INFLUENCE OF COMPUTER USE ON ATTITUDES TOWARD COMPUTERS, MOTIVATION TO STUDY, EMPATHY, AND CREATIVITY AMONG JAPANESE FIRST- AND SECOND-GRADE CHILDREN

DISSERTATION

Presented to the Graduate Council of the
University of North Texas in Partial
Fulfillment of the Requirements

For the Degree of

DOCTOR OF PHILOSOPHY

By

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December, 1991

Miyashita, Keiko, *Influence of Computer Use on Attitudes Toward Computers, Motivation to Study, Empathy, and Creativity Among Japanese First- and Second-Grade Children*. Doctor of Philosophy (Early Childhood Education), December, 1991, 99 pp., 12 tables, bibliography, 83 titles.

This study investigated the changes in attitudes of Japanese first- and second-grade children who were exposed to microcomputers in school. Eight hundred and three, first- and second-grade children were selected from six Japanese public schools. Approximately half of the subjects were selected from urban, suburban, and rural schools using computers, while the remaining subjects were from schools not using computers.

The Young Children's Computer Inventory was the instrument used for this study. It was derived from a questionnaire originally developed at the Tokyo Institute of Technology, and contained four subscales: Attitudes Toward Computers, Motivation to Study, Empathy, and Creativity. A Japanese language version of the questionnaire was mailed to the principal of each school, where teachers distributed the questionnaires for the subjects to complete with their parents at home. Ninety-one percent of the students returned completed questionnaires. Demographic information was also collected for each classroom.

A three-way analysis of variance (MANOVA, 4 x 3 x 2 = subscale by geographic area by treatment vs. control) was employed as an overall test for significant differences in the groups' scores. Results indicated that computer experience affected children's scores on at least one subscale, while differences in school location did not affect the children's attitudinal scores.

Four one-way analyses of variance were used to compare scores for children using computers and those not using computers. On the subscale Attitudes Toward Computers, a significant difference was found between the two groups. Children who used computers had more favorable attitudes toward computers. On the Motivation to Study subscale, no significant differences were found between the two groups. The subscales Empathy and Creativity also yielded no significant differences between the two groups.

Results add cross-cultural support to existing U.S. evidence that students who use computers tend to like them more than students who do not use them. Findings also support the hypothesis that the use of computers has no negative effect on children's empathy. Findings fail to provide evidence that computer use improves intellectual activities such as creativity and the desire to study.

ACKNOWLEDGMENTS

Many persons provided helpful information and guidance throughout this study. I wish to especially acknowledge my major professor Dr. Michael Bell, who provided many valuable suggestions to his first doctoral advisee. I am also very grateful to my minor professor, Dr. Gerald Knezek, who encouraged my interest in this topic and supplied continual interaction on the subject.

I especially dedicate my dissertation to the memory of Dr. Velma Schmidt, distinguished professor, respected committee member, kind and supportive mentor.

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CHAPTER 1

INTRODUCTION

Computer technology has had a profound influence on the field of education. The number of microcomputers used for education in the United States has increased dramatically in the last decade. A 1984-1985 comprehensive survey of the use of computers in the United States revealed that more than 80% of the public and private schools had purchased microcomputers by 1984 (Hood, 1985). In addition, Quality Education Data (1989) reported that 94.9% of all elementary and secondary schools were using computers by the fall of 1987. Bitter (1989) noted, "Today, it is unusual to find a school district in the United States that does not make extensive use of computer power" (p. 47).

Although many microcomputers have been introduced in elementary and secondary schools, computer programs for young children are not yet widely used in the United States (Woodill, 1987). Only 25% of the state-licenced preschools had microcomputers in 1984 (Goodwin, Goodwin, Nansel, & Helm, 1986). However, according to a survey in 1990, 82% of 1,100 pre-kindergarten through 12th grade American teachers recommended the early introduction of microcomputers. Almost half of those teachers felt that microcomputers should be introduced to children no later than the first grade level (Bruder, 1990). There has been controversy about using computers with young children because computer-based activities have both advantages and disadvantages (Woodill, 1987). Many educators believe young children need warm nurturant care and developmentally appropriate learning environments. The results of Bruder's (1990) survey, which were previously mentioned, were based on teachers' opinions. These opinion are not supported by all early childhood specialists, and do not necessarily reflect the diverse range of opinions by educators regarding appropriate educational experiences for young children.

Japan is a modern industrialized country. Much computer hardware is manufactured in Japan. For example, Japan's Fujitsu and NEC are the largest competitors of IBM in the world. In spite of Japan's advanced technology, however, the introduction of microcomputers in Japanese elementary and junior high schools is approximately 5 years behind that in American schools (Knezek, Miyashita, & Sakamoto, 1990). While more than 90% of elementary and secondary schools were using microcomputers in the United States in 1988, only 21% of elementary schools and 44.8% of junior high schools in Japan were using microcomputers. According to Okamoto (1988), this lack of microcomputer use in the primary grades was due to heavy emphasis by the Ministry of Education on the use of microcomputers in senior high schools. Microcomputers were used by 96.3 % of the senior high schools in Japan in 1988 (Ministry of Education in Japan, 1989). After the first report by the National Council for Education Reform in 1985, however, the Ministry of Education began incorporating computer education into elementary and junior high schools as well (Sakamoto, 1985b).

The increase in computer education witnessed in United States schools in the 1980s (Tolman & Allred, 1984) will undoubtedly be seen in Japanese schools during the 1990s. Because the implementation of computer education programs for primary grade children is just beginning, studies are needed to investigate how computer use influences young children's attitudes in Japan. Of particular interest are questions such as:

1. Do young children who use computers feel better about computers? A study in the United State involving first-grade students using Logo suggests this is the case (Lever, Sherrod, & Bransford, 1989). Also a cross-cultural analysis which included the pilot test data gathered for this dissertation showed that students in the United States with computer experiences had higher attitudes toward computers than students in Japan without computer experiences (Knezek & Miyashita, in press). National educational reform documents

in Japan (National Council on Educational Reform, 1986, 1987a, 1987b) point out the unavoidable reality of computer use for future generations of Japanese citizens, so it is important to verify that young Japanese students will have positive attitudes toward computers if they are exposed to computers in school.

2. Do young children who use computer in instructional environments have greater or lesser desires to study? Some researchers have argued that computers are not necessary for young children or a waste of money because they are an expensive toy that might take time away from important learning (Elkind, 1989; Woodill, 1987). In the United States, one of the major justifications for spending money on information technology for schools is to increase student achievement (Bialo & Sivin, 1990; Kinnaman, 1990). The desire to study in the Japanese education system is currently very high but largely motivated by the desire to pass the university entrance examination (Vogel, 1979). This is perceived as detrimental to society in the long run (National Council on Educational Reform, 1986), and plans are in place to replace this pressure with content-oriented, self-fulfillment goals, hopefully without reducing the current high level of academic skills mastery in Japan (Dorfman, 1987). If increased computer use increases motivation to

study, it may help maintain the current high level of study effort in Japan.

3. Does computer use turn children into mechanistic, antisocial beings with little concern for fellow humans? In the U.S., the term computer "nerd" generally has a negative connotation from the social interaction perspective. In Japan, there is concern about the "dark side" of information technology, including possible loss of touch with reality and lack of concern for fellow citizens (National Council on Educational Reform, 1986). On the other hand, research studies in the United States have shown that computer use can help increase social interactions among school children and help foster cooperative learning (Clements, 1985; Clements & Nastasi, 1988). Verification of the lack of this negative side effect of computer use would be important for educational policy makers in Japan.

4. Does computer use help young children be more creative? There is some evidence of this in the United States (Clements, 1983, 1987; Lehrer & Randle, 1987). One of the primary goals of the national educational reform movement in Japan is to increase students' independent thinking and creative abilities (National Council on Educational Reform, 1986, 1987a, 1987b). Computer-using student' own ratings of their creativity can begin to provide evidence for or against this assertion in Japan.

5. Is Japanese society sufficiently homogeneous so that the effect of information technology on young school children can be assumed to be the same, regardless of urban, suburban, or rural location? There is widespread belief in Japan that Japanese society and the Japanese education system are highly homogeneous (Dorfman, 1987; White, 1987). verification of this characteristic with respect to the effects of information technology may be important for future formulations in national policy.

Finally, There is the larger questions as to whether computer use makes any difference in children attitudes at this age level at all. Some early childhood specialists might argue that there will be none (Woodill, 1987). If there is no positive effect, schools in the United States might have difficulty arguing for the necessary expenditures to place computers in schools. In Japan, on the other hand, the decision to place computers in schools because they will be used by virtually all future Japanese citizens, has already been made (Sakamoto & Nishinosono, 1990). The absence of negative effects may be even more important than positive effects for Japanese society.

Statement of the Problem

The problem of this study was to investigate how instructional computer experiences at school affect young

Japanese children's attitudes toward computers, motivation to study, empathy, and creativity.

Purpose of the Study

The purpose of this study was to investigate changes in the attitudes of Japanese first- and second-grade children who are exposed to microcomputers in school settings.

Hypotheses

The following hypotheses were tested.

1. In the area of Attitudes Toward Computers, as reported on the Young Children's Computer Inventory, first- and second-grade children using computers will have higher group mean scores than children not using computers.

2. In the area of Motivation to Study, as reported on the Young Children's Computer Inventory, first- and second-grade children using computers will have higher group mean scores than children not using computers.

3. In the area of Empathy, as reported on the Young Children's Computer Inventory, first- and second-grade children using computers will have group mean scores no lower than children not using computers.

4. In the area of Creativity, as reported on the Young children's Computer Inventory, first- and second-grade children using computers will have higher group mean scores than children not using computers.

5. There will be no significant differences among group mean scores for urban, suburban, and rural sites on any of the four parts of the Young Children's Computer Inventory.

Background and Significance

In order to help children learn, adults must provide materials which meet the children's cognitive level, encourage their motivation, and provide positive feedback to them. According to Piagetian theory, children who are 2 to 7 years of age are in the preoperational stage. At this level, children begin to develop a representational system and to use symbols such as words. Children use words to symbolically represent objects. Children typically acquire a functional use of "adult-like" language by the age of 4 years. However, their thinking at this age is still egocentric and they cannot do reverse thinking (Wadsworth, 1989).

Children who are from 7 to 11 years of age are in the concrete operational stage. At this stage of development, children begin to think logically if a problem is related to the real world. Children also develop conservation skills. They understand that the amount or quality of an object remains the same if nothing is added or removed from it (Wadsworth, 1989). Primary grade children at about 7 years of age begin to acquire the concrete operational level typically referred to as the transition stage approaching this level.

According to the National Association for the Education of Young Children position statement on developmentally appropriate practice, children have curiosity and a desire to make sense of their world. Therefore, adults should provide the various kinds of materials that nurture children's curiosity and desire to make sense of their world (Bredekamp, 1987). Adults can also encourage children to learn by providing them with positive feedback. In Rose and Thornburg's (1984) study of children's motivation, they suggested that verbal reinforcement affects young children's learning in a positive manner.

