COMPUTER ART IN AN ELEMENTARY SCHOOL COMPUTER STUDIO:
HOW DO STUDENTS LEARN
TO DEVELOP ORIGINAL COMPUTER ART IMAGES?

by

JOANNE MARJORIE BELL

B.Ed. (Sec.), The University of British Columbia, 1976

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF
MASTER OF ARTS
in
THE FACULTY OF GRADUATE STUDIES
(Department of Curriculum Studies)

We accept this thesis as conforming
to the required standard

THE UNIVERSITY OF BRITISH COLUMBIA
August 1995
©Joanne Marjorie Bell, 1995
In presenting this thesis in partial fulfilment of the requirements for an advanced degree at the University of British Columbia, I agree that the Library shall make it freely available for reference and study. I further agree that permission for extensive copying of this thesis for scholarly purposes may be granted by the head of my department or by his or her representatives. It is understood that copying or publication of this thesis for financial gain shall not be allowed without my written permission.

Department of Curriculum Studies

The University of British Columbia
Vancouver, Canada

Date August 24, 1995
This research was concerned with how grade four and five students developed original computer art images. I was the teacher-researcher, using action research to investigate my own interests within my classroom, and the District Computer Helping Teacher was my “critical friend”. Twelve cycles of planning, acting, observing, and reflecting took place as data was gathered using qualitative data gathering techniques. Data was then analyzed and organized into two themes, Image Development and Cooperative Interactions.

Though many guiding questions were used, three main research questions were focussed on. The secondary research question was how do students use cooperative interactions to develop individual and shared original computer art images? A key finding was that students exhibit more cooperative interactions with a partner when developing a shared image than when working on individual images. The primary research question was how does the student’s original computer art change over the course of the study? A key finding was that when developing their images, students should be encouraged to do their own problem solving, but if they copy teachers should encourage them to extend the copied image. The overarching research question, How do students learn to develop original computer art images?, was ever present throughout the study. A significant finding was that students’ use of boundaries, shape and size of image perimeter, for their computer images need to enhance their ideas for their image. The study concludes with questions for further research that the findings from this study uncovered.
TABLE OF CONTENTS

Abstract....................................................................................................................... ii
Table Of Contents....................................................................................................... iii
List Of Figures........................................................................................................... vi
Acknowledgements................................................................................................... vii
Dedication.................................................................................................................... viii

Chapter One: “Computer Art In An Elementary School Computer Studio:
How Do Students Learn To Develop Original Computer Art Images?”............. 1
   Personal Ground........................................................................................................ 4
   Research Questions.................................................................................................... 7
   Clarification of Terms............................................................................................... 8
      I. Cooperative interactions: student-student......................................................... 8
      II. Original computer art images............................................................................ 9
   Research Plan............................................................................................................ 9
      Action Research...................................................................................................... 9
      Methodology.......................................................................................................... 11
   Significance of the study.......................................................................................... 12
   Thesis Overview....................................................................................................... 13

Chapter Two: Review Of The Literature: Establishing The Landscape................. 16
   The Background: Computers in Education.............................................................. 16
   The Horizon: Computers in Art Education.............................................................. 26
   The Foreground: Computer Graphics in Art Education.......................................... 34

Chapter Three: Research Plan: Establishing the Terrain........................................ 43
   Action Research: from the View of the Teacher/Researcher................................ 43
      I. What is action research?..................................................................................... 43
      II. Action research in art education......................................................................... 45
      III. Why I used action research for this study....................................................... 47
   Population and Setting............................................................................................. 49
   The Action Research Format.................................................................................... 51
   Data Collection Techniques..................................................................................... 52
      I. Field Notes.......................................................................................................... 52
      II. Informal Interviews............................................................................................ 53
      III. Student Response Journal.............................................................................. 55
      IV. Artifact Collection: Photographs, tape recordings, computer
          art samples, and video....................................................................................... 56
   Research Participants Starting Place....................................................................... 57
   Procedure: Twelve Cycles of Action Research...................................................... 58
      Cycle one: the first computer art studio................................................................. 60
      Cycle two: the second computer art studio............................................................. 63
      Cycle three: the third computer art studio............................................................. 64
<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1</td>
<td>Rubinjeet's Image, March 10, 1994</td>
<td>97</td>
</tr>
<tr>
<td>Figure 2</td>
<td>Rubinjeet's Image, April 7, 1994</td>
<td>98</td>
</tr>
<tr>
<td>Figure 3</td>
<td>Rubinjeet's Image, May 2, 1994</td>
<td>101</td>
</tr>
<tr>
<td>Figure 4</td>
<td>Rubinjeet's Image, April 14/May 12, 1994</td>
<td>102</td>
</tr>
<tr>
<td>Figure 5</td>
<td>Rubinjeet and Andrew's Shared Image, May 20-June 1, 1994</td>
<td>116</td>
</tr>
<tr>
<td>Figure 6</td>
<td>Balwinder's Image, March 17, 1994</td>
<td>121</td>
</tr>
<tr>
<td>Figure 7</td>
<td>Balwinder's Image, May 12, 1994</td>
<td>122</td>
</tr>
<tr>
<td>Figure 8</td>
<td>Balwinder's Image, May 2, 1994, revisited with his partner</td>
<td>127</td>
</tr>
<tr>
<td>Figure 9</td>
<td>Balwinder's Image, April 7, 1994</td>
<td>130</td>
</tr>
<tr>
<td>Figure 10</td>
<td>Balwinder and D.J.'s Shared Image, May 20-June 1, 1994</td>
<td>136</td>
</tr>
<tr>
<td>Figure 11</td>
<td>PJ Jenn's Image, March 10, 1994</td>
<td>139</td>
</tr>
<tr>
<td>Figure 12</td>
<td>PJ Jenn's Image, April 14-21, 1994</td>
<td>140</td>
</tr>
<tr>
<td>Figure 13</td>
<td>PJ Jenn's Image, April 2-14, 1994</td>
<td>141</td>
</tr>
<tr>
<td>Figure 14</td>
<td>PJ Jenn's Image, April 7, 1994</td>
<td>145</td>
</tr>
<tr>
<td>Figure 15</td>
<td>PJ Jenn and Elaine's Shared Image, May 20-June 1, 1994</td>
<td>154</td>
</tr>
</tbody>
</table>
ACKNOWLEDGEMENTS

First, I thank my students for sharing their ‘voices’ with me as we co-learned through the computer art unit. Their enthusiasm for the project was contagious.

Second, I thank ‘my critical friend’ who truly was more than an encourager as we problem solved and problem posed throughout the study. His technical support proved invaluable to the completion of the computer art unit.

Third, I acknowledge three of my professors from the University of British Columbia. The courses I took from them during my Master’s program enriched my understanding within the field of art education, and research in particular. Because of their efforts, I will take back to my school an enthusiastic attitude towards researching in my own classroom, and the skills in which to continue participating in active action research. I owe much to Dr. Graeme Chalmers, Dr. Rita Irwin, and Dr. Linda Peterat. Thank you for your patience and understanding while serving on my thesis committee. Your guidance was appreciated.

In conclusion, a special thank you to Dr. Rita Irwin, who served as the head of my thesis committee. The depth of my learning was richer because she kept me constantly questioning my experiences and the thesis writing process.
DEDICATION

Professor Bob Steele taught me more than the art curriculum during the two graphic courses I took with him in the early seventies. He taught me the value of people, as well as to value the ideas of others. His personal commitment to his students included an awareness of what was happening in his students’ lives, and the development of their images within the graphic studio.

When I reconnected with Bob while working on my Master’s, I found that retirement from teaching had not stopped Bob’s desire to understand what affects the development of students’ images. His focus today is to understand the connections between drawing and writing, and with his enthusiasm he involves educators in exploratory projects. His intention to use the results to compile books that will be available for others to glean from speaks of his commitment to the arts.

Thank you Bob for being an inspiring example of lifelong learning. May my thesis support your quest for greater understanding in the arts.
CHAPTER ONE

“COMPUTER ART IN AN ELEMENTARY SCHOOL COMPUTER STUDIO: HOW DO STUDENTS LEARN TO DEVELOP ORIGINAL COMPUTER ART IMAGES?”

As technology advances, computers are becoming both more user friendly and economical, therefore, more computers are available in our schools. Computers have become a “tool” to enhance and extend learning. As computers are used across the curriculum, research is needed to understand what is happening and how to best use the computer to enrich student learning.

The purpose of this study was to examine how students learn to use computer graphic software to develop their own original computer art images in an elementary school computer studio. I recognized the value of using computers for the development of original art images as I focussed my study on how student’s original art was achieved. The emergence of elementary computer laboratories, and the rapidly changing technology within them, is one of many reasons that makes educational computer research an area of constant rethinking and researching. “We are continually buffeted by technological changes, but such changes encourage us to ask how we might teach...with the use of computers” (Carson, Conners, Ripley and Smits, 1989, p. 9). I viewed computers as one way to strengthen the elementary art program and expand the techniques available to students to develop
their own original art images.

My review of the literature uncovered three relevant research studies that helped form a theoretical base for my study: Freedman, (1989), Freedman and Relan, (1992), and Chia and Duthie, (1993). These studies had distinctively different settings than my study and all three assigned topics to their students to develop, whereas I had my students choose a theme they were interested in.

Freedman’s (1989) ethnographic study involved elementary students at the grade three, four, and five level, however the environment was a class setting that included only one computer. The elementary students worked on an Apple IIe computer, which was efficient technology within the elementary school setting in 1989, but not for the present elementary school. Her findings, related to image development and social interaction, made me want to take a second look in my setting, an elementary computer art studio, to see what was happening while my students developed original art images. Freedman’s concern that the aesthetics of developing computer art images would be overshadowed by their technical experience, helped me to focus on what affected the development of my students’ original computer art images. Her findings on the general social interactions of her students indicated that student interactions influenced student imagery. I became curious as to how student interactions while making individual images would compare to student interactions
while making shared images and how my students would feel about the two different approaches.

In 1992, Freedman and Relan reported a second ethnographic study done with undergraduate art education majors. Though the setting was now a university Apple IIgs lab and the participants were adults who planned to teach, the focus of inquiry was on control issues: whether student focus on ideation and production would change, or remain the same, whether student computer-interaction remained constant, and whether social interaction affected the students' image development. Their findings were similar to Freedman's 1989 study even though participant's ages varied. How would my students' images develop and what would influence the development of their images?

The primary class (eleven year olds) of Chia and Duthie's (1993) study returned my focus to participants who compared in age to my grade four and five class. Freedman's (1989) study is referenced in Chia and Duthie's (1993) study and influenced the focus on image development and social interaction. However, Chia and Duthie also focussed on the teachers' developing strategies for instructing students to develop creative imagery on the computer. When the students were focussed on, the key issue was the students' social interaction while creating computer art images. An elementary computer laboratory was the setting, but the participants were selected because they were high
achievers in art and they came out of other classes specifically for the time of the study, and the themes for their assignments were assigned. The strengths of my study are based on the involvement of all students in my own class and that my students chose their individual themes. I began to ask myself: How will my students develop original computer art images within a regular class environment where they have control of their themes?

Significant changes in computer hardware and software, as well as changes from the class setting to a computer studio setting constantly require art educators to rethink what is happening within their computer art classes. Until now, no one has looked at how a regular class of elementary students learn to use a paint program in a relatively more technologically advanced setting - a Macintosh Classic studio. This is important because it is becoming a growing expectation for art teachers to use computers in their art programs.

Over the last decade, the graphic qualities and capabilities of the computer have rapidly developed. Focussing on the graphic components of the ClarisWorks program allows me to see how my students develop their original computer images. Knowing the different factors that influence their image making will help me develop appropriate curriculum to enhance their learning.

Personal Ground

This study emerged from my growing involvement in computer
education, and my personal desire to extend the arts into the field of computer graphics at the elementary level. I've also become interested in action research, which allows me to be an active researcher within my own classroom.

Computer art is now possible at the elementary level because most elementary schools have, or are currently establishing, computer laboratories. Students are highly motivated to learn how to use computers. As an art educator, I wanted to extend my understanding of what was happening in my elementary computer art studio, to record my findings and to reflect on how this information could be used to help my pupils achieve a high degree of success while developing their own computer images.

I have involved my students over the last three years in a District Computer Art Show. The presence of the show is a positive indication of district interest in the development of computer art. My students have enthusiastically participated and their active involvement in developing computer art images encouraged me to investigate their computer studio experiences.

