a computer gets instructions from software written in a programming language.
22	2.93	Discuss some of the positive and negative consequences in computer use in today's society, for example, machine dependence vs machine independence; depersonalization vs personalization; increase vs decrease in job availability.
23	2.89	Explain various applications of computer technology for business, industry, leisure and home management.
24	2.83	Summarize future projections and trends in computer technology.

Appendix J

RANK OF MEANS OF COMPUTER COMPETENCIES RATED BY TEACHERS

Rank	Mean	Competencies
		The teacher should be able to:
1	3.95	Load and run a variety of computer software packages; i.e., instructional and data management.
2	3.91	Respond appropriately to common error messages when using software.
3	3.84	Identify various options for using computers in an instructional setting for teaching and classroom management, such as: computer assisted instruction, computer managed instruction, problem solving, test scoring, word processing, data-base management.
4	3.83	Use computer courseware to individualize instruction and increase student learning.
5	3.79	Characterize the use of the computer as an object of instruction, as an instructional medium, and as a problem-solving tool.
6	3.76	Demonstrate appropriate uses of computer technology for basic skills instruction.
7	3.72	Differentiate between instructional computer applications such as drill-and-practice, tutorial, simulation, and problem-solving.
8	3.59	Describe how computers can assist the individual.
9	3.58	Apply and evaluate the general capabilities of the computer as a tool for instruction.
10	3.53	Respond appropriately to changes in curriculum and teaching methodology caused by new technological developments.
11	3.35	Define the elements of a district plan for computer-based instruction, and define the role of the individual teacher in supporting that plan.
12	3.31	Evaluate and assess information regarding computer uses in education, and use that information to plan for appropriate instructional uses.
13	3.29	Demonstrate an awareness of the major types of applications of the computer such as information storage and retrieval, simulation, decision making, computation, and data processing.
14	3.26	Use at least one quality evaluative procedure to appraise and determine the instructional worth of a variety of computer software.

Rank	Mean	Competencies

The teacher should be able to:

15.5	3.24	Plan for effective pre- and post-computer interaction activities for students (for example, de-briefing after a science simulation.
15.5	3.24	Recognize that a computer gets instructions from software written in a programming language.
17	3.14	Locate and use a variety of sources of evaluative information about software.
18	3.05	Describe the impact that technological developments have on various career options.
19	2.95	Describe ways computers can assist in decision making.
20	2.94	Describe appropriate instructional arrangements for computer-based learning experiences (for example, physical arrangements and groupings).
21	2.82	Demonstrate an awareness of computer usage in fields such as: health, law enforcement, education, business and industry, transportation, communications, military.
22	2.73	Discuss some of the positive and negative consequences in computer use in today's society, for example, machine dependence vs machine independence; depersonalization vs personalization; increase vs decrease in job availability.
23	2.72	Explain various applications of computer technology for business, industry, leisure and home management.
24	2.47	Summarize future projections and trends in computer technology.