The microcomputer is a new technology that children can use to learn. Adults who work with children can benefit from understanding the advantages and disadvantages of exposing young children to microcomputers, especially in the area of the effect of microcomputer usage upon children's learning.

A number of computer programs have been designed to help young children develop creativity, cognitive skills, and other basic skills such as reading, writing, and mathematics (Bracey, 1984; Genishi, McCollum, & Strand, 1985; Johnson, 1985; Yawkey, 1986). For example, Logo was developed at the Massachusetts Institute of Technology. It was designed to be a simple-to-use programming environment which would provide positive experiences for young children as well as older students. "The essence of using Logo with children is to initiate them into building the kind of intellectual structures that Piaget and Papert discussed in their writings" (Vaidya, 1984, p. 124).

Many researchers have studied the relationship between Logo programing and children's basic skills (Clements, 1983, 1987; Genishi et al., 1985; Lehrer, Guckenberg, & Lee, 1988). One of the characteristics of Logo programing is that it helps children to develop social skills (Clements, 1985). For example, Clements noted that children who worked with computers spent 63% of their time with other children, whereas children who were engaged in other activities spent 7% of their time with other children. Cooperative behaviors were more likely to be observed in computer situations than in situations when a computer was not used. Clements also suggested that Logo programming enhances students' independent judgment and enthusiasm for learning.

Lever, Sherrod, and Bransford (1989) studied first-grade children's attitudes toward computers and school in general. Half of the 94 first-grade students in their study used Logo programming for 1 hour for 5 days a week for 4 weeks. The other half of the students did not use computers. Using a questionnaire which was develcped and validated by the researchers, Lever et al. discerned that children with Logo programming experiences had more positive attitudes toward school and computers. Moreover, they found that the level of mastery of Logo did not significantly correlate with students' attitudes toward school or computers.

In addition to Logo, other computer software packages apparently affect children's cognition (Lehrer & Randle, 1987). Computer play and games can positively influence children's basic skills. According to Yawkey (1986, p. 477), "computer play and games are ideal for representational thinking--that is, representing objects and situations by symbols." Computer play and games help children understand how objects act and react, and help them develop their intellectual skills. Reading and writing skills can also be enhanced through computer activities (Bracey, 1984; Leton & Perts, 1984; Phenix & Hannan, 1984; Reitsma, 1988).

Although there are several advantages of using microcomputers with young children, some educators believe that microcomputers are simply not necessary (Woodill, 1987). Several researchers have found that the computer-assisted instruction programs used in their studies did not effect children's cognition (Clements, 1986; Clements & Gullo, 1984; Goodwin, Goodwin, Nansel, & Helm, 1986). Howell, Scott, and Diamond (1987) could not verify that Logo programming helped children move from the preoperational stage to the concrete operational stage, as outlined by Piaget (1952).

McCollister, Burts, Wright, and Hildreth (1986) pointed out that computer-assisted instruction for mathematics did not affect children who were unable to recognize numerals. In their study, 53 kindergarten children were divided into two groups. One group received computer-assisted instruction and the other received teacher-assisted instruction. Although the computer-assisted instruction helped the children who had an understanding of numerals, it did not affect the children who were unable to recognize numerals.

Thomas and Lai (1990, p. 710) stated that through a computer, "two-dimensional representations are removed from interactions with real objects in a real environment." They suggested that pre-school children needed to interact with real objects in order to develop problem-solving skills.

William and Beeson (1986) found that the computer was not as effective at holding the attention of young children as more traditional educational aids. In their study, children ranging in age from 24 to 69 months spent significantly more time working with puzzles and blocks than working with the computer.

In a study of the importance of selecting software, Grover (1986) provided two different software packages to two similar groups of children. He found that software that was designed using cognitive-developmental principles enhanced children's learning significantly more than software that was not designed with those principles. Few educational software applications are currently available that were developed following cognitive-developmental principles (Grover, 1986).

Most first-grade children are in a transition between the preoperational and concrete operational stages. Therefore, some computer-assisted instruction is too abstract for young children. Educators should recognize the individual differences among children, provide software appropriate for each child's level, and, importantly, view the computer as one of many mediums that children can manipulate and use to express themselves. Educators of young children should not forget the importance of other activities which help children interact with real, concrete objects. The appropriate introduction of computers can favorably influence children's attitudes toward computers.

Limitations of the Study

The use of a questionnaire as the instrument for collecting data for this study resulted in some difficulties in assessing the children's attitudes. Subjects were selected from two neighboring schools in three geographically different areas. Although teachers in each of the schools were trained in a comparable fashion and were required to pass the same examination to be teachers, each of the teachers was trained differently for teaching computers, and some of the teachers received training after they had begun teaching. Therefore, teaching style for other school subjects was homogeneous, but individual differences in teachers' styles for using computers could not be controlled in this study.

The computer software and hardware used in the three schools in this study were not the same. Therefore, children did not have identical experiences with microcomputers in the three schools. No attempt was made to control for differences in students' computer experiences outside the schools. In addition, it was impossible to guarantee that students at the various schools were taught through comparable instructional techniques in previous years.

Because a one-time administration technique was used for this study, there was no opportunity to compare pretest and posttest changes in attitudes at the various sites. It is assumed that the homogeneous nature of the Japanese educational system and society resulted in similar attitudes, prior to the introduction of computers, at each site. This assumption facilitated the use of schools where computers were not used as "pseudo" control groups in a posttest only design.

Definition of Terms

For the purposes of this study, the following definitions were used.

Microcomputer is defined as a personal computer which is used by children, either at school or at home.

Computer-assisted instruction describes instructional activities in which computers are used as the primary deliverer of instruction (Burke, 1982).

Instructional computing software is the software used with computer-assisted instruction.

Attitude is defined as the thoughts, feelings, and behaviors of persons toward a category, class, set of phenomena, or cognitive objects (Kerlinger, 1986).

Likert-type scale is a summated rating scale which contains equal "attitude values." Each of the values represents a degree of agreement or disagreement. The degree of each value is interpreted by a number. The values given to all items are summed to obtain a score (Kerlinger, 1986).

CHAPTER 2

REVIEW OF LITERATURE

Development of the Whole Child---Ages 6 Through 8 Years

Physical Development

First- and second-grade children's physical growth is considered slow when compared with the first 6 years of life. The average 6-year-old American child is about 46 inches tall and weighs about 48.3 pounds. The average 8-year-old American child is about 51 inches tall and weighs about 60.5 pounds. These averages reflect both nutritional and genetic factors (Lowrey, 1986).

The gross-motor and fine-motor skills of children in this age range are still developing. For example, children aged 6 through 8 years are able to use their bodies with increasing mastery; their abilities to jump, ride, run, and climb continue to improve during these years. Since fine-motor skills are developing, children can learn to write while grasping their pencils tightly (Seefeldt & Barbour, 1986). However, children at the beginning of first grade often still have some difficulties with their drawing and handwriting (Black, Puckett, & Bell, in press).

Emotional Development

Several researchers had addressed the emotional development of young children. Freud and Erikson described children's developmental stages from a psychoanalytic perspective. According to Freud's theory, children who are 6 years of age through puberty are in the latency stage. Before entering this stage, children develop a superego and conscience which incorporate the morals of society. At the latency stage, children's ideas about sexuality are developed but not yet mature (Papalia & Olds, 1986).

Erikson extended Freud's theory to include eight stages of psychosocial development. Children who are 6 years of age through 11 are in Erikson's fourth stage, which is called industry versus inferiority. Children in this period of emotional development are willing to create and produce something through mastering real tasks. Typically, they are proud of their accomplishments, yet children who often fail to accomplish something develop a sense of inferiority (Black et al., in press).

Charlesworth (1987) explained that, although Rogers and Maslow are not considered to be stage theorists, their focus is on children's need for a positive self-concept. Rogers' theory of emotional development focuses on children's personal experiences. Through the use of physical and mental faculties, children gain their daily experiences and develop the capability of seeing their own emotions and the emotions of others. Maslow, on the other hand, developed a hierarchy of needs which characterizes people's behavior with respect to their physical and psychological needs. Maslow theorized that children develop their self-knowledge through dealing with each need.

Researchers of constructivism have also considered children's emotional development. They postulate that children at the preoperational stage have begun to develop "reverse thinking," but that their feelings and emotions are not "conserved." Thus, although children have day-to-day feelings, these feelings are not related to prior feelings. At the concrete operational stage, children have fully developed reverse thinking. Children who are 7 and 8 years of age can conserve their feelings and values (Wadsworth, 1989).

As their emotions develop, children gain a sense of empathy. Feelings of empathy have two dimensions. The first dimension, called "event-focused empathy," deals with the cause of an event. For example, children feel sad when they see an animal hurt. The second dimension, called "participatory empathy," deals with other persons' internal feelings. For example, children feel sad when they see an other child crying without having seen the cause of the event. The level of both dimensions of empathy vary according to a child's age. Older children have more accurate empathical feelings than young children. Although 5-year-old children can interpret other's negative and positive emotions very well, their feelings toward other persons' emotions are not similar to those of older children (Saarni, 1990).

Social Development

After entering the primary grades, children develop their social skills mainly through peer relationships. Peers can function as friends, models, and reinforcers. Children develop their concepts of cooperation, mutual respect, and interpersonal sensitivity through their friendships. Through their observations, children learn to imitate others whom they admire. As reinforcers, children provide their peers with positive attention and approval, personal acceptance, and submission (Charlesworth, 1987).

According to Piagetian theory, children from the age of 2 to 6 years are somewhat egocentric; therefore, they cannot see another person's way of thinking. However, children who are 6 to 7 years of age reduce their egocentric thinking and begin to accommodate others (Wadsworth, 1989).

According to Selman and Selman (1979), children's friendships are different according to their age level. At stage 0 (between the ages of 3 and 7 years), children develop "momentary playmateship." For example, a child might play with another child because he or she has an interesting toy. At stage 1 (between the ages of 4 and 9 years), children develop "one-way assistance." A child's good friend is a person who does what the child wants him or her to do. At stage 3 (between the ages of 6 and 12 years), children develop a sense of give and take. Children between the ages of 6 and 8 develop these three stages of friendship.

Cooperative behaviors are developed among children and between teachers and children. These behaviors occur because children develop their reasoning skills, moral and social judgement, and emotions and personality (DeVries & Kohlberg, 1987).

Cognitive Development

According to Piagetian theory, children who are 2 to 7 years of age are in the preoperational stage. At this level, children begin to develop a representational system and to use symbols such as words. Children use words to represent an object. Children increase their language skills dramatically during the first 7 years of life. However, during the preoperational stage of development, their behavior and thinking are still somewhat egocentric. Children at this stage typically do not have transformational thinking. Children can only focus on elements in sequence and cannot see successive states and cannot reverse their thinking. During this time, their thinking is egocentric. They cannot understand the amount or quality of an object as the same if nothing is added or removed from it (Wadsworth, 1975).