What is happening in my computer art studio? What makes my students successful? How can I improve the learning that is occurring? I have done a lot of personal reflection on these questions and decided I would search the available research in the field of education and computers to see what had been done. As I searched the
current literature dealing with computer graphics I became very excited. My personal thinking was reflected in the literature and my excitement grew because I could see a need to find out more about what was happening in my own computer art studio.

I wanted to be the researcher, and I wanted to use my class so that I could use the conclusions within my own professional teaching. I was introduced to the concept of action research during a graduate art education class at the University of British Columbia. I liked the concept of taking a teacher’s concern and addressing it as research and allowing the research to evolve as the study progressed. Action research appeared to be a method that would allow me to extend my professional growth as a teacher/researcher even after my magistral program was finished. After all, when my institutional studies end, it will be my classroom and what will take place there, that I will want to continue to explore.

In order to strengthen my understanding of action research I registered in an Action Research course at the University of British Columbia. After completing the course my understanding of action research had grown and I was convinced that I had chosen the right research method for me.

Having taken three levels of cooperative learning courses offered by my School District between 1987-1990, my knowledge of formal cooperative learning strategies and how to implement them in
the classroom had been established. I found myself looking forward to seeing how students’ cooperative interactions can affect the development of computer images within an elementary computer art studio.

To enhance my understanding of computers and the view of a student studying computer programs, I enrolled in a course entitled Microcomputers for Professionals. Bob Best, our district Computer Helping Teacher, was the instructor. The experience helped me realize some of the feelings my students must have when working in my computer class. Having known Bob for the last three years as a resource person, and now knowing him as an instructor, our mutual enthusiasm for computer knowledge was evident. He became my “critical friend” during my action research project.

Research Questions

This action research study used qualitative techniques for data gathering. The qualitative techniques were employed to seek detailed insight into the perceptions of the student’s understanding of what was happening in the computer art studio.

Examining how students learn to develop original computer art images in an elementary school computer studio followed action research cycles of planning, acting, observing and reflecting. It is through these processes that action research deals with problem-posing and problem-solving. Yet, “Action research is not simply problem-
solving. It involves problem posing, the search for the questions beneath the questions that we typically ask about our educational practices” (Carson et al., 1989, p. 5).

Computer art in an elementary school computer studio was the setting for looking at the starting research questions.

The research questions consisted of the overarching research question: How do students learn to develop original computer art images?; the primary research question: How does the students’ original computer art change over the course of the study?; and the secondary research question: How do students use cooperative interactions to develop individual and shared original computer art images?

These questions evolved and became more specific as the study emerged.

Clarification of Terms

The following terms are used throughout the study and therefore require clarification to ensure mutual understanding between the author and the reader.

I. Cooperative Interactions: Student-Student

In this study, cooperative interactions are monitored between students, and refer to social interaction or the social process of working together. During the study, students worked with a partner within a computer studio setting. At first, the focus was on the spontaneous
interaction between students that occurs when students are learning the basic how to's of the graphic program, and while creating separate original computer images. As the study progressed, focus was on how the students cooperative interactions affected the development of a shared original computer image.

II. Original Computer Art Images

Original computer art images are images developed by the student without the use of any premade, stereotypical images, that is 'clip art'. The ClarisWorks 2.1 program had an optional clip art component, however this feature was not shown to the students. Some software programs contain preset images and tools, ie. stars, trees, etc. as part of their menu and these programs were not chosen for this reason. Using ClarisWorks 2.1 assured the researcher that all images were drawn or painted by the student, and this allowed the student to develop personal strategies for image production through the use of the computer graphic tools. The computer graphic tools consisted of both object based draw tools and pixel based paint tools.

Research Plan

Action Research

McKernan (1988) stated the following:

The aim of action research, as opposed to much traditional or fundamental research, is to solve practitioners' immediate and pressing day-to-day problems...Practitioners carry out action
research, *in situ*, to resolve conflicts and to improve their understanding of events, situations, and problems and so to increase the effectiveness of their practice. (p. 173)

"Action research is conscious and deliberate, a characteristic that leads to 'strategic action'" (Tripp, 1990, p. 159). The quality of strategic action is what sets action research apart from teacher action used to spontaneously problem solve in their class. The teacher was the researcher, who initiated and reflected on the action taken. The key elements of planning, acting, observing/monitoring, and reflecting were repeated throughout the action research project (Carson et al., 1989; Dicker, 1990; McKernan, 1988; Ripley and Hart, 1989). It is because "Action research offers a framework for taking practice seriously, validating educational experiences, and linking theory and practice dialectically" (Peterat, 1992-1993, p.65) that this method was chosen.

The advantages of using action research in my classroom included (1) uncomplicated access to the site, (2) minimal disturbance to the students' natural setting, (3) direct involvement at the implementation level, and (4) feedback for me as the teacher/researcher was used to assist my planning of further classroom activities. However, as a researcher I had a prior role in the site in which I was conducting my research, and observer-setting interaction effects were a major threat to the validity of the design. By using a
“critical friend” (Bob Best) to check data gathered, my awareness of different perspectives improved and enriched my understanding. The role I played was both as the teacher and researcher.

**Methodology**

Through action research, a twelve week case study was conducted using qualitative techniques. My grade four/five class, a heterogeneous group composed of 24 students (five grade four’s and nineteen grade five’s; 13 females and 11 males) formed the case for the study. Three sample students were chosen to represent three distinctly different ability ranges (high, medium, and low) that had been observed when the students were producing original computer art during the first two weeks of the study. A base line informal interview was conducted with each of the three sample students before week three and further informal interviews were done before week seven and at the end of the study. I focussed on the three sample students to gather my data for the remaining ten weeks, though the whole class kept response journals throughout the study and I used this information to better understand the weekly experiences of my students and to help me plan for the next week’s lesson.

The school was undergoing major renovations that were not completed in time for the study to start in the new computer laboratory, so data collection started March 10, 1994 in the old computer studio. The study transferred to the new Macintosh studio setting on
April 7th, but with the same equipment. Data collection included my teacher journal, student response journals, original student computer art, still photographs, some selective video recording of some of the weeks, informal interviews/discussion within the studio setting, and informal interviews done outside of the studio setting with the three sample students. Data covered approximately 12 hours of computer art studio time, and notes were also kept on the pre-entry session that involved approximately six hours of class time and utilized the data from the previous week’s student journal entries. The data collection was completed on June 17, 1994.

Significance of the Study

Technology is an important part of our society today, and the future needs of our students include an understanding of how to control computers as tools. Since computer laboratories or studios are in most elementary schools, we need to explore a variety of uses, and computer art is an area of high interest. Visual arts education at the elementary school can be enriched by the addition of computer graphics to the art curricula, as it expands the experience of the students and helps direct their creative thinking towards art applications for the future.

This study allowed me, the researcher/educator, to become a participant observer who started to learn what happens in an elementary school computer art studio, and then used the findings to
guide my practice in future computer art classes. The existing research was extended (Freedman 1989, 1991; Freedman and Relan 1992; Chia and Duthie, 1993), by looking at the upgraded computer studio and its impact on elementary students within a regular class. My findings offer new understanding of the field of computer graphics, as I looked at how my students developed their images I discovered four significant features that were affecting their image making. Though the previous studies generally looked at how students were socially interacting on the computer, my study extended this understanding to how my students used cooperative interactions while developing individual and shared images. These findings significantly changed the focus of my future computer art lessons.

ClarisWorks 2.1 was chosen because of its versatility and its availability. The program includes word processing, data base, spread sheet, and communication components, as well as the graphic components. ClarisWorks 2.1 became available in March of 1994 and was still available to educators after the research study completed. When the study concluded, students were able to transfer their knowledge of the graphic components to mixed presentations, allowing integration of art images with their writing.

Thesis Overview

In Chapter Two the literature is reviewed first to establish the changing impact of computers within education in general. The
second section then deals with computers as they have been utilized within art education. An awareness of the current potential of computer graphics within art education concludes the chapter.

The research plan of the current study is elaborated in Chapter Three. Definitions, for what action research is, are followed by a glimpse at the use of action research within art education, and followed by an explanation of why action research was chosen for this study. An overview and explanation of the data collection techniques is then followed by a descriptive account of the actual procedures followed during the study. The chapter concludes with explanations for how the collected data was analysed.

The findings are presented in Chapter Four, and include the experiences of myself as a teacher and as a researcher. Findings based on my students as a class are included briefly. However, the focus of the chapter is on the findings discovered when looking at my three sample students, Rubinjeet, Balwinder, and PJ Jenn. My findings for my sample students were presented separately and organized within two themes. The first being ‘Image Development’ which included four categories: their personal connections to their images, an awareness of the space within their images, the construction of their images, and their tool choices. The second theme, ‘Cooperative Interactions’, included the two categories, separate images with a partner, and their shared image. The chapter concludes with the findings of my class as
shared through a post journal entry in their response journals.

In Chapter Five I analyze the findings shared in chapter four using a similar format, however the findings of the three sample students are included together as the acquired knowledge is presented under the same themes and the same categories within the themes. A small section comparing the findings from my study to the previous studies of Freedman (1989), Freedman and Relan (1992), and Chia and Duthie (1993) is included next. An emphasis on the fact that my study was site specific precedes a listing of statements summarizing my findings and concludes with recommended questions to be used as catalysts for future research.
CHAPTER TWO
REVIEW OF THE LITERATURE:
ESTABLISHING THE LANDSCAPE

A researcher needs to understand the theoretical knowledge that already exists before entering into a research setting. Looking at the whole picture, the landscape, means we have to understand not only what has occurred recently within our specific interests, the foreground, but also what has occurred in our area of instruction, the horizon, as well as what has occurred generally within education, the background. To help guide our understanding of the landscape within the computer graphic studio, the review of the literature is subdivided into three main headings: 1) The Background: Computers In Education, which discusses the impact of computers on education in general, curriculum in particular and the question of leadership; 2) The Horizon: Computers in Art Education, which brings an awareness of the changing climate of acceptance for computer art and the search for suitable applications; and 3) The Foreground: Computer Graphics, which reviews the previous research and establishes the place of departure for this study.

The Background: Computers In Education

Peele recognized in 1984 that the acceptance of computers in education was growing and his challenge for educators was to “be ready for change. Ready for new technology. Ready for new curriculum,
new questions, new ways of teaching and learning” (p.37). The need to respond to this challenge is increasing as more computers are available in our schools, and with educators' increased desire to understand the new settings comes the need for further research.

The need to know what is most valuable to teach and how to teach it are pedagogical decisions all teachers confront when planning class time and curriculum, and it is no different when looking at computers and how to utilize them within education. Underwood and Underwood (1990) utilize Peele's (1984) metaphors and refer to the computer as both a tool and a catalyst for change. However, now the software selected can both influence and enrich the computer's potential to be used as a catalyst to change the quality of thinking in our students. Along with change comes the need to evaluate, to challenge our thinking and to look closely at our classroom practice.

Since "The computer appears in all kinds of vocations and avocations, which means that educators have the responsibility of preparing learners to make good use of it” (Croft, 1993-94, p. 302), teachers generally agree that students should be introduced to

1 Rather than constantly cite Underwood and Underwood throughout the following section I am acknowledging that the reasoning within their (1990) book, Computers And Learning: Helping Children Acquire Thinking Skills, is supportive of my own understanding of the educational computer environment, and my class setting in particular.
computers and become aware of what they can do. Computer studies has a place as a school curriculum subject, both as a separate subject and an integrated subject, and has been defended from two positions: 1) the needs of society, and 2) the need to develop children's minds. 

Reflecting on what we want for our students is essential, as computers are capable of supporting many educational philosophies. Educators need to know the philosophy behind their teaching and what the educational goals are that they're trying to achieve, before they can choose the appropriate software (Croft, 1993-94; Ragsdale, 1989).

Miller and Seller define curriculum perspectives through three categories: transmission, transaction, and transformation. They also use the Berlak dilemmas (as cited in Miller and Seller, 1990) to help define what each perspective includes. The transmission position sees learning as teacher centered, the student is the receiver of public information, knowledge is content, motivation is extrinsic, learning is molecular, and the child is a client. The transaction position sees learning as interactive with shared control between teacher and student, the student is a partner in problem-solving, though public knowledge is evident it is not fixed, knowledge is process, motivation is moving towards intrinsic, learning is developed on a framework, and the child's individual development is considered within the shared learning experience. The transformation position sees learning as interdependent on all phenomena with the student in control as
much as possible (student centered), knowledge is connected to personal meaning, motivation is intrinsic, learning is holistic, and the child as a whole person is considered along with the need for connective meaning.