Children between the ages of 7 and 11 years are in the concrete operational stage. During this time, children acquire the ability to think logically if a problem is relevant to their real world. Children also develop conservation abilities during this stage. They understand the amount or quality of an object as the same if nothing is added or removed from it (Wadsworth, 1975).

Primary grade children between the ages of 6 and 8 years are usually at either the preoperational stage or the concrete operational stage. Some primary grade children are in the transition stage following the preoperational stage and are approaching the concrete operational level.

Learning and Motivation

Piagetian theory views young children's learning as unseen, yet significant, behavior. Piaget (1952) stated that learning is a continuous process of adaptation. When children learn, they go through the process of assimilation and accomodation. Assimilation is a child's thinking process that enables children to deal with new ideas and concepts by fitting them with old ideas or concepts. Accommodation is another thinking process of children which enables them to change old concepts to fit a new concept. Equilibration or balance occurs between assimilation and accommodation (Charlesworth, 1987).

According to Papalia and Olds (1986), "Learning is a change in behavior that occurs as the result of experience. This experience may include study, instruction, observation, or practice, and the person has to be able to remember the experience" (p. 108). There are several types of learning theories, such as classical conditioning, operant conditioning, and imitation and observation.

Classical conditioning, developed by Pavlov in the late nineteenth century, is the study of unconditioned stimuli (UCS) and conditioned stimuli (CS). A dog salivates when it sees food. The food is the UCS, and the response the dog makes is the unconditioned response (UCR). If a dog listens to a certain sound before it is fed, and this process is repeated, the dog salivates when it listens to the sound. The sound is the CS, and the response the dog makes is the conditioned response (CR). A UCR does not have to be learned, whereas a CR must be learned (Papelia & Olds, 1986). Watson and Rayners (1920) extended this learning theory to human babies.

Operant conditioning was originally developed by Thorndike (1911) and was studied in-depth by Skinner (1938). Thorndike found that a behavior was repeated when it resulted in a satisfying experience and was not repeated when it resulted in an unsatisfying experience. Skinner focused his studies on positive and negative reinforcements. An appropriate behavior is repeated when followed by a positive reinforcement, such as a reward. Inappropriate behavior is stopped by negative reinforcement, such as taking away something that a person likes(Papelia & Olds, 1986).

Imitation and observation are other learning components (Ball, 1977). Miller and Dollard (1941) studied this type of learning by observing a certain kind of bird that imitated the sounds from the adult birds in their nest even though the adult birds were not of the same species. In the classroom, a teacher is sometimes a model for children. The children often imitate their teacher's behavior. Children also learn behaviors by observing someone who receives a reward for appropriate behavior (Charlesworth, 1987).

Motivation is an essential element in the learning process. Seefeldt and Barbour (1986) investigated children's art activities and their motivations. Children should have psychological motivation and environmental motivation. In order to provide psychological motivation, adults should accept each child as an individual, provide freedom of choice, and provide enough time for the child's activities. Children also need environmental motivation. Adults should provide a variety of experiences for children. For example, reading books and rhymes can be used to motivate children to create art work.

Achievement motivation is an important motive for learning. According to Vidler (1977), "Achievement motivation is not necessarily the same thing as the search for observable accomplishments, such as obtaining high test scores, socially approved positions, or a high salary" (p. 67). In order to achieve something, individuals must have motivation for planning. Achievement motivation has several patterns: a pattern of planning, a pattern of actions, and a pattern of feelings (Vidler, 1977).

Creativity

Vernon (1989) described creativity as "a person's capacity to produce new or original ideas, insights, restructurings, inventions, or artistic objects, which are accepted by experts as being of scientific, aesthetic, social, or technological value" (p. 94).

Children who have creativity often exhibit divergent thinking. Convergent thinking occurs when a child chooses the most correct solution to a given problem. On the other hand, divergent thinking occurs when a child uses many problem solutions and does not focus on one correct answer (Lundsteen & Tarrow, 1981).

The cognitive style of creative children is typically field independent. Creative children have the ability to analyze the environment and choose relevant features while ignoring less important aspects. On the other hand, field-dependent children have difficulty isolating important aspects of a problem from less important information (Woodman & Schoenfeldt, 1989).

As stated by Charlesworth (1987), "problem-solving skills and curiosity behavior are important elements in the definition of creativity" (p. 369). Lundsteen and Tarrow (1981) classified children's problem-solving situations into the following four aspects: language, open-endedness, avoidance of predicaments, and being wrong. First, in order to develop problem-solving skills, children need to develop an adequate vocabulary. Next, children need the opportunity to solve problems which provide several answers from which the children can choose. Adults should avoid predicaments for children. In a predicament, children are not able to have the freedom of choice. Therefore, open-ended problem-solving skills are discouraged. Adults should accept children's wrong solutions to problems. Because children's thinking skills are not yet mature, children often develop their thinking through making mistakes.

According to the National Association for the Education of Young Children position statement on developmentally appropriate practice, adults who work with children should be familiar with the age appropriateness and individual appropriateness of children. Children at certain age levels are developing specific physical, emotional, social, and cognitive skills. Although this development is predictable and universal during the first 9 years of life, each child has a unique personality, learning style, and family background. Adults who work with children should provide activities and materials that are appropriate for the children's age. Adults also need to develop appropriate environments which meet the individual growth patterns, strengths, interests, and experiences of children (Bredekamp, 1987). The development of children has many dimensions. Children grow physically, emotionally, and socially, and their cognitive and other skills develop. The dimensions of children's development are closely interrelated and reflect the complexity of development in the early years.

History of Computer Use in Education

Since the development of large scale integrated circuits, the use of microcomputers has spread to the field of education. However, even before the development of integrated circuits, the possibility of using computers in education had been studied. The first powerful system for education was called PLATO, and was developed at the University of Illinois in 1959. The authoring language utilized for the PLATO system was called TUTOR. The level of expertise necessary to write programs using TUTOR was minimal, thus teachers were able to use it easily. PLATO systems were used world-wide in the 1960s. Next the authoring language Coursewriter was developed at Pennsylvania State University in the late 1960s (Bitter, 1989).

In 1969, Al Bork developed several computer-assisted instruction programs which included graphics and simulations. In the 1970s, Seymour Papert developed a programming language for children called Logo. This programming language is still widely used, even by preschool children. In 1971, a new microcomputer-based system called TICCIT was developed by Bunderson. This system used an authoring facility similar to the PLATO system (Bitter, 1989).

During the 1980s the use of computers became widespread in the field of education in the United States. However, as late as 1982, almost no elementary schools were utilizing computers. The emphasis of using computers was, instead, directed toward secondary and university students. The utilization of computers at lower levels of education increased dramatically in the mid-1980s. In the fall 1987, 94.9% of all United States schools, both elementary and secondary, were using computers (Quality Education Data, 1989).

Advantages of Using Computers in Early Childhood Education

The microcomputer is a new technology that children can use to learn. Adults who work with children need to understand the importance of children's learning and to investigate the advantages and disadvantages of exposing young children to microcomputers.

Several computer programs have been designed to help young children develop creativity, cognitive skills, and other basic skills such as reading, writing, and mathematics (Bracey, 1984; Genishi, McCollum, & Strand, 1985; Johnson, 1985; Yawkey, 1986). Logo was developed at the Massachusetts Institute of Technology. It was designed as a programming environment to provide positive experiences for young as well as older children. The Logo programming language has many advantages for young children. When children use Logo, they teach the computer. Children use several simple commands which program the computer to create a shape, design, or picture (Merrill et al, 1986). "The essence of using Logo with children is to initiate them into building the kind of intellectual structures that Piaget and Papert discussed in their writings" (Vaidya, 1984, p. 124).

Genishi et al. (1985) observed six kindergarten children using the Logo program for 3 months. They found that Logo was very effective in helping young children develop language skills because it provided a variety of social interactions: child-to-child, child-to-computer, and child-to-adult. During their observations, Genishi et al. recorded a significant amount of interaction between children. The interaction between the children and the computer was also recorded. While programming, children often spoke to the computers calling their computers "you" or "he," instead of "it." Child-to-adult interaction was also significant. When children explained their computer pictures to adults, they were very creative, incorporating imagination and humor.

Clements (1985) also noted the influence of the Logo program on young children's social skills. For example, he observed that children who worked with computers spent 63% of their time with other children, whereas children who were engaged in other activities spent 7% of their time with other children. Cooperative behaviors were more frequently observed in situations involving the computers than in situations when a computer was not used. Clements also suggested that Logo programming enhanced independent judgment and enthusiasm for learning.

Clements and Nastasi (1988) extended the study of social interaction in relation to Logo and computer-assisted instruction. Specialists observed 48 first- and second-grade children during 28 training sessions. Children were randomly assigned to use either Logo or drill-and-practice type computer-assisted instruction twice per week for 45 minutes. Instances of cooperative work, conflict, and resolution of conflict were observed and recorded as indicators of social problem-solving behavior. Instances of self-directed work, persistence, rule determination, and showing pleasure were also recorded. According to their analysis, children in the Logo group and the computer-assisted instruction group spent almost equal percentages of their time working cooperatively. Both groups spent approximately 60% to 70% of their computing time working cooperatively. There was a significant difference between groups for resolution of conflict. Children in the Logo group tended to negotiate with each other in order to define problems and to discuss strategies for solutions. In addition, self-directed work and rule determination activities were observed significantly more often in the Logo group. Clements and Nastasi concluded that even though children in both computer environments worked cooperatively, the quality of cooperative behavior was different.

Clements (1983, 1987) addressed the relationship between the language Logo and young children's cognition and creativity. In his first study, Clements provided a Logo programming lesson to nine first-grade children. After 3 months, the children scored higher on the posttest of creative thinking than they had on the pretest. During Clements' second study, 16 third-grade children who had learned either Logo or computer-assisted instruction in the first grade were studied. Clements (1987) found that children who had Logo experience had more skills "to complete items," "to decide of nature of the problems," and "to select adequate representations and solution strategies" (p. 90) than children who had computer-assisted instruction.

Lehrer, Guckenberg, and Lee (1988) studied the effects of Logo programming on children's geometric concepts. Forty-five third-grade children were divided into three groups: (a) working with problem-solving packages, (b) programming in Logo, and (c) working with geometry Logo. For the programming Logo group, children drew pictures based on certain themes, such as flowers or trees. For the geometry Logo group, children received some geometric instruction, such as polygons and angles. Lehrer et al. found that children who worked with either programming Logo or with geometric Logo gained more dynamic descriptions of geometric concepts than children who worked with problem-solving packages.

Lever, Sherrod, and Bransford (1989) studied first-grade children's attitudes toward computers and school in general.

They used 94 first-grade students. Half of the students used Logo programming for 1 hour for 5 days a week for 4 weeks. The other half of the students did not use computers. A questionnaire was developed and validated by the researchers. They found that children with Logo programming experiences had more positive attitudes toward school and computers. Moreover, they found that the level of mastery of Logo was not significantly correlated with students' attitudes toward school or computers.

Other computer software packages apparently affect children's cognition as well. Lehrer and Randle (1987) noted that available software enhanced problem-solving performance on a novel task for first-grade children. The software entitled "Tower of Hanoi" was found to be as effective as Logo programming in their study.

Computer play and games can also affect children's intellectual skills. According to Yawkey (1986), "computer play and games are ideal for representational thinking--that is, representing objects and situations by symbols" (p. 477). Hurt and Kirk (1988) found that first-grade children had the ability to recognize and interpret computer-generated pictures. In their study, 155 first-grade students were examined to assess their ability to recognize and interpret pictures in three different formats: photographs, scanned pictures, and computer-aided drawings. The children could identify the objects effectively in all three formats. However, more children correctly interpreted the pictures containing peripheral objects in the computer-aided drawing format. They found that the children could gain more information in the low-resolution computer drawing format. Thus, the researchers concluded that computer-generated pictures could be incorporated into programs, and could be valuable instructional tools.

Shade and Watson (1990) studied the relationship between Erikson's theory and children's computer experiences. In Erikson's theory, children in primary grades develop a sense of industry. The children are proud of mastering real tasks. The researchers concluded that since technology is important in today's society, appropriate use of computers can help children to develop a positive sense of industry.

Reading and writing skills can also be developed using computer activities. For example, children's use of computers can help develop their learning of prereading concepts (Bracey, 1984). Irwin (1987) addressed the importance of connections among reading, writing, and computers. She stated, "social interaction and modeling with software programs read from the screen help children to develop concepts about reading and the handling of electronically printed materials and about the value to be derived" (pp. 40-41).

Phenix and Hannan (1984) introduced "Story Writer," a word processing program, to 28 first-grade children. They observed the children for 6 weeks and found that after using "Story Writer," the children included more details in their writings, made more revisions, and were more critical of their work.

Leton and Perts (1984) noted that a computer-assisted instruction program for reading enhanced second-grade children's word recognition and phrase reading skills. The program used for their study was developed by a reading specialist and used a speech synthesizer so that children could listen to an oral rendition of the text. Ten first-grade and 10 second-grade children were examined using a pretest and posttest, but the researchers determined first-grade children selected for the treatment and control groups were not comparable. Therefore, only scores for second-grade children were analyzed. After 10 lessons of 35 minutes each, second-grade children who used the computer assisted instruction program obtained significantly higher scores on word recognition and phrase reading skills tests.

Reitsma (1988) examined three different methods for reading efficiency and found that independent activities enhanced beginning readers' reading efficiency. He introduced guided reading, reading-while-listening, and independent reading with computer-controlled, cassetterecorded speech feedback to 72 beginning readers who were from 6.8 to 7.5 years of age. The children in the guided reading group took turns reading several lines of a story aloud. A teacher in the group gave corrective feedback to each child. The reading-while-listening group listened to a tape-recorded story repeatedly, and followed the story in the book. For feedback, the children did exercises related to the story. The independent reading group of children viewed text printed on paper which was overlaying a pressure-sensitive tablet. A child could request the sounds for any word in the text by touching the printed word. Children in the guided reading group and the computer-using group gained more reading efficiency than did children in the reading-while-listening group.

Goore, Morrison, Maas, and Anderson (1989) also investigated the effectiveness of computer activities for improving young children's prereading skills. Fourteen 5-year-old children were examined in their study. The children attended a computer lab for 60 minutes per session, twice a week, for 9 months. During this period, children used commercial software programs which had been previously evaluated as developmentally appropriate. The children's posttest scores on the school language and rhyming portions of the Metropolitan Reading Test were significantly higher than their pretest scores.

Disadvantages of Using Computers in Early Childhood Education

Although there are several advantages of using microcomputers with young children, some educators believe that microcomputers are simply not necessary (Woodill, 1987). Many researchers have failed to find that computer-assisted instruction software affects children's cognition (Clements, 1986; Clements & Gullo, 1984; Goodwin, Goodwin, Nansel, & Helm, 1986). Howell, Scott, and Diamond (1987) could not confirm that Logo programming helps children move from the preoperational stage to the concrete operational stage as outlined by Piaget (1952).

McCollister, Burts, Wright, and Hildreth (1986) did not find computer-assisted instruction in mathematics to be effective for children who were unable to recognize numerals. In their study, 53 kindergarten children were divided into two groups. One group received computer-assisted instruction and the other received teacher-assisted instruction. Although computer-assisted instruction improved arithmetic scores of children who had a better understanding of numerals, it did not affect the children who were not able to recognize numerals.

Thomas and Lai (1990) suggested that pre-school children need to interact with real objects in order to develop problem-solving skills. In their study, they found that "two-dimensional representations are removed from interactions with real objects in a real environment" (p. 710).

Although Cohen and Geva (1989) agreed with the effectiveness of Logo programming, they pointed out the fact that primary school children often have difficulty understanding Turtle Wraps, the length of Turtle Steps, right and left discrimination commands, and REPEAT commands. As a result of these difficulties, they suggested that the original Logo program be revised for primary age children.

William and Beeson (1986) found that the computer was not as effective at holding young children's attention as more traditional educational aids. In their study, children ranging in age from 24 to 69 months chose to spend significantly more time working with puzzles and blocks than they did working on the computer.

Although Irwin (1987) addressed the importance of the use of computers in teaching young children reading and writing, she criticized commercial software. According to Irwin, appropriate reading software should meet two criteria. The first one is proper screen display. The size, clarity, color, and amount of spacing should be examined to assure that it can be read easily by children. The second requirement is that the software should be based on theoretical beliefs about the teaching of reading and writing. There are few programs available which meet these criteria.

In a study on the importance of selecting software, Grover (1986) provided two different software packages to two similar groups of children. He found that the software that was designed with cognitive-developmental principles enhanced children's learning significantly more than software that was not designed with these principles. To date, few educational software applications have been developed following cognitive-developmental principles.

Most first-grade children are in a transition between preoperational and concrete operational stages. Therefore, some computer-assisted instruction packages are too abstract for young children. Educators should recognize individual differences among children, and provide software appropriate for each child. It is also important that educators view the computer as one of many mediums that children can manipulate and use to express themselves. Educators of young children should not forget the importance of other activities which help children interact with real, concrete objects. The appropriate introduction computers can affect children's attitudes toward computers in a positive manner.

CHAPTER 3

METHODS AND PROCEDURES FOR COLLECTING AND ANALYZING DATA

Subjects

Characteristics of Japanese Education

Japanese education is highly centralized by the Ministry of Education. The standards of curriculum and textbooks are decided by special committees within the Ministry of Education. The standards are more strict for public schools than for private schools. Children who transfer to another public school do not have difficulties adjusting to a new curriculum.

The achievements of Japanese children are also standardized. Japanese schools do not allow students to skip grades and do not provide transitional classes. Advanced students often are required to wait until other children catch up. Unless children in elementary and junior high schools have problems with their health, they move to the next grade chronologically (Vogel, 1979). The Japanese school year is from April through March. Children who are 6 years old on or before April 2nd are placed in the first grade.

Teachers' status and general regard by society in Japan are extremely high. In order to obtain a teaching certificate, Japanese students are required to take a standard liberal arts program, courses in professional education, teaching-field specialization, principles of education, educational psychology, methods, and a student-teaching internship (White, 1987). As a result of the difficult requirements for certification, teachers in Japan are regarded as highly qualified professionals.

Selection of the Subjects

The subjects for this study were selected from schools in three geographically distinct areas in Japan: urban, suburban, and rural. In each area, two public schools were selected: one school with microcomputers and one school without microcomputers. Approximately 60 first-grade children and 60 second-grade children were selected from each school. Both first- and second-grade children were selected in order to allow future investigations of the relationship between the duration of computer experiences and children's attitudes.

Urban--Shimomeguro Elementary School, Tokyo. Shimomeguro Elementary School is located in Meguro-ku, Tokyo. This school had 401 children from first through sixth grades and had two classes in each grade in March 1991. The school used microcomputers for school management, classroom management, and school subjects. The microcomputers which were being used in this school were Fujitsu FMR-50Ss running the Japanese version of the MS-DOS operating system.

Fifty-nine first-grade children (30 boys and 29 girls) and 60 second-grade children (30 girls and 30 boys) were used as subjects. The first-grade children began using microcomputers in July 1990. At the time of this study, they had used microcomputers in the classroom for about 40 minutes per week for 9 months for mathematics, language arts, social studies, and art. The second-grade children began using classroom microcomputers in September 1989. At the time of this study, they had been using microcomputers about 40 minutes per week for 19 months. When they were in the first grade they used microcomputers for mathematics, language arts, social studies and art. From the beginning of second grade these students had used microcomputers for mathematics and social studies.

Since Shimomeguro Elementary School is a model school for using microcomputers, professors, computer specialists, and other teachers visit this school once a month to give seminars to teachers at the school. Therefore, teachers at this school learn from specialists and from each other.

Urban--Kaketsuka Elementary School, Tokyo. Kaketsuka Elementary School is located in Shibuya-ku, Tokyo. This school had 380 children from first through sixth grades and had 2 classrooms in each grade in March 1991. This school did not use microcomputers. Sixty-two first-grade children (35 boys and 27 girls) and 62 second-grade children (33 boys and 29 girls) were used as subjects for the study.

Suburban--Fuchinobe Elementary School, Kanagawa. Fuchinobe Elementary School is located in Sagamihara City, Kanagawa Prefecture, about 30 miles west of downtown Tokyo. Sagamihara City is a bedroom community in the Tokyo area. This school had 931 children from first through sixth grades and 25 classrooms in March 1991. Microcomputers were used for school management, classroom management, and school subjects. The microcomputers used at this school were NEC 9801s running the Japanese version of the MS-DOS operating system.

Seventy-eight first-grade children (38 boys and 40 girls) and 63 second-grade children (30 boys and 33 girls) from this school were selected as subjects for the study. The first-grade children began using microcomputers in June 1990. They used microcomputers in their classrooms about 1 hour per week for 10 months. The second-grade children began using microcomputers in their classrooms in May 1989. They had used microcomputers about 1 hour per week for 22 months.

Both first- and second-grade children used microcomputers for mathematics and LOGO WRITER for computer literacy.

Fuchinobe Elementary School is also a model school for using microcomputers. Teachers at this school are trained by other teachers at the school, computer specialists, and university professors.

Suburban--Namiki Elementary School, Kanagawa. Namiki Elementary School is located in Sagamihara City, Kanagawa Prefecture. The location is very close to Fuchinobe Elementary School. This school had 608 children from first through sixth grades and 3 classrooms in each grade in March 1991. This school did not use microcomputers. Sixty-three first-grade children (26 boys and 37 girls) and 68 second-grade children (36 boys and 32 girls) from this school were selected as subjects for the study.