With these definitions in mind, it is important for the teacher to know their basic position and when their position changes, it is important for them to know why. Different philosophical positions can be chosen for different learning situations and often a blend of the positions can be used (Rieber, 1992). However, an educator needs to understand what it is they want to teach and focus on how they are going to teach it in order to choose appropriate software to support the learning experience (Stoddart and Niederhauser, 1993).

Teaching computer literacy and awareness involves knowing what software is available to support each philosophical position, when to use it, how it applies to the learning goal, and whether your hardware will support the software. Computers and computer software are not neutral and they directly influence the learner. As the availability of software increases, educators must be astute consumers and choose programs based on the needs of their students, the goals of their programs, and what hardware is available to them.

The question is: what is the difference between software for each position? Software that reflects the transmission position promotes direct teaching of facts, ie. drill and practice activities, closed packages
where the student has no room to explore. The software itself gives feedback to the student, both when they are doing something right and when they need guidance in order to achieve an acceptable level of performance. This software was the first to be available and represents the position that “The essential ideas of transmission approaches are rooted in the objectivist view that learning should involve students in mastering and replicating the knowledge and skills transmitted to them in school” (Stoddart and Niederhauser, 1993, p. 7). Two of its benefits are that educators are able to select software suitable to the abilities of their students and because the students can work independently, the educator is freed to give special attention to smaller groups or individuals not working on the computer. The computer is seen as teacher (Peele, 1984; Stoddart and Niederhauser, 1993).

Software used to enrich the transaction position allows the learner working within a frame (created by the teacher, or teacher/student interaction) to control computer tools in order to problem solve (Stoddart and Niederhauser, 1993). However, when learners are confronted with difficulty achieving the results they want, the computer is not able to give guidance. The teacher is a facilitator who interacts with the students to co-learn the solutions to problems that arise. “In the constructivist approach, the learner is in control and the computer is a tool for inquiry” (Stoddart and Niederhauser, 1993, p. 11). Educators and researchers alike are encouraging the use of tool
software so learners can build "a cognitive toolkit of sub-skills (categorizing, questioning, debugging, etc.) which are necessary for generalised problem-solving" (Underwood and Underwood, 1990, p. 26).

Learning is open ended in the transformation position and the students have control of their learning as they seek to solve problems of personal significance either independently or within groups. The software used in the transaction position is used here to obtain self-actualization, transpersonal experiences, or social change. Therefore, the difference between transaction and transformational software is more a change in the learning environment than the software used. Transactional activities have the potential to become transformational type experiences when the students demonstrate greater autonomy through having acquired production skills that allow them to solve open-ended problems and, in response, the teacher withdraws into the background, yet still available when needed, allowing the students further freedom for self exploration and discovery. The concept of play to develop imagination discussed by Croft (1993-94) can apply here: "An important element of learning about something through play is that the activity not be directed toward the creation of some specific predetermined result" (p. 306).

Educators are encouraged to use a transaction approach to computer literacy as it extends the students thinking and allows them
to take greater control of the computer and their learning. Helping students obtain basic computer skills in order to build a cognitive toolkit is the first step in helping learners move towards autonomy. Freeing the student's mind from making low-level decisions by practicing problem solving skills and activities is superior to a drill-and-practice approach. Providing experiences where students can utilize their toolkit to solve problems extends their thinking and allows them to transfer their learning to other situations both within the school setting, the work place, and life in general.

"It can be argued that our future economic success depends on the degree to which children are taught to be sufficiently flexible and adaptable in their thinking and actions in order to handle the pace of change brought about by information technology" (Underwood and Underwood, 1990, p. 60). In order to do this, the teacher must be available to the learners as a facilitator when needed and as an observer when they are succeeding on their own. Students are encouraged to ask questions and consequently find answers. The shift of the teacher's role from direct instruction to facilitator opens up the computer laboratory environment to limitless learning as students "discuss their learning experiences and share them as teacher-learners" (Underwood and Underwood, 1990, p. 168). Thus, computers are catalysts for innovative curriculum when the teacher selects tool software that allows the learner to achieve control, where the teacher has challenged
his/her students, and the content is meaningful for the learner. “Constructivist theorists would argue that going through the process of discovery is the most efficient way to help learners develop conceptual understanding” (Stoddart and Niederhauser, 1993, p. 18).

Sheingold and Hadley (1990) document the thinking of teachers from grades four to twelve who were already committed and motivated to implementing computers into their classroom practices. Though the results are encouraging, they also detail the barriers of effort, time, and support that are needed to be addressed in order to successfully integrate computers into education. According to this 1990 report, in order to realize successful integration of computers into schools in general three factors must be present:

- there is enough technology (and, in particular, enough technology for teachers to have unrestricted access);
- there is ample support and time for teachers to learn how to use it and to plan for its use; and
- there is a school structure and culture in which teachers are encouraged and expected to take a professional and experimental approach to their work. (p. ix and 25)

Developing computer literacy of students needs to begin with their teachers, and their teacher’s teachers. A barrier to change is the need for in-service teacher training for all teachers from kindergarten to grade twelve, as well as at the university level. Faculty must
understand computer skills in order to integrate them into their classes. Demonstrating relevant applications to learning their content area would not only enrich their university classes but also model computer applications needed in our public schools (Budin, 1991). Teacher education programs need to include compulsory computer courses, or have computer awareness integrated into all content areas, so that teachers have already started to build their cognitive toolboxes and therefore their confidence in using technology, before they begin their teaching career.

There is a need for educators to become confident teacher-learners of technology. As Ragsdale (1989) says, “Teachers should know the skills that the tool programs require and produce, but need not be expert users” (p. 450). Educators are not expected to become expert computer users within their classroom, rather they should become comfortable co-learners with their students while continuing to use the teaching strategies they already feel comfortable with and choosing software that is compatible with their values (Budin, 1991).

The need for computer leadership within a school district is addressed in Cory’s 1991 article where she suggests there are four stages of computer use: Stage 1) computers arrive, they are set up, and the teachers are shown how to turn them on and off. Stage 2) some teachers and some students are using computers; acquiring hardware is a major concern; teachers are expected to know what to do; staff
development needs are recognized by the teachers trying to use the computers, but the principals and district administrators don’t recognize the need; when the students aren’t becoming computer literate the superintendents and principals hire a consultant, or a computer coordinator, for staff development and program evaluation. Stage 3) greater understanding of hardware, and appropriate peripherals are being added; Staff development is considered vital; integration of technology in the content areas is encouraged instead of adding technology to the curriculum as a new subject; teachers select software that reflects what they teach; to strengthen leadership a teacher from each school represents their staff and work with the district coordinator. "The focus of change from Stage 3 to Stage 4 is on curriculum and instruction, not on technology" (Cory, 1991, p. 40). Stage 4 includes restructuring of our schools in order to allow for new assessment techniques, forming new timetables, using the computer as a tool for integrated curriculum, using computer laboratories to develop inquiry-based learning, etc. In order to achieve stage 4, the three requirements previously mentioned by Sheingold and Hadley (1990) are needed, but also strong leadership starting with the superintendent and, at the school level, the principal. Leadership cannot just come from coordinators and teacher representatives from each school, it must come from “professors in our schools of education, superintendents, principals, teachers and parents” (Cory, 1991, p. 43).
The computer art study done for this thesis was reflective of the type of experience we can expect to have happening as schools enter into Cory's stage four of computer use. The superintendent, principal, teacher, district computer helping teacher, parents, students, and teachers were all supporters of the experience.

The Horizon: Computers in Art Education

The first computer was developed in 1946 and the first microcomputer was introduced to the public in 1976 (White, 1983). Yet, it took until May 1983 for computers in art to become the focus of a special edition of the journal, *Art Education*. Twelve years ago the attitude towards computer art had mixed reviews from art teachers, but the journal fairly represented the position of educators.

Squire's journal article (1983) quoted critical opinions about computer art while still recognizing the views of the computer advocate. He saw computers as representing only sequential, linear type activity presented in a prescriptive manner, and this did not fit with his understanding of creative, open-ended artistic experience. His concerns were understandable when one looked at the kinds of computer hardware and software available to educators at that time. The end result did look like a machine had made it, and Squire questioned the machines ability to reflect the artist's creative capacities. Even though Squire acknowledged that computer production of animation and serial art constituted effective use of the computer, he
cautioned us to “assess its cost in terms of human values” (Squire, 1983, p.23).

In the same journal issue, Linehan (1983) favored computer art and its interactivites that allow one to envision multiple points of view. He also recognized a shift in research thinking from people learning how machines work, to changing how machines communicate to people. His request for art educators to become involved in research development by proposing computer applications to art, backed up his belief that computer graphics was here to stay.

The processing of information and communication, according to White (1983) is the focus bringing us towards the third millennium. Just as the transition from the first millennium, an agrarian focus, to the second millennium, a mass production focus, caused an artistic metamorphosis as new materials and situations influenced the art community, the transition to the third millennium, due to the rapidly escalating technological changes, will require ultra modification of the way we think. White’s (1983) message is very clear to art educators who are not prepared to embrace the changes:

Unfortunately, those who fail to assimilate the required knowledge in order to effectively function within the classrooms of the next millennium, for whatever reason, may discover they have become living, educational artifacts to those very students they proclaim to serve. (p. 9)
Though this is a harsh statement, I believe there is more truth to these words today than when White wrote them. Within art education, he sees a need for relevant technological programs, restructuring of curriculum, and integration of computer literacy. He also recognized that art educators do not have to be computer experts, just willing to explore applications for artistic expression. These thoughts are still very powerful messages for today’s art educators.

The appearance of a second special edition on computers, Art Education’s March 1985 issue, revealed a greater acceptance of computers in art. Computer literacy, according to Hubbard (1985) was “to enable learners to understand how computers work and how to solve problems with them” (p. 15). The value of an initial opportunity to explore the capabilities of the computer, through play, was recognized (Freedman, 1989, 1991; Hubbard, 1985; Stokrocki, 1986). Hubbard’s (1985) art students were encouraged to work on paper before working on the computer. This strategy was used to help students focus on creative artistic expression within a familiar medium to help them see purpose in the time spent programming the computer to create their image. Though today’s software does not require students to program in their images, this preliminary drawing strategy is still a good bridge between the familiar pencil medium and the students first encounters with drawing on the computer.

Ettinger (1988) recognized that computers can impact art education
in three ways: (1) as an art medium, (2) as a research and teaching tool, and (3) as a management tool. She maintained that implementation of computer art in the classroom and curriculum planning must be paralleled by professional questioning and research. The unique qualities of the computer need to be explored while still paying attention to the basic art techniques and principles. "Art educators have the necessary preparation and orientation to explore the pedagogic roles of this new medium and to contribute their perspectives" (Ettinger, 1988, p. 61). These thoughts are still relevant today as research is needed to understand what is happening when students produce computer art so that appropriate software and curriculum can be developed to guide teachers in developing substantive programs. Who better to do the research than art educators themselves.

Nevertheless, D'Angelo (1988) still reports an apprehension on the part of art educators towards having computers in art rooms. Concern for expense is addressed by sharing reduced pricing; increased speed in altering images is presented as not only a time saver, but a motivation for students to make changes; and lack of computer knowledge is seen as unimportant because of the ease in which the new computers can be used. D'Angelo encourages hands-on experience and goes on to explain some simple, to him, computer applications and ends with four impressive ways of displaying finished
work. His enthusiasm for computers is evident, and encouraging other art educators to commit to using computers is commendable, but I feel the element of real support to these educators is not addressed.

Art educators' resistance to using computers to make "fine art" continues even though computers can be seen to attract students who were never interested in art before, even if they were not artistically talented (Hubbard, 1989; Hughes, 1991; Welter, 1988). A lack of suitable software, because of availability and the technical limitations of existing programs, gave momentum to the concern of validating computer art (Welter, 1989). Hubbard (1989) recognized the appropriate timing for computer inservice training for teachers to emphasize interdisciplinary benefits. Leadership is needed that is readily available to help understand current and future software, as well as the changes that are rapidly occurring with the computer itself (Cory, 1991; Hubbard, 1989).

Welter (1989), like Squires (1983), doesn't like the look of computer generated images. When the computer is used to teach like flash cards he is concerned. Welter bases the value of the computer on the educational software, which he says should reflect teaching philosophy and that art educators should be involved in creating suitable software for art programs (Croft, 1993-94; Ragsdale, 1989; Underwood and Underwood, 1990).

Based on Greh's (1990) article, a new decade still has some art
teachers wondering if computers belong in the art room? Her article on computer art workshops represented four distinct teacher-learners: (1) those who knew nothing but wanted to use computers with their students; (2) those who knew nothing but had been told to be there; (3) those who were curious; and (4) those who wanted more knowledge. She shares the fact that there is no risk in trying ideas out on the computer, because the image can be saved at different stages and the student can select the finished image from any stage. Her declaration of commitment and excitement at being a computer teacher-learner is evident as she shares an address where she can be reached to share questions or suggestions for future articles.

Creative thinking and the creation of new ways to express artistic concepts are being developed by the use of the computer, as sound, images, text, and animation are integrated (Truckenbrod, 1990). As students use creative thinking to help them learn how to control graphic programs to develop their original art, it is natural for them to collaborate with one another. It is also possible that teaching specific cooperative skills could enhance the learning that takes place.

Brandt’s (1989/1990) interview with Spencer Kagan discusses the potential of structured approaches to cooperative learning and to see the potential for further research applied to art education. As Kagan said, “...our behaviors are determined to a large extent by the situations we’re in. People tend to underestimate the power of situational
variables" (Brandt, 1989/1990, p. 9). Cooperative learning in pairs is effective, time on task is greater than when students work independently, and individual needs are met better than when students work in isolation (Watson, 1990-1991). These are facts that help reinforce the art educator who does not have enough computers within their computer art studio or art class for everyone to have their own computer.

As art educators become aware of the advances in computers and the educational software now available to them, more emphasis on computer art will occur. Tomeo (1991) admits that five years ago she thought computers would not be part of her class and yet today she has become a computer art advocate. She saw a need to prepare her students for the expanding job market that computer art opened to her students. She restructured how she would present some of her already established lessons by using the computer as the medium. Tomeo admits it takes more time to learn the tools, but quickly shares how greater amounts of time are saved as the unique features of the computer speed the image development, an example would be when defined spaces need to be filled with textures one chooses an appropriate fill, clicks on the space, and it is done (Hughes, 1991).

The concern for art teachers to have computer pre-service training and what that should include was reported by Hubbard and Greh (1991). They recognized four areas that should be addressed in Art
Education. They are:

(1) knowledge about hardware and software suitable for school art programs; (2) applications of computing that advance the teaching of art; (3) ways in which computers need to be managed for use in art rooms; and (4) ways in which computers may be used to integrate art studies with those from other areas of the curriculum. (p. 19)

The report also included recommendations for unique computer topics for the fine arts. It is included here to demonstrate the major change in thinking about computer art from wondering if it belonged, to establishing specific criteria to enrich art education for all.

The connection between aesthetics and technology "increase human potential and provide opportunity for art to take its rightful place in the schools as an important 'basic'" (Hicks, 1993, p. 42). Hicks reports that the National Art Education Association (NAEA) and the National Endowment for the Arts (NEA) are supporting the need for technologies to be included in the art programs. White's (1983) belief that art educators need to embrace the changes brought about by technology is coming to reality ten years later as the information age advances and art educators are responding.

One advantage for today's art teachers, when they become involved in computer art, is that the computer laboratory or studio already exists in many elementary schools, so the high cost of start up
that plagued art teachers four to twelve years ago has been all but eliminated (Efland, 1976; Hubbard, 1989; Linehan, 1983). The general budget of the school, including the "capital budget", pays the expenses. This leaves the "limited art budget" for building other resources and frees the art teacher to explore and research computer art with their students.

The Foreground: Computer Graphics

The foreground was the location where a researcher could be found at the beginning of the study. A need to see clearly, to understand what gave ground for the work to come, demanded an understanding of what research had already been done and what further research was needed within computer art to develop the curriculum that Ettinger (1988) and I believed to be necessary within the new technological settings. A curriculum developed by art educators through professional questioning and teacher research.

Computer graphics evolved with the evolution of technology. In 1983 Madeja reported on the new technologies that were available then and how to apply them to the art program. At the same time he acknowledged that the computer "has enormous aesthetic and design potential... (however) Computer and video art have not caught the fancy of the art school art program" (p.16).

Two years later O'Connell (1985) reported that the computer was now recognized as an image making tool. His article discusses a
summer workshop where participants represented stakeholders ranging from high school students, teachers, and community business. The microcomputer used still relied heavily on programming and yet exploration with peripherals were giving the flexibility and control that was needed for computer artists to start answering their own questions. As O'Connell said, "To make the best use of computer graphics, artists and designers must ask, ‘What if I did this?’" (p. 25).

Students at the University of Houston explored the capabilities of the koala pad, and White (1985) applauded its low cost, and user-friendly features, for example the artist was now able to choose to use preset shapes or to draw freehand, control color mixing, magnify sections to add detail, and an erase selection that would clear the image and allow a fresh start. White was impressed that "Students are able to learn how to use the power of the computer to create art without mastering the world of programming" (p. 14). Consequently, he encourages the development of computer studios for graphic purposes and shares what White considers to be minimal equipment for such a studio.

The first actual research study involving younger students was reported by Stokrocki (1986). She found that computer graphic design development was believed to have a stereotypic image making rudimentary stage, and that "peer instruction and problem solving as in brainstorming and discussing technical and aesthetic dimensions"
was encouraged (Stokrocki, 1986, p. 47). Stokrocki was working with
gifted and talented adolescents (11 to 16 years of age) during a two week
Indiana University Summer Arts Institute.

An ethnographic study done by Freedman (1989) involved two
elementary classrooms and one secondary classroom. "The
preparations for the research indicated that when computers are used
in art education, there is usually one computer in the classroom" (Freedman, 1989, p. 291). When in groups of four, the third and fourth
graders used one Apple IIe computer. Freedman looked at three main
concepts: (1) development of imagery, (2) gender relations during the
production of computer-assisted art, and (3) general social interactions
during the production of computer-assisted art. Criteria for student
selection included anyone who was prepared to start working on the
computer and those chosen were to represent approximately equal
numbers of girls and boys. The selected participants did not necessarily
reflect the class. The present study occurred in a computer studio
where all students were involved on the computer with three students
chosen as samples within the case study.

It was Freedman's (1989) results, when she was reporting social
interaction, that made me more reflective. These findings were based
on a classroom with only one computer. It is not surprising that "On
almost every occasion, students not working on the computer observed
those who were" (Freedman, 1989, p. 292). In my school's new
computer art studio all students had access to a computer, either through direct hands on or by observing their partner, while they were on the computers.

In 1992, Freedman and Relan conducted a second ethnographic study with a small class (N=11) of undergraduate art education majors. The first and third questions paralleled the earlier study (Freedman, 1989): (1) student focus on production and ideation during image making, (2) awareness of student/computer interaction, and (3) social interactions effect on image development. Freedman and Relan's case study (1992) used triangulation to validate their findings. Their conclusions included: (a) student focus changed from production to ideation; (b) students controlled the computer, but the computer influenced the student images; and (c) the student's computer art and technical abilities were affected by their cooperative behavior.

Freedman and Relan's 1992 study ends with a good comparison of the results of Freedman's 1989 study: "Much of what happened in the study of the university students was also apparent in the studies of children discussed earlier. However, an important difference was that the university students seemed to desire more control over the technology than the children sought..." (Freedman and Relan, 1992, p. 108). Though, "This study indicates that promoting group interaction when using computers in art education aids student learning" (Freedman and Relan, 1992, p. 108), the need to understand how
students cooperatively interact in the new environment of an elementary computer art studio still needs to be explored.

Singapore was the place of Chia and Duthie's (1993) computer art study. They too were influenced by Freedman's 1989 study. The School Computers Art Media Project (S.C.A.M.P.) was developed with primary children who were eleven years old. Comparatively, here in Canada, the children would be in grade five and that made the study directly relevant to this current study which was done with grade four and five students. Many similarities existed between the studies: (1) equivalent age of students, (2) both were computer studio settings with computers that had black and white monitors, (3) the ClarisWorks 2.1 program compared to the Aldus SuperPaint 3 program, as both could use object-based draw components and a pixel-based paint palette, although SuperPaint is specialized graphics software that has additional graphic tools, (4) computer graphics was an extension of both art programs, (5) research was informing both studies, (6) developing strategies for instructing students to create visual imagery on the computer occurred in both studies, (7) both were done in contexts of a planned learning environment, (8) social interaction within the computer studio was attended to in both studies, and (9) both celebrated their conclusions as a public celebration, Chia and Duthie's students published a calendar they created, and my study concluded with a school computer art show.

Both Chia and Duthie's (1993) study and my study support each
other, and at the same time enrich each other through their differences: (1) Chia and Duthie were researchers going into a school to work with five teachers, acting as instructors-researchers-facilitators; in this study I was the teacher of the class as well as the researcher, who was being assisted by a "critical friend", Bob Best - the district computer helping teacher, who was a participant-observer for some of the sessions, a technical support person, and also an encourager. (2) The outside researchers, Chia and Duthie, helped the teachers investigate curricular applications for using computers both for exploration and instruction; I was a researcher in my own classroom investigating my own concern for knowing how students develop original computer art in my computer art studio, with the desire to improve my teaching through using action research. (3) The students in Singapore were chosen from several classes because they had the highest art grades; my students were chosen because they were in my grade four/five class, a class that was formed based on school configuration, not because they were to be involved in the computer art study. (4) Recording of data was shared by five teachers in Singapore; I was the main recorder of data, with the assistance of Bob Best who would video and photograph within the computer studio when he was present. (5) Chia and Duthie did two training sessions with the five teachers to familiarize them with the graphic program; I based my knowledge of the ClarisWorks graphic components on personal experience and a distance education
course. (6) Chia and Duthie’s project lasted eight weeks with one session of three hours per week plus two hours additional time per week; my project lasted twelve weeks with one hour of computer studio time per week and fifteen to thirty minutes of pre-entry interaction within the regular class time, minimal extra studio time occurred in the last few weeks of the study. (7) Chia and Duthie’s study had thirty computers available for twenty students; I had twelve computers for twenty-four students. (8) Chia and Duthie had the use of Macintosh computers - MacPlus’s and SE’s; I had Macintosh - Classic and Classic II’s, my machines were newer and more advanced than the MacPlus’s and SE’s. (9) SuperPaint 3 is a purely graphic software; ClarisWorks is an integrative software, that has been rated the best integrated software for the past two years by major computer magazines. (10) With the increased computer time, Chia and Duthie’s study was able to do a concluding class theme; my students concluded by sharing their work through a school computer show. When the findings from this computer art study are analyzed, attention will be given to some of the similarities and differences between these two studies.

To date, only three known studies have addressed how students cooperatively interact while producing original computer art using a paint program. The number of computers available, due to increased technology and lowered cost, has changed significantly since these
studies were done. The single Apple IIe used with the third and fourth graders in Freedman's 1989 study, the Apple IIgs studio used by Freedman and Relan (1992), and even the 30 Apple MacPlus and SE's used in Chia and Duthie's (1993) study have been replaced with Macintosh Classic and Classic II's and these too are soon to be replaced with more advanced computers. Though students often need to work with a partner, the elementary school computer studio now allows students to work on their own computer.

New art curriculum is forcing art teachers to learn more about the application of computers in art education (Campbell, 1991) and as new career options continue to develop through the use of computer graphics, art teachers' knowledge of computers needs to be extended. The findings of Freedman (1989) focussed on image development generally in terms of the sophistication of the imagery coming from familiarity of the computer tools, and the general social interactions of students who were concerned with the ownership of computer images. Freedman and Relan's study (1992) looked at image development in terms of the shift from process to ideation, and social interactions among the students as being important to graphic development and their learning about aesthetic possibilities and decision making. While Chia and Duthie (1993) concentrated on the key issue of social interaction of students while creating computer images within the framed assignments established by the teacher. To extend the findings
of these studies and to enable us to understand better what is happening in an elementary computer art studio, my study looked at what affected the development of my students' original computer art images, how their images developed through the time of the study, and how spontaneous cooperative interaction between student partners affected the development of their images both when creating individual images and shared images. My findings had a transformative impact on my pedagogy as I, the teacher/researcher, became a teacher/learner with my students.
CHAPTER THREE

RESEARCH PLAN: ESTABLISHING THE TERRAIN

Action Research: from the View of the Teacher/Researcher

The focus on action research for this study is taken from my position as a teacher, who wanted to have a greater understanding of how my students learned to develop original art images within my computer art classes. By critically reflecting on the findings, both formatively and summatively, during the computer art unit I was able to make changes that enhanced student and teacher learning at all cycles of the research process.