Rural--Hishigata Elementary School, Kagoshima. Hishigata Elementary School is located in Kamoto-gun, Kagoshima Prefecture which is more than 800 miles southwest of Tokyo. Most parents' at this school are farmers or have other jobs related to agriculture.

This school had 491 children from first through sixth grades. The first, third, and sixth grades had 2 classrooms each, and other grades had 3 classrooms each in March 1991. This school used microcomputers to help children become familiar with new technologies. The microcomputers used were Fujitsu FM-7s running the Japanese version of the MS-DOS operating system.

Sixty-eight first-grade children (29 boys and 39 girls) and 82 second-grade children (46 boys and 36 girls) were used as subjects for the study. The first-grade children began using microcomputers in June 1990. The children had used microcomputers in their classrooms about 1 hour per week for 10 months. The second-grade children had begun using microcomputers in June 1989.

At the time of this study, the children had used microcomputers about 1 hour per week for 22 months. Both first- and second-grade children used microcomputers for word processing and making graphics. Teachers at this school were trained by computer specialists from computer companies and by other teachers at the school.

Rural--Sakurai Elementary School, Kagoshima. Sakurai Elementary School is located in Kamoto-gun, Kagoshima Prefecture. This elementary school is located in a same village as Hishigata Elementary School. Therefore, the family backgrounds of children who attend the two schools are quite similar. This school did not use microcomputers. Sakurai Elementary School had 410 children from first through sixth grades and 2 classrooms in each grade in March 1991. Sixty-six first-grade children (31 boys and 35 girls) and 71 second-grade children (40 boys and 31 girls) were used as subjects for the study.

Instrumentation

The Young Children's Computer Inventory, which was used to gather data for this study, was derived from the English edition of a questionnaire originally developed by Takashi Sakamoto of the Tokyo Institute of Technology. The questionnaire consists of 155 items on the following five subscales: Attitudes Toward Computers, Psychological Effects of Computers, Creativity, Motivation to Study, and Empathy. This questionnaire was designed for use by fourth-grade children in a United Nations Educational Scientific and Cultural Organization (UNESCO) study (Sakamoto, personal communication, July 11, 1990). One subscale of the original questionnaire, Attitudes Toward Computers, was translated from a questionnaire which was developed by Light, Colbourne and Smith in 1987. Two subscales, Creativity and Motivation to Study, were derived from Sakamoto's previous studies (Sakamoto, 1985a; Sakamoto, Kimura, Muta, Shimada, & Nagaoka, 1980; Sakamoto, Matsuda, & Muta, 1985). The Empathy subscale was developed by Sakurai in 1986.

Several modifications were made to form the Young Children's Computer Inventory. One subscale, Psychological Effects of Computers, was removed because of the abstract nature of the statements. Wording for other items on the remaining four subscales was simplified for the first-grade level. Because of the relatively short attention span of young children, the number of items was reduced. This reduction procedure is summarized in Table 1.

Table 1

UNESCO Derivation of Young Children's Computer Inventory Items

Subscale	UNESCO	YCCI Version 2	YCCI Version 3
Attitudes toward computers	30	15	8
Psychological effects of computers	36	0	0
Motivation to study	32	15	8
Empathy	20	15	8
Creativity	37	15	8
Total Items	155	60	32

Version 2 of Young Children's Computer Inventory consisted of the following four subscales: Attitudes Toward Computers, Motivation to Study, Empathy, and Creativity. Each subscale contained 15 items. A total of 60 items were back-translated (Baker, Matuura, & Fukumura, 1990;

Spielberger, 1982) into Japanese from English. This 60-item questionnaire was administered to all 102 first- and second-grade children in a public elementary school in Tokyo, Japan, in September 1990 (Appendix).

Children were asked to answer each item with their parents' help at home. The results of this questionnaire were factor analyzed using SPSS; ULS, varimax rotation, to assess construct validity for the four factor subscales. Seventeen items which did not produce strong ($r >= .20$) factor loadings were removed. In order to have an equal number of items for each subscale, the eight items which had the strongest factor loadings with each subscale were selected for inclusion in the revised form of the questionnaire (Table 2, Appendix).

The number of choices on the Likert-type scale for each item was also increased from three to four: no, maybe no, maybe yes, and yes in the revised version of questionnaire. This was done to increase the range of possible scores for each 8-item subscale. Content validity of the questionnaire was established by two native Japanese teachers and five bilingual Japanese graduate students.

Table 2

<u>Factor Loadings for Young Children's Computer Inventory, Version 3</u>

Attitudes Toward Computers

1. I enjoy doing jobs which use a computer	.71
2. I am tired of using a computer	.67
3. I will be able to get a good job if I learn how to use a computer	.64
4. I concentrate on a computer when I use one	.56
5. I enjoy computer games very much	.50
6. I would work harder if I could use computers more often	.46
7. I think that it takes a long time to finish when I use a computer	.46
8. I know that computers give me opportunities to learn many new things	.43

Motivation to Study

1. I study by myself without anyone forcing me to study	.61
2. If I do not understand a problem, I will not stop working on it	.44
3. When I don't understand something, I keep working until I find the answer	.43
4. I review my lessons every day	.43
5. I try to finish whatever I begin	.42
6. Sometimes, I change my study habits	.39
7. I enjoy working on a difficult problem	.39
8. I think about many ways to solve a difficult problem and I never give up	.36

Empathy

1. I feel sad when I see a child crying	.47
2. I sometimes cry when I see a sad play or movie	.46
3. I get angry when I see a friend who is treated badly	.45
4. I feel sad when I see old people alone	.45
5. I worry when I see a sad friend	.43
6. I feel very happy when I listen to a song I like	.41
7. I do not like to see a child play alone, without a friend	.26
8. I feel sad when I see an animal hurt	.20

Table 2--Continued

Creativity

1.	I examine unusual things	.58
2.	I find new things to play with or to study, without any help	.53
3.	When I think of a new thing, I apply what I have learned before	.45
4.	I tend to consider various ways of thinking	.44
5.	I create many unique things	.41
6.	I do things by myself without depending upon others	.35
7.	I find different kinds of materials when the ones I have do not work or are not enough	.35
8.	I examine unknown issues to try to understand them	.34

The internal consistency reliability of each of the four subscales of the revised instrument was then calculated using Cronbach's Alpha, a generalized reliability coefficient of which measures such as KR 20 and odd-even split-half are special cases (Cronbach, 1970; SPSS, 1986). The pilot test data from Japan was used for the analyses. The reliability of subscale 1, Attitudes Toward Computers, was .78; subscale 2, Motivation to Study, was .69; subscale 3, Empathy, was .55; and subscale 4, creativity, was .67. Overall reliability for the 32 items was .77.

The factor loadings, indicating the strength of relationship between each item and its factor, for the 32 items confirmed for the four subscales, are listed in Table 2.

Procedures for Collection of Data

After permission was received from the principals of the schools, each principal was contacted in order to schedule the administration of the Young Children's Computer Inventory to children. Instructions on how to administer the questionnaire were provided for each principal and teacher. The following items were sent to each principal: (a) a letter of instruction for the principal and the teachers at each school (Appendix), (b) a letter of instruction for the parents of the subjects (Appendix), and (c) the Young Children's Computer Inventory. The letters for parents and the questionnaires for each class were placed in envelopes. The teachers distributed the questionnaires to the subjects in their classrooms. When the subjects returned the questionnaires, the teachers recorded the number of subjects responding and not responding, placed the questionnaires back into the envelope, and returned the envelope to the principal. Follow-up telephone calls were made to the principals after 1 week, verifying that data collection had been completed, and requesting that they return the envelopes.

Procedures for Analysis of Data

A three-way analysis of variance (MANOVA, 4 x 3 x 2 = subscale by geographic area by treatment vs. control) was employed to test for significant differences among any combinations of group means on the Young Children's Computer Inventory. Failure to confirm significance at this level would have called into question the appropriateness of proceeding with tests of hypotheses one through four.

1. A univariate *F*-test (One way, treatment vs. control) was employed to test for significant differences in the group mean scores of computer users and non-users in the area of Attitudes Toward Computers on the Young Children's Computer Inventory.

2. A univariate *F*-test (One way, treatment vs. control) was employed to test for significant differences in the group mean scores of computer users and non-users in the area of Motivation to Study on the Young Children's Computer Inventory.

3. A univariate *F*-test (One way, treatment vs. control) was employed to test for no significant negative differences between the group mean scores of computer users and non-users in the area of Empathy on the Young Children's Computer Inventory.

4. A univariate *F*-test (One way, treatment vs. control) was employed to test for significant differences in the group mean scores of computer users and non-users in the area of Creativity on the Young Children's Computer Inventory.

5. A three-way analysis of variance (MANOVA, 4 x 3 x 2 = subscale by geographic area by treatment vs. control) was employed to test for no significant differences among the geographic categories of urban, suburban and rural on any of four parts of the Young Children's Computer Inventory.

The .05 level of significance was selected as the rejection criterion for testing the null hypothesis in each analyses.

CHAPTER 4

PRESENTATION AND ANALYSIS OF DATA

Response Rate

Seven hundred and thirty-four of the 803 subjects, or 91.4%, completed the questionnaires and were included in the analysis. Three hundred sixty-six of the 734, or 49.9% of the subjects who completed questionnaire, were boys. All of the subjects were in the age range from 83 through 107 months. As shown in Table 3, 364 of the subjects completing questionniares were selected from urban, suburban, and rural schools using computers, while 370 were from schools not using computers.

Table 3

Distribution of Subjects Completing Questionnaire

Group	Urban	Suburban	Rural	Total
Children with computers	108	132	124	364
Children without computers	129	119	122	370
Total	237	251	246	734

Tests of Hypotheses

A three-way analysis of variance (MANOVA, 4 x 3 x 2 = subscale by geographic area by treatment vs. control) was employed as an overall test for significant differences among any combinations of group means on the Young Children's Computer Inventory. The .05 level of significance was chosen for this test.

As shown in Table 4, the extent of computer experience affected children's scores on at least one subscale of the Young Children's Computer Inventory. No differences due to site (urban, suburban, rural) were found among the children's scores on the Young Children's Computer Inventory. In addition, no significant interaction (computer by site) was found, indicating that the effects due to computer experience are consistent across urban, suburban, and rural sites (Norusis, 1985). These results confirmed the suitability of the data for proceeding with tests of hypotheses 1-4.

Table 4

Overall Tests for Significance--Scale by Site by Treatment MANOVA

Effect	Pillais Value	Approx.F	Hypoth. DF	Error DF	Sig.of F
Computer by site	.017	1.342	8.00	1212.00	.218
Site	.020	1.547	8.00	1212.00	.138
Computer	.105	17.923	4.00	605.00	.000

Hypothesis One

Hypothesis one stated: In the area of Attitudes Toward Computers, as reported on the Young Children's Computer Inventory, first- and second-grade children using computers will have higher group mean scores than children not using computers. The mean scores for Attitudes Toward Computers of first- and second-grade children using computers and those not using computers are reported in Table 5. Analysis of variance results presented in Table 6 indicate a significant difference between the two groups at the .05 level (F = 57.16, 1, 662 df, p = .000), leading to rejection of the null hypothesis. The alternative hypothesis of more positive attitudes for computer users was therefore accepted.

Table 5

Mean Scores for Attitudes Toward Computers of First- and Second-Grade Children Using Computers and Not Using Computers

Group	N	Mean
Children with computers	364	3.49
Children without computers	370	3.18

Table 6

Analysis of Variance for Computer Users versus Non-Users on Attitudes Toward Computers

Source	DF	SS	MS	F	P
Between groups	1	1040.437	1040.437	57.168	.000
Within groups	662	12048.044	18.199		
Total	663	13088.481			

Hypothesis Two

Hypothesis two stated: In the area of Motivation to Study, as reported on the Young Children's Computer Inventory, first- and second-grade children using computers will have higher group mean scores than children not using computers. The mean scores for Motivation to Study for first- and second-grade children using computers and not using computers are reported in Table 7. Analysis of variance results presented in Table 8 indicate no significant difference between the two groups at the .05 level (F = 1.03, 1, 669 df, p = .155), leading to acceptance of the null hypothesis. There is no evidence that children using computers exhibited higher motivation to study.

Table 7

Mean Scores for Motivation to Study of First- and Second-Grade Children Using Computers and Not Using Computers

Group	N	Mean
Children with computers	364	2.59
Children without computers	370	2.55

Table 8

Analysis of Variance for Computer Users versus Non-Users on Motivation to Study

Source	DF	SS	MS	F	P
Between groups	1	26.233	26.233	1.030	.155
Within groups	669	17802.588	25.468		
Total	700	17828.821			

Hypothesis Three

Hypothesis three stated: In the area of Empathy, as reported on the Young Children's Computer Inventory, first- and second-grade children using computers will have group mean scores no lower than children not using computers. The mean scores for Empathy for first- and second-grade children using computers and those not using computers are reported in Table 9. Analysis of variance results presented in Table 10 indicate no significant difference between the two groups at the .05 level (F = .05, 1, 701 df, p = .406), leading to acceptance of the null hypothesis. There is no evidence that children using computers exhibited lower empathy.

Table 9

Mean Scores for Empathy of First- and Second-Grade Children Using Computers and Not Using Computers

Group	N	Mean
Children with computers	364	3.16
Children without computers	370	3.15

Table 10

Analysis of Variance for Computer Users versus Non-Users on Empathy

Source	DF	SS	MS	F	p
Between groups	1	1.348	1.348	.055	.406
Within groups	701	16933.439	24.156		
Total	702	16934.788			

Hypothesis Four

Hypothesis four stated: In the area of Creativity, as reported on the Young Children's Computer Inventory, first- and second-grade children using computers will have higher group mean scores than children not using computers. The mean scores for Creativity for first- and second-grade children using computers and those not using computers are reported in Table 11. Analysis of variance results presented in Table 12 indicate no significant difference between the two groups at the .05 level ($F = .27$, 1, 701 df, $p = .300$), leading to acceptance of the null hypothesis. There is no evidence that children using computers exhibited higher creativity, based upon their self report on a Likert scale.

Table 11

Mean Scores for Creativity of First- and Second-Grade Children Using Computers and Not Using Computers

Group	N	Mean
Children with computers	364	2.90
Children without computers	370	2.94

Table 12

Analysis of Variance for Computer Users versus Non-Users on Creativity

Source	DF	SS	MS	F	P
Between groups	1	7.011	7.011	.274	.300
Within groups	701	17895.668	25.528		
Total	702	17902.679			

Hypothesis Five

Hypothesis five stated: There will be no significant differences among group mean scores at urban, suburban, and rural sites on any of the four parts of the Young Children's Computer Inventory. Since the overall three-way analysis of variance (MANOVA, 4 x 3 x 2 = subscale by geographic area by treatment vs. control) results, shown in Table 4, indicate no significant difference among group mean scores by site, the null hypothesis was accepted. There is no evidence that the urban, suburban, or rural categories make any differences with respect to Japanese first- and second-grade students' attitudes toward computers, motivation to study, empathy, or creativity.

CHAPTER 5

SUMMARY, FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

Summary

This study investigated the changes in attitudes toward microcomputers of Japanese first- and second-grade children who were exposed to microcomputers in school. Eight hundred and three, first- and second-grade children were selected from six Japanese public schools. Approximately half of the subjects were selected from urban, suburban, and rural schools using computers, while the remaining subjects were from schools not using computers.

The instrument used for this study was the Young Children's Computer Inventory, which was derived from the English edition of a questionnaire originally developed by Takashi Sakamoto of the Tokyo Institute of Technology. This instrument was validated using data from a pilot test site in Japan. The results were factor analyzed using SPSS; ULS, varimax rotation, to assess construct validity. Content validity was established by two native Japanese teachers and five bilingual Japanese graduate students. The reliability of this instrument was calculated using Cronbach's Alpha, a generalized reliability coefficient.

The Young Children's Computer Inventory consisted of four subscales: Attitudes Toward Computers, Motivation to Study, Empathy, and Creativity. The questionnaire was mailed to the principal of each school, where teachers distributed the questionnaires to the subjects. Demographic information collected for each classroom included sex, age, number of months of experience with microcomputers, types of microcomputers used, and various inservice experiences of the teachers regarding computers.

A three-way analysis of variance (MANOVA, 4 x 3 x 2 = subscale by geographic area by treatment vs. control) was employed as an overall test for significant differences among any combinations of group mean scores on the Young Children's Computer Inventory. Results indicated computer experience affected children's scores on at least one subscale. Geographic site did not affect the children's scores.

Four one-way analyses of variance were used to compare mean scores on each scale of the instrument for children using computers and those not using computers. On the Attitudes Toward Computers subscale, a significant difference was found between the two groups. Children who used computers had more favorable attitudes toward computers. On the Motivation to Study subscale, no significant difference was found between the two groups. The subscales Empathy and

Creativity also yielded no significant differences between the two groups.

Findings

The following findings resulted from this study:

1. A significant difference in the hypothesized direction (F = 57.16, 1, 662 df, p = .000) was found between the group mean scores of first- and second-grade computer users and non-users in the area of Attitudes Toward Computers, as measured by the Young Children's Computer Inventory. Children who used computers had more positive attitudes toward computers than children who did not use computers.

2. No significant difference (F = 1.03, 1, 669 df, p = .155) was found between the group mean scores of first- and second-grade computer users and non-users in the area of Motivation to Study, as measured by the Young Children's Computer Inventory.

3. No significant difference (F = .05, 1, 701 df, p = .406) was found between the group mean scores of first- and second-grade computer users and non-users in the area of Empathy, as measured by the Young Children's Computer Inventory.

4. No significant difference (F = .27, 1, 701 df, p = .300) was found between the group mean scores of first- and second-grade computer users and non-users in the area of

Creativity, as measured by the Young Children's Computer Inventory.

5. No significant differences were found (Approx. F = 1.54, Hypoth. df = 8.00, Error df = 1212.00, Sig. of F = .138) among the group mean scores of urban, suburban, and rural first- and second-grade children on the four subscales of the Young Children's Computer Inventory.

The findings referred to in this section only apply to the subjects used in this study. The findings are contingent upon the variables considered, the conditions under which the study was conducted, and the instrument used to collect data.

Conclusions

Eight hundred and three first- and second-grade children were selected from six Japanese public schools for inclusion in this study. Approximately half of the subjects were selected from urban, suburban, and rural schools using computers. The other half were from schools not using computers. Children using computers in the three geographic categories of public schools had different types of experiences with computers. For example, children from the urban public school had computer-assisted instruction experiences, children from the suburban public school had both computer-assisted instruction and Logo experiences, and children from the rural public school had word processing and graphics experiences. According to the findings of this study, the urban, suburban, and rural categories did not result in significant differences on the four parts of the Young Children's Computer Inventory. Therefore, there is no evidence that the kind of computer experiences (Logo, well-designed computer-assisted instruction, emergent word processing activities, or graphics production) result in significant differences in children's attitudes toward computers, motivation to study, empathy, or creativity.

Computer experiences appear to have influenced children's attitudes toward computers in a positive manner. Lever, Sherrod and Bransford (1989) discerned that children with Logo programming experiences had more positive attitudes toward computers. According to the findings of this study, not only Logo but also well-designed computer-assisted instruction, emergent word processing, and graphics production influence children's attitudes toward computers in a positive manner.

Computer experiences were not found to influence children's motivation to study, empathy, or creativity in this study. Seefeldt and Barbour (1986) mentioned that children should have psychological and environmental motivation. In order to provide psychological motivation, adults should accept each child as an individual, provide freedom of choice, and provide enough time for the child's activities. Children also need environmental motivation. Adults should provide a variety of experiences for children. For example, reading books and rhymes can be used to motivate children to create art work. In this study, computer experiences had no measurable influence on children's motivation to study. This may be attributable to the fact that computer experiences are only a few of the experiences among children's many school experiences, or may indicate that computer experiences are not directly related to children's motivation to study.

Children's empathy was also not found to be influenced by computer experiences. Saarni (1990) mentioned that older children had more accurate empathical feelings than young children. Researchers of constructivism addressed the idea that children's emotions are related to their cognitive levels (Wadsworth, 1989). Therefore, computer experiences might not be an aspect which directly influences children's empathy.

Children's creativity was also not found to be influenced by computer experiences in this study. However, according to two studies by Clements (1983; 1987), Logo programming influenced children's creative thinking; children who had Logo experiences had higher creative thinking than children who had computer-assisted instruction experiences. In this study, Logo experience was not found to improve children's creativity. Moreover, no differences were evident among children based upon different computer experiences. In order to assess children's general creativity, it might be necessary to use instruments other than a self-report questionnaire.

According to the findings of this study, children's attitudes toward computers were improved by any of four computer experiences: Logo, well-designed computer-assisted instruction, emergent word processing, and graphics production. However, children's motivation to study, empathy, and creativity were not confirmed as being influenced by any of these computer experiences.

Since children's scores on the subscale Attitudes Toward Computers were affected by their computer experiences, differences between the mean scores of first-grade children with computer experiences and second-grade children with computer experiences were further analyzed. *T*-tests indicated a significant difference between the two groups at the .05 level (t = 3.33, 345 df, one-tailed p = .001); first-grade children with computer experiences had significantly more positive Attitudes Toward Computers than did second-grade children with computer experiences. However, mean scores for Attitudes Toward Computers of second-grade children with computer experiences were still significantly higher than the mean scores of the first-grade children without computer experiences (t = 3.57, 312 df, one-tailed p = .000) and the second-grade children without computer experiences (t = 3.50, 325 df, one-tailed p = .001). There was no significant difference in the group mean scores of first-grade children without computer experiences and second-grade children without computer experiences (t = -.19, 315 df, p = .847) on the subscale Attitudes toward Computers.