I. What Is Action Research?

Action research can be used by all practitioners to look at their teaching within the context of their class. Participants, beyond the teacher and students, can include an outside observer, critical friend, co-researcher, other teachers, principal, etc. The perspectives of all participants affect the changes and learning that occurs.

In this study there was no question of who owned the research, as the research questions were posed and explored by myself, an art teacher. My students shared ownership with me as their perspectives, questions, and suggestions were integrated with mine as the study progressed.

Action research was defined by Peterat (1992-1993) as "... a cyclical procedure involving the steps of identifying the problem,
reconnaissance, action planning, implementation, monitoring implementation and its effects, and a repeat of reconnaissance in revising the initial problem and beginning the next cycle” (p. 65). Within this study the reconnaissance included critical reflection as a catalyst to continuing the cycle of planning, acting, monitoring, and reflecting again, forming the link (theory) between the cycles of action (practice).

Action research involves both action that is cyclic, where change is not only an outcome but also a part of the process, and understanding that is ongoing, because of the continual changing focus of the action. The development of theory (research/understanding) and practice (the action/change) is so interconnected within action research that they integrate, become inseparable, and form praxis² (Connelly & Clandinin, 1988; Klincheloe, 1991; May, 1993). This integration of action and understanding within a classroom establishes a curriculum that is flexible and emergent.

Connelly and Clandinin (1988) stated simply that “A curriculum...can mean the paths we have followed and the paths we intend to follow” (p. 1). When I use action research I critically reflect on the paths I have taken and then I use my new understanding to construct paths to follow. The development of curriculum is a natural

² “Critical research is praxis. Praxis involves the inseparability of theory and practice...” (Klincheloe, 1991, p. 20).
part of the process of conducting action research within the school classroom. The curriculum that is developed is particularly meaningful in the situation being explored and becomes a part of the personal practical knowledge of the practitioner conducting the research. "...action research is simply an extension of the notion of curriculum inquiry" (Connelley & Clandinin, 1988, p.152).

Action research permits students and teachers to participate "in a shared search for knowledge...The practitioner is not cast as an expert but as an inquirer and co-learner" (McKernan, 1988, p. 199). The researcher's depth of knowing is enriched by reflecting on the experience from different participant perspectives as well as the use of different data gathering techniques, such as student journals, discussions, interviews, and a teacher journal.

II. Action Research In Art Education

Action research can be qualitative, quantitative, or a combination of both. However, action research has been used as a qualitative form of inquiry to address practitioners concerns within art education. Bresler (1993, 1994) has published two articles that have included examples of using action research along with examples of educational criticism, ethnography, phenomenology, and case study. As Bresler (1994) shares,

The aim of qualitative research is not to discover reality, for by
constructivists’ reasoning this is impossible, but to focus on different interpretations of that reality by constructing a clearer experiential memory which helps us obtain a more sophisticated account of things. (p. 1)

Bresler’s (1994) article takes time to share the history of each method, as well as share accounts of practitioners research followed by how to report the research. Art educators can then make an informed decision as to which qualitative method they will use based on the type of understanding that the practitioner chooses to focus on.

As the teacher enters his or her classroom as a researcher, teacher knowledge is an invaluable tool to help understand the classroom as a research setting. Teacher knowledge is now gaining acceptance in the academic world. This is confirmed by the presence of academics at teacher conferences, sessions about teacher knowledge at academic conferences, academic conferences focussing on teacher knowledge and journal articles, as well as, books that focus specifically on teacher knowledge. With that recognition, the voice of teachers is beginning to be heard (Bresler, 1993).

3 "Our notion of constructivism contends that reality, contrary to the arguments made by proponents of realism, is not external and unchanging. In contrast to rationalism, constructivism maintains that human thought cannot be meaningfully separated from human feeling and action” (Klincheloe, 1991, p.27).
Acknowledgement, of the value and use, of qualitative research within art education is being strengthened by publishing the accounts of art practitioners research, which includes their experiences using action research (Bressler, 1993, 1994). This, along with the fact that action research has been used over the last fifty years within the wider research field, adds incentive for art educators to look at their own situations through the use of action research “to create ‘practical theory’ that comes from practice and that makes sense to other practitioners” (Bresler, 1994, p. 13).

III. Why I Used Action Research For This Study

Action Research...frees...

ME... the practitioner...

to be the seed of thought... in process...

seeking understanding... in order to grow...

to know... within my class...

I seek... so, so much to learn...

the roots of theory...form rootlets of strategies... that divide

and divide again... so much to choose from...so much to know...

choose one path...and drink deeply... be nourished...

in this manner...

I will grow in understanding...

within MY CLASS!

By poeticizing my lived experience, I share my voice with the
reader. As Van Manen (1990) says, “Poetry allows the expression of the most intense feelings in the most intense form” (p. 70). Why are these spaces within my poem (within my thoughts)? “The text as a whole aims at a certain effect, and thus the silence of spaces is as important (speaks as loudly) as the words that we use to speak” (Van Manen, 1990, p. 113). It is in the spaces of my poem that I provide an opportunity for the reader to reflect on my words allowing each reader to control time and thought before moving on. The bold faced type acts as a guide to the essence of the pure thought I wish to express...Action Research... ME... within my class... I seek... I will grow... within MY CLASS.

By using action research I am learning to investigate my own questions about my students, my curriculum, the context of the class...to understand, to change focus, to find a deeper knowing that frees me as a practitioner to enrich my class for all learners, based on theory grounded within my class. There is no question of relevancy when using ones own class, as utility is built in. Theory and practice become praxis, as their interconnectivity defies separation. One is holistically learning to teach and to teach, in this case, is to learn.

Poirot and Knezek (1992) concur with my own thinking, that as the experiences with computer technology in education are comparatively new, the complexity of the computer laboratory is best understood by using qualitative research. “Teachers and researchers alike will find little in the works of Bruner or Piaget or Skinner that
postulates precisely what effect computer use will have in a specific classroom situation" (p. 8). Though the value of quantitative research is recognized, they go as far as saying that if quantitative research fails, a possible solution would be to go back and look at the situation through qualitative research, which allows for a holistic view of the setting, before repeating the quantitative study. Deeper idiosyncratic understandings come from qualitative research and may in turn lay foundations for later quantitative research.

Population and Setting

The teacher/researcher’s school was automatically the site of the research thus eliminating the need to develop criteria for site selection. This study site was my assigned school, a rural school that relies on bussing for over 90% of its 244 students. The school student population has a mixed cultural background. There are English Language Training Classes (ELT), where students are pulled out of the regular class for extra assistance.

The purposeful sampling technique chosen was comprehensive sampling. Every participant’s view point in the class was considered (McMillan & Schumacher, 1989). Participants in the study were my grade four/five class, a heterogeneous group (their academic, social, and production abilities varied) composed of 24 students (five grade four’s and nineteen grade five’s; 13 females and 11 males). Student ages ranged between nine and twelve years of age. By using quota
selection (Merriam, 1988) three sample students within the class were selected for intensive study, by focussing on three students data gathering was more manageable. However, the thoughts of all students were used to assist in curriculum development for each week. All students completed a summative response journal in order to share their perspective on what had occurred, and what they felt should be included when the computer art unit was taught with new students.

There were twelve divisions at my school: two grade six/seven, one grade five/six, one grade four/five, two grade three/four, one grade two/three, one grade one/two, one grade one, two kindergarten, and one Primary Skills Development Class (PSD). Integration of special needs students usually occurred from the PSD Class to the regular classrooms. However, this year, one of the special needs students was registered in a regular classroom and was then integrated back into the PSD Class for specific times to obtain resource support.

My principal was an advocate of computer laboratories, and extended time and finances for the development of a progressive setting for students and teachers to grow in their understanding of computers.

The school has two portables in use and was under renovation and construction. The construction included the addition of four new intermediate classrooms, a multipurpose room, a new office, an extended library, and a new computer laboratory. At first, the
computer laboratory was held in a renovated special class area. It was equipped with five Macintosh Classic II’s and seven Macintosh Classics. The Classic’s had built in black and white monitors and internal hard drives (4 Ram/105 MB). The Classic II’s also had built in black and white monitors and internal hard drives (4 Ram/80MB). All the computers were system seven, which designated the type of ‘brain’ that ran the programs, a factor one needed to know in order to choose compatible software. Each computer worked independently from the rest. There were two ImageWriter II printers networked to all of the computers, so time to print student images in draft or best copy was usually available in class. When construction was completed, the students were able to access the new laboratory during assigned recess and lunch times for extra work or for printing their images. A laser printer, Data Products LZR 960, became available in the latter part of the study.

The Action Research Format

(1) Each week of the twelve week study was a full cycle where planning, acting, observing/monitoring, and reflecting occurred. (2) Each cycle evolved from the previous cycle. By having one computer studio class a week, the researcher had one full week to reflect on the experience and use the results to plan the actions for the next cycle of the study. (3) My “critical friend” (pseudonym: Bob Best) was an observer in the computer art studio starting with the first studio
session and ending with the last studio session. Six observations were completed. A time for collaboration was arranged as post conferencing for each visit and this time included Bob viewing artifacts from all sessions. Bob also met with me twice for pre-conferencing and we kept in touch frequently by phone as he assisted me with technical concerns and research questions. (4) The initial results from the study were compared to the findings of Freedman's (1989), Freedman and Relan's (1992), and Chia and Duthie's (1993) case studies to see if any translatability between the two studies were possible. (5) The thirteenth cycle for this study included a review of the twelve in-class cycles in order to record findings, to analyze the findings, to propose future research, and to formally write this thesis. After the twelve week study, I kept in contact with Bob so that the write up of the study could be further enriched by his expertise. (6) The final cycle included a personal reflection of the impact of the action research process on me as a researcher/teacher, and on the students (as seen through my eyes).

Data Collection Techniques

Data collection included the following:

I. Field Notes: I recorded what happened as it happened in my teacher journal. The notes included detailed descriptions of actions and reactions. Cooperative interactive observations of all my students during the first two weeks of the study and the cooperative interactive observations of my three sample students for the remaining ten weeks
included awareness of gestures, facial expressions and other nonverbal social interactions.

At the end of the computer studio time, and/or at the end of the day, I recorded reflective notes. My analyses of data collected from the current cycle were written as summative notes. These included my theoretical reflections and the action/theoretical questions they inspired. My notes were used to revise my plan for the start of the next cycle. Personal reflections on how I as the teacher/researcher changed over the course of the study were also included.

Even though many changes to the written format of my journal occurred over the first six sessions, the format chosen did not allow for analysis as I had used the pages fully and there was no space for any further reflection or coding. After brainstorming solutions I proceeded to enter my teacher journal in its entirety into the ClarisWorks 3.0 word processing program. Now not only could I add further reflective thoughts, but I was able to cut and paste to create documents relevant to my themes and my sample students. These selected notes from my journal established a solid foundation for my writing.

II. Informal Interviews: I did not start informally interviewing my students during the first two sessions, however I was a silent listener who recorded some dialogue in my journal. Student/teacher interactions were limited to conversations on how to do something the students needed to know. However, after I knew who my three sample
students were, informal interviewing occurred during every computer studio session and I often recorded selected dialogue. Informal interviews with my three sample students gave me access to their in process thoughts about their computer art images and how these images had developed. All out of studio interviews were conducted separately and tape recorded for later transcription and data analysis.

My three sample students were each given a base line interview prior to week three’s studio time. The students were interviewed in a section of the classroom that allowed visual privacy from the rest of the class. The remainder of the class had been given independent seat work to do while the interviews were in progress. At the start of the interview I repeated the first response journal questions. The students had seen and responded to the questions in writing before and the familiarity seemed to strengthen their confidence in sharing orally. The interviews were guided by using the student’s printed computer art images that they had done so far. The informal questioning of the student allowed me to ask questions in response to student answers. The interviews were done in a relaxed manner, without a set time frame. When all of the current images had been discussed the interview was closed by asking the student what they planned to do in the next computer studio. The first interview was on March 31st, the second on April 29th, and the third on June 17th, which was after the study had concluded. During the second interviews the students were
interviewed in their free time at recess and lunch time. The final interview was done within the class setting as described for the first interview.

Spontaneous informal interviews/conversations also took place in the studio setting. All students were included individually and/or with their partner at sometime during the twelve studio sessions, though I did not record excerpts in my field notes after the first two studio sessions. However, my field book did include excerpts from conversations with my three sample students for the last ten studio sessions. I was amazed at how much I learned about my students and how they felt towards their images and how they constructed them.