Recommendations

The following recommendations are based upon the findings and conclusions of this study:

1. It is recommended that computers be introduced to primary grade children in order to develop positive attitudes toward computers.

2. It is recommended that computer experiences such as well-designed computer-assisted instruction, Logo, word processing, and graphics production, be used to help primary grade children develop positive attitudes toward computers.

3. It is recommended that more studies be done to investigate the influence of using computers on the development of the whole child.

4. It is recommended that a longitudinal study be done to investigate the relationship between the duration of computer experiences and children's attitudes as measured by the Young Children's Computer Inventory.

5. It is recommended that a replication of this study be done using subjects from different nations and cultural groups.

6. It is recommended that young children be observed in natural settings, such as classrooms, homes, and computer laboratories, in order to augment this study in assessing young children's attitudes toward computers.

APPENDIX

Young Children's Computer Inventory (Version 2)

(Name:)

This questionnaire has 4 parts. Read and discuss each of the following statements with your child and mark the response your child gives you.

(Part I)

Part I is about computers.

	Disagree	Undecided	Agree
(1) I can learn many things when I use a computer.	___1.	___2.	___3.
(2) I enjoy lessons on the computer.	___1.	___2.	___3.
(3) I would work harder if I could use computers more often.	___1.	___2.	___3.
(4) I think that computers are very easy to use.	___1.	___2.	___3.
(5) I would like to study with a teacher rather than using a computer.	___1.	___2.	___3.
(6) I believe that it is very important for me to learn how to use a computer.	___1.	___2.	___3.
(7) I will be able to get a good job if I learn how to use a computer.	___1.	___2.	___3.
(8) I know that computers give me opportunities to learn many new things.	___1.	___2.	___3.
(9) I believe that the more often teachers use computers, the more I will enjoy school.	___1.	___2.	___3.
(10) I enjoy computer games very much.	___1.	___2.	___3.
(11) I concentrate on a computer when I use one.	___1.	___2.	___3.

	Disagree	Undecided	Agree
(12) I am tired of using a computer.	___1.	___2.	___3.
(13) I enjoy doing jobs which use a computer.	___1.	___2.	___3.
(14) I think that it takes a long time to finish when I use a computer.	___1.	___2.	___3.
(15) I can learn more from books than from a computer.	___1.	___2.	___3.

Part II, III, and IV are related to other experiences.

(Part II)

	Disagree	Undecided	Agree
(1) I think about many ways to solve a difficult problem and I never give up.	___1.	___2.	___3.
(2) I review my lessons every day.	___1.	___2.	___3.
(3) I like to go work out problems which i can use in my life every day.	___1.	___2.	___3.
(4) If I do not understand my teacher, I ask him/her questions.	___1.	___2.	___3.
(5) I enjoy working on a difficult problem.	___1.	___2.	___3.
(6) I try to finish whatever I begin	___1.	___2.	___3.
(7) I study by myself without anyone forcing me to study.	___1.	___2.	___3.
(8) I never forget to do my homework	___1.	___2.	___3.
(9) If I fail, I try to find out why I failed.	___1.	___2.	___3.
(10) If I do not understand a problem, I will not stop working on it.	___1.	___2.	___3.

	Disagree	Undecided	Agree
(11) I listen to the teacher and classmates carefully.	___1.	___2.	___3.
(12) If some work help others, I will be glad to do it.	___1.	___2.	___3.
(13) When I do not understand something, I keep working until I find the answer.	___1.	___2.	___3.
(14) Sometimes, I change my study habits.	___1.	___2.	___3.
(15) I study well, even if I have only a little time.	___1.	___2.	___3.

(Part III)

	Disagree	Undecided	Agree
(1) I do not like to see a child play alone, without a friend.	___1.	___2.	___3.
(2) I feel sad when I see a child crying.	___1.	___2.	___3.
(3) I feel happy when I see a friend smiling.	___1.	___2.	___3.
(4) I feel sad when I see an animal hurt.	___1.	___2.	___3.
(5) Children who have no friends sometimes do not want a friend.	___1.	___2.	___3.
(6) I do not cry, even if I read a sad story or see a sad movie.	___1.	___2.	___3.
(7) I eat all of my cookies, even if another child wants some of my cookies.	___1.	___2.	___3.
(8) I feel sad when I see old people alone.	___1.	___2.	___3.
(9) I get angry when I see a friend who is treated badly.	___1.	___2.	___3.
(10) I worry when I see a sad friend	___1.	___2.	___3.

	Disagree	Undecided	Agree
(11) I feel strange when I see a happy child crying.	___1.	___2.	___3.
(12) I feel sad when I see a child hurt from falling down.	___1.	___2.	___3.
(13) I sometimes cry when I see a sad play or movie.	___1.	___2.	___3.
(14) I feel that a young child is pretty, even if it cries often.	___1.	___2.	___3.

(Part IV)

	Disagree	Undecided	Agree
(1) I invent new methods when one way does not work.	___1.	___2.	___3.
(2) I find different kinds of materials when the ones I have do not work or are not enough.	___1.	___2.	___3.
(3) I find new things to play with or to study, without any help.	___1.	___2.	___3.
(4) I think about using other things to solve a problem	___1.	___2.	___3.
(5) I make a plan before I start to solve a problem.	___1.	___2.	___3.
(6) I examine unknown issues to try to understand them.	___1.	___2.	___3.
(7) I invent games and play them with friends.	___1.	___2.	___3.
(8) I choose my own way without imitating methods of others.	___1.	___2.	___3.
(9) I tend to consider various ways of thinking.	___1.	___2.	___3.
(10) I tend to think about the future.	___1.	___2.	___3.
(11) I create many unique things	___1.	___2.	___3.

		Disagree	Undecided	Agree
(12)	When I think of a new thing, I apply what I have learned before.	___1.	___2.	___3.
(13)	I examine unusual things.	___1.	___2.	___3.
(14)	When I concentrate on one thing, I sometimes forget everything else.	___1.	___2.	___3.
(15)	I do things by myself without depending upon others.	___1.	___2.	___3.

Thank you very much.

Young Children's Computer Inventory (Version 2)

（　年　組　番　男*女）

このアンケートは四つのパートに分かれています。それぞれの文章をお子さんとよく読み、お子さんにとって「そう思う」場合は「はい」に、「そうは思わない」場合は「いいえ」に、「わからない」場合は「わからない」に○をつけてください。ひとつの問題に○はひとつだけつけてください。

（パート1）

パート1はコンピュータについてのおたずねです。

	いいえ	わからない	はい
1. コンピュータをつかうと、しらなかったことがたくさんわかる。. . .	1	2	3
2. コンピュータをつかうじゅぎょうは たのしみだ。.	1	2	3
3. コンピュータがもっとつかえるなら、もっといっしょうけんめいべんきょうしたい。.	1	2	3
4. コンピュータはとてもかんたんにつかえる。.	1	2	3
5. コンピュータよりも、せんせいからならいたい。.	1	2	3
6. コンピュータをつかうことは、とてもたいせつなことの1つだ。. . .	1	2	3
7. がっこうでコンピュータをつかっていれば、おとなになってからよいしごとにつくことができるとおもう。.	1	2	3
8. がっこうのコンピュータをつかっていると、それについてもっとしりたいことがでてくる。.	1	2	3
9. せんせいがコンピュータをもっとつかえば、がっこうはもっとたのしくなるだろう。.	1	2	3

	いいえ	わからない	はい
10．コンピュータ．ゲームはとてもおもしろい。	1	2	3
11．コンピュータをつかっていると、それにむちゅうになってしまう。	1	2	3
12．コンピュータをつかうことはたいくつだ。	1	2	3
13．コンピュータでさぎょうするのはとてもたのしい。	1	2	3
14．コンピュータをつかうことは、じかんのむだづかいだ。	1	2	3
15．コンピュータよりも、ほんのほうが　たくさんのことをべんきょうできる。	1	2	3

パート２、３、４はコンピュータについて、考える必要はありません。

（パート２）

	いいえ	わからない	はい
1．もんだいがとけなくても、すぐにあきらめないでいろいろかんがえます。	1	2	3
2．ふくしゅうをまいにちすることにしています。	1	2	3
3．すすんで、いろいろなおうようもんだいをします。	1	2	3
4．じゅぎょうちゅう、わからないことがあったときせんせいにしつもんします。	1	2	3
5．しゅくだいは、わすれずにやってきます。	1	2	3
6．なんでもどんどんやってみます。	1	2	3
7．ほかのひとにいわれなくても、じぶんですすんでべんきょうします。	1	2	3

	いいえ	わからない	はい
8. むずかしいもんだいにであうと、がんばってやろうとおもいます。. .	1	2	3
9. しっぱいしたとき、どうしてしっぱいしたのか　かんがえます。. . .	1	2	3
10. いちどかんがえてわからなくても、あきらめません。.	1	2	3
11. せんせいのはなしや、ともだちのはっぴょうをよくきいています。	1	2	3
12. みんなのやくにたつことなら、すすんでしごとをします。. . . .	1	2	3
13. いえでべんきょうして　わからないことがあったら　そのままには　しません。.	1	2	3
14. べんきょうがはかどるように、ときどきべんきょうのしかたを　かえてみます。.	1	2	3
15. みじかいあきじかんをつかっても、べんきょうするように　しています。.	1	2	3

(パート3)

	いいえ	わからない	はい
1. だれともあそばないで　ひとりぼっちでいるこをみると、かわいそうだとおもいます。.	1	2	3
2. ないているこをみると、じぶんまでなんだか　かなしいきもちに　なることがあります。.	1	2	3
3. ともだちがにこにこわらっていると、じぶんまでなんとなく　たのしくなります。.	1	2	3
4. どうぶつがけがをして、くるしそうにしているのをみると、かわいそうになります。.	1	2	3

	いいえ	わからない	はい
5. ともだちがいないこは、ともだちがほしくないこだとおもいます。.	1	2	3
6. かなしいものがたりや　えいがをみても、なきません。.......	1	2	3
7. おやつをたべているとき、そばにほしそうにしているこがいても、じぶんでぜんぶたべてしまうことができます。...........	1	2	3
8. ひとりぼっちでくらしている、おじいさん、おばあさんをみているとかわいそうになります。................	1	2	3
9. ともだちがいじめられているのをみると、はらがたちます。....	1	2	3
10. げんきのないこをみると、しんぱいになります。.........	1	2	3
11. うれしいときになくこは、おかしいこだとおもいます。.....	1	2	3
12. けがをしてくるしがっているこをみると、かわいそうだとおもいます。......................	1	2	3
13. かなしいげきをみていると、ついないてしまうことがあります。.	1	2	3
14. ちいさいこはよくなくけれど、かわいいなとおもいます。....	1	2	3
15. あるうたをきくと、とてもたのしいきもちになります。.....	1	2	3

(パート4)

	いいえ	わからない	はい
1. ひとつのほうほうがだめだったら、ほかのほうほうをかんがえます。	1	2	3
2. ざいりょうがたりないとき、かわりになるものをみつけます。...	1	2	3

	いいえ	わからない	はい
3. あたらしいことをみつけてやります。	1	2	3
4. どうぐなど、もっとかんたんにできないかとかんがえます。	1	2	3
5. なにかをやるまえに、やりかたをかんがえます。	1	2	3
6. わからないところをしらべます。	1	2	3
7. ともだちといっしょに、あそびをかんがえます。	1	2	3
8. ひとのまねをせず、じぶんのやりかたでやります。	1	2	3
9. いろいろなかんがえかたで、ものごとをかんがえます。	1	2	3
10. みらいのことをかんがえます。	1	2	3
11. いろいろとかわったものをつくります。	1	2	3
12. あたらしいことは、まえにやったことをおもいだしながらかんがえます。	1	2	3
13. めずらしいことがあると、しらべます。	1	2	3
14. ひとつのことをやりはじめると、ほかのことをわすれるくらいです。	1	2	3
15. ひとにたのまず、じぶんのちからでやります。	1	2	3

☆どうもありがとうございました☆

Young Children's Computer Inventory (Version 3)

(name:)

This questionnaire has 4 parts. Read and discuss each of the following statements with your child and mark the response your child gives you.