The voices of my students were heard through these informal interviews and I quoted many dialogues within my findings chapter to share the richness of their voices. As my May 12th journal entry showed, the impact of informal interviews affected my pedagogy. “I have learned how valuable it is to informally interview my students and hear in their voice how they think about their images. It has changed how I will teach.”

III. Student Response Journal: Student response journals were started before the action research began. On computer developed forms, students were asked specific questions to determine prior knowledge and attitudes toward computers in general and computer art in particular. At the study’s conclusion similar questions were asked to
determine any change in student thinking.

I developed weekly response forms using the ClarisWorks word processing component, printed them out and duplicated them for the students to include in their duotang journal. Class time was given after each computer studio for students to manually record their personal reflections, concerns, or questions about their studio experience. The guiding questions evolved over the duration of the study.

The students handed in their journal after each recording of their computer studio experiences. I read their comments and questions and acknowledged their thoughts both by written comment(s) in their journal and the inclusion of their comments and questions in the pre-entry time before the next computer studio.

IV. Artifact Collection: Photographs, tape recordings, computer art samples and video: For the first two weeks, all student computer art was transferred to a teacher disk so that the students retained their original disks and printouts, this allowed the teacher to printout copies of student work for use in the study. After the three sample students were selected only their computer art was transferred to the teacher’s disk and printed for use in the study, though all student images continued to be printed out for the students. However, at the end of the study each student in the class shared their favorite image with me by transferring it to my class saving disk, from which I could then print
The three informal interviews that were tape recorded for each of the sample students, were transcribed into ClarisWorks 3.0 documents. These documents were then used during data analysis to obtain dialogue included in the findings.

Using still photographs and video taping sections were effective, but after two weeks it became obvious that I had too much to do during the computer studio. I conferenced with my critical friend, Bob Best, and he volunteered to do both the still photographs and the video recording when he was present in the studio. I appreciated the opportunity to look at images gathered by my critical friend, as it permitted me to view what someone else felt was valuable to record.

Research Participants Starting Place

The students received one hour of continuous computer art studio time per week for twelve weeks. One additional 45 to 60 minute weekly art class included instruction with traditional art media. Each student selected their own theme and the theme content for both art classes was the same. My students chose their partners to share a computer with for the duration of the study.

Since September the ClarisWorks 2.1 word processing component had been used by my students to do creative writing as well as written reports. Therefore, they knew how to enter the program, select the word processing component, set up a new file, use the menu
bar to select various items for use, save documents, and do printouts. During the study my students utilized the ClarisWorks 2.1 graphic components (drawing and painting) and the new tools contained within the two new menus.

However, initial understanding of the drawing and painting features of the graphic components were new to most of the students. Their previous experience on ClarisWorks 2.1 allowed them to focus specifically on the graphic components. All of my class were included to allow as broad a picture as possible, though to deepen understanding three students were selected as foci for the majority of the study.

Procedure: Twelve Cycles of Action Research

Before sharing the focus questions for each cycle and what took place, I have outlined the basic format of what happened each week. The following components were consistently used: pre-entry session, the computer art studio, the student response journals, and teacher reconnaissance through critical reflection.

The pre-entry session, in our regular classroom, took place prior to each computer art studio. These pre-entry sessions lasted between fifteen minutes and half an hour, and during this time I utilized a class computer to demonstrate some of the graphic tools. By focussing on the monitor of the class computer with a camcorder set up on a tripod and connected to a large screen television, all of my students had a clear view of what was happening during the demonstrations. I used
the responses from the previous week’s student journals to share student discoveries and questions. As the study developed, my students also participated as demonstrators when they made suggestions for solving problems presented by their classmates. These pre-entry sessions increased all participants’ understandings of how the graphic tools could be used to provide answers to their own problems which they encountered during their studio session.

The computer art studio lasted one hour. During the first nine weeks each student had one half hour ‘hands on’ the computer and then their partner had one half hour ‘hands on’. The focus was for each student to develop their own computer art image based on their own theme. However, during sessions ten and eleven the focus changed to the partners developing a shared image, and at this time the way the hour on the computer was shared depended on how the partners planned their time. The main focus on data gathering was during studio time.

After each computer art studio the students returned to their regular classroom and filled in their response journals independently. I developed an open ended response journal that I kept constant for the first five sessions. Based on my weekly reconnaissance and critical reflection on what had taken place and what I was trying to learn, the response questions were changed for each of the remaining seven weeks (See Appendix A).
My teacher/researcher observations and reflections happened as the action occurred in the pre-entry session, but especially in the computer art studio. Critical reflection took place as I looked back at the data gathered from all sources and what I had observed happening in the studio. A final reflection ended in planning the action for the next computer art studio.

This time of reflection was enriched when my critical friend, Bob Best, attended and post-conferenced six of the twelve computer studio sessions. Phone conferencing occurred whenever I wanted another opinion. During the writing of the thesis Bob read my drafts and confirmed my findings.

A final reflection from my whole class was given as they independently wrote responses to the questions in the post-journal entry for the computer art study. By reflecting on their first journal entry and comparing it to their last entry I was able to see how they changed over the course of the study.

**Cycle one: the first computer art studio**

Actually, cycle one started prior to the first computer art studio, as the initial planning for the study began when I identified my overarching research question, *How do Students Learn to Develop Original Computer Art Images?*. I then chose a primary starting question: *How does the student's original computer art change over the course of the study?* and a secondary research question: *How do
students use cooperative interactions to develop individual and shared original computer art images? As I planned for the first studio it became obvious that initially I could not focus on changes in images, as no computer images had been created. My second question focused on how the ‘students’ used cooperative interactions, and by my establishing two person partnerships with one computer I had made student interactions imperative for my students to successfully develop their images. In order to deal with both questions, I needed to know how much my students knew about computers before they entered the first session.

I developed the first entry for the student response journal as a pre-study entry (See Appendix B). After I discussed each item for clarity, the students filled out these sheets during a class writing time. My students’ journal entries gave me an understanding of their prior knowledge and thinking toward computers in general and their expectations for learning computer graphics.

During March 10th’s pre-entry session and prior to the new computer studio’s opening, the studio sessions started in the old computer studio. My focus was on direct instruction to teach my students how to access the graphic components of the program and utilize some of the draw tools available. I demonstrated how to draw a box and change its size, line, width, and fills. The students were then given assignment one to develop in the first studio session: they were
to explore the drawing option using their own personal themes, established in their regular art class, as content.

I entered the studio session knowing that the whole class was a large group to collect data on, but that I had to have some concrete understanding of why I would choose three of my students to focus on. I had a guiding question: What is happening within the computer art studio? Direct observation of my students' levels of comfort in operating the program, what their image looked like, and how they worked with their partner were noted. However, my field notes were minimal because not only was I focusing on the whole class, but I was also in heavy demand as a teacher and photographer.

Having Bob present for the first session gave depth to my understanding of what had happened. He had video taped classroom interactions while the studio was in progress. During our post-conference we reviewed the tape and reflected together on our experience. We concurred on three main points: The students needed another week to explore, with guidance, the draw component of the program; data gathering would be more manageable if Bob did both the video and still photo work when he was present, so that I could increase my time to make field notes; and data gathering would be less complicated when at the end of the second computer art studio three sample students would be chosen as focus students. As Bob would not be at the second studio session, we brainstormed possible criteria for
the selection of the three students to focus on.

**Cycle two: the second computer art studio**

When I reflected on the responses my students gave from their first studio session journal, their short answers surprised me. I wanted to know more than they were telling me. During March 17, 1994 pre-entry session I discussed the response journal questions with the students so that they would share more of their thoughts. My students were encouraged to share the why’s of their comments and questions. My demonstration focussed on how to do a horizontal or vertical page set-up, using the graphic rulers, and saving the new image with a title that included the date of the computer art studio.

Entry into the second computer art studio was more relaxed as the students’ assignment had remained the same and they quickly applied themselves to their task. My focus question had remained the same, What is happening within the computer art studio?, but I had changed some of my data gathering strategies. I had kept the guiding questions for the student response journal the same, but I had discussed with my students the kind of responses I was looking for. I focussed on my field notes and recorded short excerpts from student/student and student/teacher conversations. I did some still photo work, but I did not video. I took time to write general observations of student actions and my awareness of their attitudes.

Reflecting on the data and the experiences within the second
computer art studio was exciting. My students were all so involved with developing their own computer art images that choosing three to follow had been a challenge. Criteria for selecting the three students was developed for both image development and student interactions (See Appendixes C and D). Using the two sets of criteria I critically analyzed the data gathered during the first two computer art studio sessions. I found that using two sets of criteria proved too difficult as students may fit a different level on one set of criteria than on the other. As my overarching research question had to do with the development of computer art images, I chose to use the image development criteria, which included points about process, response, and product, for student selection (see Appendix C). I identified my three sample students from my class, and they represented one student from each ability category (high, medium, and low) when developing computer art images. Though the interactions with their partner were also noted, the focus remained on the three sample students. Tape recorded base line interviews with the selected students took place prior to session three's computer art studio.

**Cycle three: the third computer art studio**

March 31, 1994 pre-entry session included complimenting my students for their improved responses in their journal and encouragement to keep up the good work. I had the students talk 'me' through how to open and save a paint document. My demonstration
focussed on the new paint tools and included a comparison to the tools used in a draw document. How to erase using both the pencil and eraser tools, and how to save their image using their pseudonym and date of the computer art studio was also shown.

My students assignment for the third computer art studio was to explore the painting option using their own personal themes, as they had done with the draw component in the first two studio sessions. Bob was present and attended to both video and still photography. My focus question, *What is happening within the computer art studio?* continued, both in relation to image development and student interactions. However, my focus was on recording field notes on my three sample students. I recorded specific comments and/or actions to help me understand how they were handling computer art image development. Though I now had only three students and how they interacted with their partner to gather data on, it was not as easy as I had thought. My class was exploring a new graphic component, ‘paint’, and as a teacher I had to survey the whole class and be as available as possible for trouble shooting and encouragement.

During my post-conference with Bob we discussed the criteria I had used for selecting my three sample students. We both agreed that the sample students had different abilities for producing computer art images, and that they also had different personalities. Bob’s impressions of how the three sample students time in the studio went
were recorded.

Reflecting back on the studio time made me realize that the way I had recorded my field notes on my three sample students had caused some of my frustration. I had recorded the data as it happened, which meant comments on each sample student were scattered throughout my entry. I set up my journal for the fourth computer art studio so that each sample student had a separate page for recording data specifically relevant to them. Though the research question had been addressed, the strategies of gathering data still needed focus. I had kept the student response journal questions the same, but I continued to help my students develop their skills of recording their answers. For example, I integrated some student reflective time, which included discussion and writing, into Language Arts.

Cycle four: the fourth computer art studio

The study transferred to the new studio setting, but with the same equipment, on April 7th. The pre-entry session included teacher/student demo and response to journal comments and questions. Student confidence showed as more students involved themselves in the demonstrations and discussions.

The fourth computer art studio was a continuation of the student assignment to develop, through exploration of the paint tools, a paint document that showed further development of their own theme. I started to develop the research question, What is happening
within the computer art studio?, by focussing on my three sample students when I asked them 'why?' they had made specific changes. I focussed on the development of their image, but I stayed aware of the kinds of interaction that occurred with their partner/with the class.

The separate pages for data collection for each sample student worked better than recording things chronologically, but as my skills at recording data improved, there was insufficient space to record my observations/information. To overcome this problem, I changed my field notes set-up to two facing pages for each of my sample students for the fifth computer art studio.

Time to reflect on what had occurred so far made me aware that the exploration images developed so far lacked composition. So far, learning how to use the different tools had been our aim. Now the students would be using their knowledge to develop full compositions. In preparation for the fifth computer art studio, the regular art classes and home assignments were used to focus on composition. Since their understanding of the tools needed to develop their theme had grown, how to present their theme effectively had gained importance. Students were assigned the development of pencil compositions based on their theme, which they would include in their student portfolios. The students were also encouraged to include photographs, magazine pictures, articles, and anything else they felt would help them understand their theme more fully. Their portfolios became a rich
source of information.

**Cycle five: the fifth computer art studio**

During the pre-entry session I demonstrated the difference between draw, paint, paint and draw, and draw and paint documents. The student assignment was to develop a full composition over the next two computer art sessions and students chose which type of graphic document they would use to develop their theme.

Most of the students chose to bring their preparatory pencil drawings into the April 14, 1994 computer art studio. However, the students understood that they were not expected to duplicate their pencil picture from paper to screen, but simply use it as a guide. My research focus was on my three sample students as I continued to ask myself the question, *What is happening within the computer art studio?* Data recorded reflected how the sample students were developing and how they interacted with their partner and other classmates. As this was the first attempt at developing a full composition, time to informally interview was very limited because trouble shooting and responding to all my students was a full time job.

Reflecting on the data stimulated further change. In the student response journals, I extended my written comments to include questions and even questions about their questions to help stretch the student’s knowledge. I also *rethought and rewrote the student response journal questions to get more information on how the*
students think they were developing their computer art images
(Teacher Journal, April 18). For the remainder of the study, my student journal questions were revised and changed for each cycle based on the information I was seeking, because students responded better to direct questions.

I met with my advisor and discussed the changes I had made for the next cycle. My overarching question, How do students learn to develop original computer art images?, and my primary question used in the previous sessions, What is happening within the computer art studio?, needed to be more focussed. I recognized that as a researcher I had first focussed on learning strategies to get my data recorded and generally understand what had happened in each of the computer art studios, but now my research questions needed to help me obtain deeper understanding.

**Cycle six: the sixth computer art studio**

My focus question for April 21, 1994 computer art studio was, *How do the students think as they produce original images?* Focus of data was on informal interviews that took place during the studio. Some students completed their first full composition and printed it out.

As I reflected on the student response journals I could see that their discovery comments were usually connected to the pre-entry session demonstrations and not something they had discovered on
their own. I included this observation in the next pre-entry class discussion so that my students might increase their value of in-process discovery!

**Cycle seven: the seventh computer art studio**

My three guiding questions for April 28, 1994 computer art studio were responded to during informal interviews with my students: *How did you decide to do _____? What will you do next? What do you think about _____?* Though I used guiding questions, I still used open response to what my students shared with me. Students were working on completing their previous composition or starting their second one in the graphic component not used previously (draw or paint component).

Between having made appropriate changes to the student response journals for each new session, and having focused on guiding questions for each computer art studio I had started to understand more of what had happened as my students developed their computer images. The images had become stronger and I believed that having more time to develop them allowed for greater detail. Wanting particular effects continued to encourage experimentation to get the desired results.

A second taped informal interview of each of my three sample students occurred before the next cycle. I noted in my journal that these taped informal interviews had become my most powerful
research tool so far. The students were letting me “see” their thinking as we discussed their own images.

**Cycle eight: the eighth computer art studio**

The May 2, 1994 computer art studio focussed on performance (skills, strategies) as I asked myself guiding questions: *How do the students choose what to do next? Which strategies do they use most often? What are my students’ attitudes towards computers, their images, their partners...?*

Some students completed their second image and had time left to ‘revisit’ one of their earlier images and add detail to complete it. Those that did not finish their second image were encouraged to use extra studio time during lunch.

When I reflected, I realized that I had become a stronger researcher. I recorded the following reflection in my May 2nd journal, *I am changing as I feel I had to crawl into the research role wondering at each turn if I would stand one day and maybe even walk. The process of becoming a researcher was so entwined in the learning (the curriculum) that it was after week five when I first realized I was standing...I am excited now that I am beginning to ‘see’ my students from both the outside, what was visually apparent, and the ‘inside’, their shared thinking,...and the knowledge that these two perspectives of ‘seeing’ are not always the same. In fact things are always more than they seem.*
Confidently I looked forward to cycle nine where I would use my established research skills to walk among my students.

**Cycle nine: the ninth computer art studio**

During May 12, 1994 my focus was on three guiding questions: *How are my students developing their image? How have my students' images changed? What are their attitudes towards time to complete/time to revisit images?* However, I also felt a need to ask three questions of myself: *How is my research affecting my teaching? What are the most important things I am learning? What are my perceptions of my students?*

This need to clarify what was happening carried over into the pre-entry session which included a time of celebrating where we had started from and how much we had learned. While in the studio the students completed images and went back and developed previous images. This was the first time that the laser printer had been in the studio and students printed out when their images were finished. When they saw their printed image so immediately, the students felt a more powerful connection to their completed work.

Reconnaissance and planning for the next cycle included my awareness that I still wanted to look at student development of original images, but the research question needed to change to reflect the new student assignment, the development of a shared image with their partner that combined both of their chosen themes. For the next three
weeks the general research question was: “How do student partners (teams of two) learn to cooperatively design and develop a shared, original computer art image?” In preparation for cycle ten my student/partners did preparatory sketches together and decided if their shared image was to be vertical or horizontal.

**Cycle ten: the tenth computer art studio**

During the May 20, 1994 studio, based on the new general research question, I developed three guiding questions: How did the students decide to combine their images? How are the partners responding to a one image situation? How do the students feel about the new process/image? Students started a combined image and as they shared ownership for their image cooperative interactions changed.

My reflections referred directly to the guiding questions and then to the way in which the students had shared their time on the computer. I also noted, My students have taken me beyond process and how to’s to self awareness of where they are coming from. Recognizing them, accepting them, and moving on with them to help them grow.

**Cycle eleven: the eleventh computer art studio**

On May 27, 1994 I continued focussing on the new general research question by using these guiding questions: How are the students interacting? What is different in their interactions now
compared to when they were creating separate images? What are they learning? What do they perceive they're learning? How are the images being developed? At the end of the studio, the student groups were at various stages: some had worked on their first joint picture and some had tried a second and even a third variation (seriation). The degree to which the groups were committed to detail and preciseness directly affected the development of their image.

The students' questions in their response journals had decreased. The discover section had increased meaning which, I believe, reflected the growing knowledge that the students had attained and the decreasing need to even ask questions.

**Cycle twelve: the twelfth computer art studio**

For June 1, 1994 the general research question changed slightly: “How do student partners cooperatively conclude the development of a shared, original computer art image?” During the studio I focussed on student interaction, image development, and the students' closure choices (to do seriation with their partner on their completed joint image; to revisit an earlier image of their own to either complete it and/or do seriation; to take some time to view what other students were doing with their images; and to view and discuss printed images, both their own and those of their classmates). During informal interviews with my three sample students I used the guiding question, “Have you been surprised by what you've done?”, to stimulate
reflective comments that I could then respond to.

A post-response journal entry (See Appendix E) was completed by all of my students a day after the study ended, to allow for student reflection time. A third informal interview was done with each of my three sample students on June 17th. These informal interviews covered cycles eight to twelve where my students had worked on individual images with partner help and ended with partners creating a shared image.

Treatment of Data: Formative and Summative

Data gathered during my study needed to be reviewed systematically so that my present experiences could positively affect the next studio session. Learning what worked and what needed to be changed came from reviewing my experiences. Therefore, formative evaluation was continuous and changes were made as needed at the end of each cycle of action. At the conclusion of the computer art unit my findings were recorded as statements that were site and situation specific.

Reviewing My Study’s Data Holistically

Looking back to see the whole study, the computer art unit, when I was no longer accountable for being the teacher who was planning lessons for her students, allowed me to be fully “the researcher”. Different sources of data were revisited to extend my understanding further:
(i) The data revealed through video tapes and still photographs was revisited by viewing the images again and revising, when needed, my reflective notes recorded in my journal.

(ii) The raw data, from field notes, informal interviews, student response journals, and the teacher journal, were first read several times to obtain a holistic understanding of the computer art unit and what had occurred.

(iii) I entered the raw data into a computer word processing document (ClarisWorks 3.0) which allowed me to manipulate information, through cutting and pasting, into new documents developed around main themes.

(iv) The themes and the categories within the themes included: As a Teacher: My Instructional Format; As A Researcher: My Data Gathering Begins; and My Students: Class Findings At Entry Level; Research Questions Explored: Three Sample Students; Image Development, with four distinct categories: Personal Connections to Their Images, Awareness of Space Within Their Images, Construction of Their Images, and Their Tool Choices; Cooperative Interactions, with two categories: Separate Images With a Partner, and Shared Image With a Partner; and Reaching Stride: My Students Attaining Class Empowerment.

(v) Binders for my class findings and my three sample students were compiled. Each binder included all the data collected for each of
my sample students and then the data was color coded to recognize the categories to be reported.

(vi) Support for each theme was developed through the use of the data: quotes and examples acquired from the coded binders, as well as teacher knowledge from reflecting and the teacher journal.

(vii) Each theme was included in this thesis under separate headings and the findings and analysis of the findings were written in thick descriptive narrative.

Data analysis occurred as the study was in progress and after observations had terminated. Data collected was investigated for patterns, categorized, and coded for ease of organizing the material (Eisner, 1991; Hopkins, 1985). Triangulation both by gathering information from three different points of view (the teacher, students, and critical friend), and by using multiple methods of data collection (teacher journal/field notes, informal interviews, student response journals, and artifacts) increased the quality of my findings. The cyclic nature of action research has been recognized here in Chapter Three. However, the integrative nature of my findings is acknowledged in Chapter Four, where I organize my findings around the themes and categories established during data analysis.
CHAPTER FOUR

THE FINDINGS: SIGNPOSTS OF DISCOVERY

My lived experiences within the computer art unit took me beyond my familiar classroom environment. I felt challenged intellectually to find the best way to handle the needs of my students, as well as to learn more about the computer art environment that I created. Though I experienced many situations, some permitted me to feel moments of peaked emotion and 'flashes' of insight. These moments established mental images, memories, that became discovered signposts which guided my thinking and my actions.

Because I was using action research, I experienced the freedom to meet the challenges presented in the computer art class, and to wrestle with the meeting, to adapt my thinking, and to change my plans. This allowed me to become one with what I sought, to be transformed and in the transforming to reach beyond where I already was. The contentment of knowing this feeling, I believe, is just another way of expressing the childlike joy of having "fun".

My students assured me over and over during the computer art unit that they were experiencing this most delightful joy for learning, for knowing, they were having "fun". In this research report any italicized sections, that do not include a reference, have come from my personal journal which included my reflections on all components of my study.
As a Teacher: My Instructional Format

During the computer art unit I was a teacher first and a researcher second, as my students were my priorities. Their need to learn, to go beyond the knowledge of what they knew and to know more, about computer applications compelled me to seek new ways of understanding how to involve them. At first, I established instructional strategies that were a blend of direct instruction (transmission) and problem-solving or problem-posing (transaction). The framework of the computer art unit was established by me, yet there was freedom within the control. The students chose freely their themes, their partner, and their computer. This freedom allowed the students to start having shared ownership of how they learned to use the computer software I had chosen for our use. Direct instruction through demonstration and discussion assisted the students in learning what tools were available and some ways of accessing and using them.

As I entered the process of doing the computer art unit the practical aspects of getting the unit of study successfully under way dominated. I had not attempted a formal unit on computer art before, though I had accomplished projects that involved computer art with my students in the past. Then I was interested in using computers to develop images, but I was not asking myself "how" the images were developed by my students, just how to use the computer to create an
image.

Now I was looking at our computer art sessions for the purpose of understanding how my students learned to develop original computer art. I wanted to know what happened as their images progressed, what their thoughts were and how their thoughts affected their progress. Very quickly though, I found that I had to put this second as I was accountable for the holistic understanding of not only what was happening, but also what changes, if any, needed to be implemented to assure success for my students.

By necessity, establishing the routines and understanding the tools came first. How I set up the use of class time and computer studio time would impact not only what my students learned, but what I learned as well. I constantly had to think and rethink what was working and how I could make it work better. Maximizing time to our advantage was imperative as access to the computer studio was preset.

Thus, the pre-entry time was used as the direct teaching time where the technical concerns of the software were addressed from the perspective of both the students and myself. Using a class computer with a camcorder and large screen TV permitted my students to view the computer screen image from their seats. Students were permitted to move freely to consult others as questions were asked. The students stayed focused and used this opportunity to enrich their understanding with the aid of their classmates.
When we entered the computer studio the instructional format changed. Here the students explored the tools and tried some of the demonstrated features of the software while they addressed their own themes. My concern at first was to confirm that everyone had successfully entered the program and selected the graphic component, opened and saved a document, and were productively working. Assistance came first from their partner and second from me, as I circulated and made myself available to those who demonstrated a need for me to be involved, or actually asked me for support.