(Part I)

Part I is about computers.

	No	Maybe No	Maybe Yes	Yes
(1) I enjoy doing jobs which use a computer.	___1.	___2.	___3.	___4.
(2) I am tired of using a computer.	___1.	___2.	___3.	___4.
(3) I will be able to get a good job if I learn how to use a computer.	___1.	___2.	___3.	___4.
(4) I concentrate on a computer when I use one.	___1.	___2.	___3.	___4.
(5) I enjoy computer games very much	___1.	___2.	___3.	___4.
(6) I would work harder if I could use computers more often.	___1.	___2.	___3.	___4.
(7) I think that it takes a lcng time to finish when I use a computer.	___1.	___2.	___3.	___4.
(8) I know that computers give me opportunities to learn many new things.	___1.	___2.	___3.	___4.

Part II, III, and IV are related to other experiences.

(Part II)

	No	Maybe No	Maybe Yes	Yes
(1) I study by myself without anyone forcing me to study.	___1.	___2.	___3.	___4.

	No	Maybe No	Maybe Yes	Yes
(2) If I do not understand a problem, I will not stop working on it.	___1.	___2.	___3.	___4.
(3) When I do not understand something, I keep working until I find the answer.	___1.	___2.	___3.	___4.
(4) I review my lessons every day.	___1.	___2.	___3.	___4.
(5) I try to finish whatever I begin	___1.	___2.	___3.	___4.
(6) Sometimes, I change my study habits.	___1.	___2.	___3.	___4.
(7) I enjoy working on a difficult problem.	___1.	___2.	___3.	___4.
(8) I think about many ways to solve a difficult problem and I never give up.	___1.	___2.	___3.	___4.

(Part III)

	No	Maybe No	Maybe Yes	Yes
(1) I feel sad when I see a child crying.	___1.	___2.	___3.	___4.
(2) I sometimes cry when I see a play or movie.	___1.	___2.	___3.	___4.
(3) I get angry when I see a friend who is treated badly.	___1.	___2.	___3.	___4.
(4) I feel sad when I see old people alone.	___1.	___2.	___3.	___4.
(5) I worry when I see a sad friend.	___1.	___2.	___3.	___4.
(6) I feel very happy when I listen to a song I like.	___1.	___2.	___3.	___4.
(7) I do not like to see a child play alone, without a friend.	___1.	___2.	___3.	___4.
(8) I feel sad When I see an animal hurt.	___1.	___2.	___3.	___4.

	No	Maybe No	Maybe Yes	Yes
(1) I examine unusual things.	___1.	___2.	___3.	___4.
(2) I find new things to play with or to study, without any help.	___1.	___2.	___3.	___4.
(3) When I think of a new thing, I apply what I have learned before.	___1.	___2.	___3.	___4.
(4) I tend to consider various ways of thinking.	___1.	___2.	___3.	___4.
(5) I create many unique things.	___1.	___2.	___3.	___4.
(6) I do things by myself without depending upon others.	___1.	___2.	___3.	___4.
(7) I find different kinds of materials when the ones I have do not work or are not enough.	___1.	___2.	___3.	___4.
(8) I examine unknown issues to try to understand them.	___1.	___2.	___3.	___4.

Thank you very much.

Young Children's Computer Inventory (Version 3)

（　年　組　番　男*女）

このアンケートは四つのパートに分かれています。それぞれの文章をお子さんとよく読み、お子さんにとって「そう思う」場合は「はい」に、「そうは思わない」場合は「いいえ」に、はっきりしない場合は「どちらかというとはい」または「どちらかというといいえ」に○をつけてください。ひとつの問題に○はひとつだけつけてください。

（パート1）

パート1はコンピュータについてのおたずねです。

	いいえ	どちらかというと いいえ	どちらかというと はい	はい
1．コンピュータでさぎょうするのはとてもたのしい。.	1	2	3	4
2．コンピュータをつかうことはたいくつだ。.	1	2	3	4
3．がっこうでコンピュータをつかっていれば、おとなになってから よいしごとにつくことができるとおもう。.	1	2	3	4
4．コンピュータをつかっていると、それにむちゅうになってしまう。	1	2	3	4
5．コンピュータ．ゲームはとてもおもしろい。.	1	2	3	4
6．コンピュータがもっとつかえるなら、もっといっしょうけんめい べんきょうしたい。.	1	2	3	4
7．コンピュータをつかうことは、じかんのむだづかいだ。.	1	2	3	4
8．がっこうのコンピュータをつかっていると、それについて もっとしりたいことがでてくる。.	1	2	3	4

パート2、3、4はコンピュータについて、考える必要はありません。

（パート2）

	いいえ	どちらかというと いいえ	どちらかというと はい	はい
1．ほかのひとにいわれなくても、じぶんですすんでべんきょうします	1	2	3	4
2．いちどかんがえてわからなくても、あきらめません。.	1	2	3	4
3．いえでべんきょうして　わからないことがあったら そのままには　しません。.	1	2	3	4
4．ふくしゅうをまいにちすることにしています。.	1	2	3	4
5．なんでもどんどんやってみます。.	1	2	3	4
6．べんきょうがはかどるように、ときどきべんきょうのしかたを かえてみます。.	1	2	3	4
7．むずかしいもんだいにであうと、がんばってやろうとおもいます。	1	2	3	4
8．もんだいがとけなくても、すぐにあきらめないで いろいろかんがえます。.	1	2	3	4

（パート3）

	いいえ	どちらかというと いいえ	どちらかというと はい	はい
1．ないているこをみると、じぶんまでなんだか　かなしいきもちに なることがあります。.	1	2	3	4
2．かなしいげきをみていると、ついないてしまうことが　あります。	1	2	3	4

	いいえ	どちらかというと いいえ	どちらかというと はい	はい
3. ともだちがいじめられているのをみると、はらがたちます。	1	2	3	4
4. ひとりぼっちでくらしている、おじいさん、おばあさんをみていると、かわいそうになります。	1	2	3	4
5. げんきのないこをみると、しんぱいになります。	1	2	3	4
6. あるうたをきくと、とてもたのしいきもちになります。	1	2	3	4
7. だれともあそばないで　ひとりぼっちでいるこをみると、かわいそうだとおもいます。	1	2	3	4
8. どうぶつがけがをして、くるしそうにしているのをみると、かわいそうになります。	1	2	3	4

（パート4）

	いいえ	どちらかというと いいえ	どちらかというと はい	はい
1. めずらしいことがあると、しらべます。	1	2	3	4
2. あたらしいことをみつけてやります。	1	2	3	4
3. あたらしいことは、まえにやったことをおもいだしながらかんがえます。	1	2	3	4
4. いろいろなかんがえかたで、ものごとをかんがえます。	1	2	3	4
5. いろいろかわったものをつくります。	1	2	3	4

	いいえ	どちらかというと いいえ	どちらかというと はい	はい
6. ひとにたのまず、じぶんのちからでやります。.	1	2	3	4
7. さいりょうがたりないとき、かわりになるものをみつけます。. . .	1	2	3	4
8. わからないところをしらべます。.	1	2	3	4

ありがとう　ございました

Letter to Principal in Japan
(Translated to English)

February, 1991

Dear Principal,

I, Keiko Miyashita, am a doctoral student at the University of North Texas, studying Early Childhood Education and Computer Education. I will survey young children's attitudes related to computers.

Please distribute one envelope with the questionnaire and letters to teachers and parents to each teacher. The questionnaire has four scales: Attitudes Toward Computers, Motivation to Study, Empathy, and Creativity. Please ask each teacher to distribute one envelope to each child. The completed questionnaires are to be returned to the teachers within one week. Please collect them, and I will be responsible to collect them from you.

The information provided by the parents and children will help not only me, but also the College of Education at the University of North Texas. The children's responses will be kept confidential.

I really appreciate your cooperation. Thank you for your assistance.

Sincerely.

Keiko Miyashita
P.O.Box 5202 NT Station
Denton, Texas, 76203
USA

Letter to Teachers in Japan
(Translated to English)

February, 1991

Dear Teacher,

I, Keiko Miyashita, am a doctoral student at the University of North Texas, studying Early Childhood Education and Computer Education. I will survey young children's attitudes related to computers.

Please distribute the envelope with a questionnaire and a letter to parents to children, and ask them to complete it with the help of their parents and to return it to you in one week. Then please write the names of the children whose envelopes were not returned on a sheet of paper. Please return all envelopes and names to your principal.

The information provided by the parents and children will help not only me, but also the College of Education at the University of North Texas. The children's responses will be kept confidential.

I really appreciate your cooperation. Thank you for your assistance.

Sincerely.

Keiko Miyashita
P.O.Box 5202 NT Station
Denton, Texas, 76203
USA

Letter to Parents in Japan
(Translated to English)

March, 1991

Dear Parents,

I, Keiko Miyashita, am a doctoral student at the University of North Texas, studying Early Childhood Education and Computer Education. I will survey children's attitudes related to computers.

This questionnaire consists of four parts which each contain simple items. The questionnaire takes only a few minutes to complete. Please read each statement to your child, explain each one, and mark the response your child selects.

Your child may not have any experiences with computers at school or at home. Part one of this questionnaire has some questions about computers. Ask your child to think about the questions as if he or she had used a computer at school or at home. Other parts of this questionnaire are not necessarily related to experiences with computers. Please return it to the teacher in one week.

The information provided by you and your child will help not only me, but also the College of Education at the University of North Texas. The children's responses will be kept confidential.

I really appreciate your cooperation. Thank you for your assistance.

Sincerely.

Keiko Miyashita
P.O.Box 5202 NT Station
Denton, Texas 76203
USA

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