Support included being aware of the time each student needed to be successful as each assignment was created and developing a continuum for those who were ready to move on. This included building in options that allowed those students who wanted to continue with the same assignment to have sufficient time to complete it. At times the predicted pace of the unit was too fast and I paused for an extra session that allowed the students to have adequate closure. Pacing of content was a balancing act between what the students wanted to accomplish and what I wanted to see them doing. As a teacher, I always leaned towards what the students needed.

My students needed to know that the tools they were using were in good shape and capable of doing what they needed in order to develop their image. It was here that I needed the most support from my critical friend, Bob Best, as I was not a technician. My students and I
had always been successful when using the word processing component of ClarisWorks 2.0, but I had not used the graphic components with a class before. As it turned out, there was a problem with the paint component of the software that prevented the printing of the image. A great deal of time was spent with Bob to assess and correct this technical concern. With the assistance of technical support from Claris Canada some problems were corrected by installing ClarisWorks 2.1, as the software problem had been corrected in this latest version. Technical support was imperative when establishing the computer software within the computer studio setting. As the study progressed, I became more adept at solving concerns that reoccurred, but I was forever thankful for the availability of my critical friend, especially when a new technical concern presented itself.

As my knowledge and the knowledge of my students grew the technical concerns and how to handle the tools decreased. Focus changed from instruction that was transmissive to transaction as the students started to problem solve and problem-pose using the cognitive toolkit they had acquired through hands on experience with their new tool, the computer graphic software. As the students developed their own themes, I remained a resource.

Individual students reached different levels of involvement. Images changed in process and what was printed out did not always reflect what I had seen being developed on the screen. I found that risk
takers who experimented with their images the most could actually have a less developed printed image. Staying aware of what my students were doing throughout the process of developing computer art images was imperative if I was to understand their personal development.

The finished images were a personal choice, and with the inclusion of seriation at the end of the computer art unit the printed image was not always the last version of the work. Seriation allowed my students the opportunity to save images at different stages while still continuing to make changes. The students determined their finished image by selecting it from a series they had developed from one theme.

I worked through the instructional outline that I had prepared, but focus was always on how the students learned to develop their own original computer art images, and which of the instructional changes I made assisted them. I was flexible and open to hearing what they told me. In the end, I withdrew to the background and the students carried the momentum of their own learning. I had become a co-learner with my students and together we explored the pleasure of developing original computer art.

As a Researcher: My Data Gathering Begins

I was a researcher the very moment I sought to understand my classroom better. I formed my research question based on my practice
and then strategically planned how to learn more about how my students developed original computer art images. Action research permitted me to reflect on my pedagogy while gaining deeper understanding of what had happened in my class.

My students were active participants in the research when they reflected on what had occurred in the computer art unit. They filled in weekly response journals, informally discussed experiences during pre-entry and computer studio sessions, and filled in pre and post response journal entries. How my students responded during these activities affected how I continued with the study.

When the computer art unit began, I sought immediate answers to my research questions. The first session in the computer art studio was hectic. I was frustrated with being the teacher and the researcher, because the answers were illusive as I looked at my whole class. Jot notes proved difficult to enter...too many people to monitor. I quickly realized that my understanding would be shallow until I had chosen three sample students.

In the meantime, I strengthened my position as researcher when I modified my question to “What is happening within the computer art studio?” This included what did I see and hear, and what did my critical friend see and hear? I specifically looked at how images were developed and what student interaction occurred. I built my data collection for the first two sessions knowing that I would select three
sample students to follow more intensely for the remainder of the study. It was evident that selection of the sample students could not be based on participation or enthusiasm, as all students were attending to the screens, and both partners were involved, though only one had hands-on (the computer), the other was attending, suggesting, and pointing to the image on the screen.

I really wanted to hear the 'voices' of my students, so I kept the student response journal short to encourage detailed response, and the three questions I posed were open ended to allow for a variety of responses. At the end of session one, I reviewed my students response journal entries and discovered them to be less descriptive or explanatory than I had hoped. I needed more information. Thus, I left the response journal format the same, and worked on developing my student's awareness of how to answer them more fully.

When I entered the second studio session I had narrowed my expectations for gathering data, as I had become aware that answers would come one step at a time. To discover what was happening, I listened to the students and observed their actions while they were using the computer software. I still felt pressured to gather information on a large group.

I had started the study two weeks before spring break and after session two I needed to select my three sample students. I found this week, away from the study and the pressures of teaching, was an
opportune time to review critically my data and plan my selection of the sample students.

I felt confident going into session three's studio that data recording and observation would be easier to handle now that I had chosen my three sample students. However, two factors I had not anticipated made me question my choices. In session three the students explored the tools of the paint program for the first time and they responded differently than when working with the draw tools of the previous two sessions. Though I focused on the three selected students, I attended more to the whole class involvement than I had expected. I had doubts about whether I had chosen the right three students. When I conferred with Bob at the end of the session, we discussed my sampling decisions. I wanted three distinctly different students to follow during the computer art unit, and Bob confirmed that the three students I had chosen were definitely a good sampling of the ability ranges in my room.

My sample students were: Rubinjeet, who represented my low ability criteria; Balwinder, who represented my medium ability criteria; and PJ Jenn, who represented my high ability criteria. I now scripted portions of my sample students' conversations and did informal interviews throughout the studio time. It was also easier to monitor my sample students while they were on the computer, because Rubinjeet was on at a different time than Balwinder and PJ Jenn.
alternating the partners time on the computer I had inadvertently made my data recording easier, though this was not a requirement for student selection it proved useful in this situation.

My Students: Class Findings at Entry Level

The first student response journal entry prior to the study revealed that nine of my students (approximately one third of my class) had computers at home, but no one had a Macintosh. My students used these home computers to do a variety of tasks which included word processing, banner programs, games, and some had a paint program, but no one had worked with the ClarisWorks graphic components. Based on the response sheet, student time on home computers ranged from one hour to twenty-eight hours per week, with the average student putting in five hours.

All twenty-four of my students reported that they liked using computers and when asked why or why not they replied: (Pre-entry Student Response Journals, March 10, 1994)

Bruce: *Cause they are fun and because I learn new things all the time.*

Kelly: *I like using computers because [sic] it makes things easier [sic].*

Elaine: *I like using computers because I do not have to write[sic] stuff all the time*

May: *I like computers because there [sic] really [sic] fun and*
interesting [sic]

Elizabeth: *I like using computers because I enjoy leaning [sic] something new!*

P.J. Phil: *I like using computers because they have alot [sic] of games and tey [sic] are easy to use.


When I asked the students what they were hoping to learn about computer art by the end of the study the answers were dominantly production oriented. Twenty of my students noted that they wanted to know how to do something: for example: (Pre-entry Student Response Journals, March 10, 1994)

Bruce: *How to draw nice with the mouse and how all the tools on the left hand side work.*

Pepper: *I am hopeing [sic] to learn how to draw better pictures and put little or big pictures when I write a story on the computer at school and maybe at home to [sic].*

Kelly: *I am hoping to learn all the things you can do with computer art and how to have lot’s [sic] of fun on computer art. I would also like to learn how to use all the tools posible [sic], however thank-you.*

Ice Cube: *I want to learn how to do computer art and Learn [sic] more about computers. I like to draw and paint but I have never painted or drawed [sic] on a computer before so I want to*
experience it.

Some students expressed a desire to learn about computer art so they could use their new computer graphic skills for other projects in and out of the school. Only a few (four out of twenty-four) showed any concern for ideation though these four also were concerned with production comments as well: for example: (Pre-entry Student Response Journals, March 10, 1994)

Jessie: At the end of the study I would like to know how to get set up for computer art and to draw a house or fish and lots of other objects. I would also like to know how to use the tools.

Elizabeth: How to draw good pictures, and knowing how to work the different kinds of tools. I also want to be able to draw many pictures of whatever I chose for my topic!

Judy: I am hoping to be able to draw white tigers on a computer when or if we get one at home or for my dad’s new business.

Splat: I’m hoping to learn how to draw the China wall and the TasmaHall and the famest of all B.C. Station

My students were immediately included in their learning when I allowed them to choose their themes, their partners, their computer and their pseudonym. Choosing their own pseudonym for the research project was especially effective. I cannot believe how much excitement this small task had. The students appreciated being able to choose for themselves.
As the first computer studio started, I was pleased that my critical friend could see that my students had used computers before. Pre-established expectations and routines helped establish a smooth entrance into the computer art studio.

All students demonstrated enthusiasm as they were directly involved in their learning. One or both partners often used pointing to the screen to direct thinking and/or activity. Most students were highly supportive of their partner, though Rubinjeet and Andrew stood out as reluctant helpers. They were partnered because they were the two left and not because they had chosen to work with one another. This situation happened frequently in a regular class setting and my students had come to look at the partnership as a short term contract. In this case, Rubinjeet and Andrew knew the commitment was for one hour per week for twelve weeks, and then a new project would mean a new partner. For this reason, the dynamics of their interaction was worth watching, as well as the fact that they were the only girl and boy partners within the class.

During session one, some students chose to stay to only the tools demonstrated while others went so far beyond that even 'paint' was used. Images varied greatly from simple line shapes, shapes filled in, combined shapes, shapes with text added, (and) shapes with freehand and paint. The students had successfully participated in a new learning experience and I had given them the opportunity to reflect in
writing through their response journals.

The entries from the student response journals showed that the students had become aware that computer art was harder than they had thought, but most indicated that it was still interesting and fun, while others were very excited about their new knowledge. For example:

(Student Response Journals, March 10, 1994):

Salt: I discovered that you can make a whole bunch of new designs, and that it seem [sic] pretty easy once you get used to it.

Elizabeth: I discovered that working on computer is harder but fun on the computer.

Robert: Today I discovered how to work the paint program By [sic] myself

D.J.: I discovered that if you fiddle around with every tool you can create a better picture.

Their questions were very specific to what they had experienced and therefore worth the time to discuss during the pre-entry session before the second computer studio. For example: (Student Response Journals, March 10, 1994):

Jenkins: How do you make a straight line?

PJ Jenn: What it [sic] you want to erase the hole [sic] thing?

Kim: How do you get your drawing to stay and get rid of the box outside of it?

Andrew: Why do they have painting in drawing. [sic]
The third part of the student response journal dealt with comments the students wanted to share with me about their experience. The comments included key words such as "liked," "enjoyed," "fun," and "interesting." For example: (Student Response Journals, March 10, 1994):

Jenkins: I liked it! It was very fun. I liked how we got to pick our own partners.

Pepper: I really enjoyed this program is [sic] it taught me stuff and was still fun.

Jessica: I like how we got to pick our partner. I also like how I can draw my favorite animal on the computer.

Judy: It is harder than I though [sic], to do a perfect picture with a white tiger. But, it is interesting [sic].

The second pre-entry session focussed on reading the three sections of the student response journals with the students, but not saying who made what comment. However, the students knew their own thoughts and recognized when the comment had come from them. By dealing with each question in order, students were able to clarify their concern when needed and respond to students and teacher answers and suggestions. During this class interaction time the computer, camcorder, VCR, and TV were used to enlarge the images. The students confirmed that this was a good way to view demos and share their ideas or questions.
I really liked how some of the focus comes from students' questions; the students are retaining part ownership of the process! and they are responding enthusiastically...curiosity has hooked them and success is nurturing them. Pre-entry demo/instruction time is powerful. The students do apply the new info presented during demo to their work, but at varying levels of commitment.

By the second session my students' conversations were very directive to their partners and yet they remained interactive as well. For example: (Teacher Journal, March 10, 1994):

D.J.: I've got to erase this.
Balwinder: Then go to the arrow.
D.J.: I know that.

Splat: It would be like he's looking that way.
Ice Cube: Yah, that's what I was going to do.

March 17, 1994 the students participated in the second computer studio and continued to enjoy learning:

Lisa: When you go to computer art you find something new.

Greater understanding of the program was seen as specific functions were recognized and used by the students, ie. thickness of line, texture, and fill. Images showed fill, line thickness, page awareness, and most demo ideas were tried. The students had better control of the tools. However, the students did not have time to complete images, only to do exploration within their theme.
Research Questions Explored: Three Sample Students

My study's overarching research question, "Computer Art in an Elementary School Computer Studio: How do students learn to develop original computer art images?" was divided into two research questions. From these questions two themes emerged. Significant categories within these themes added structure for reporting my study's findings.

The primary research question, How does the student's original computer art change over the course of the study? was simplified to the theme, Image Development. Within this theme, four distinct categories were recognized as the study progressed: (i) Personal Connections to Their Image, (ii) Awareness of Space Within Their Image, (iii) Construction of Their Image, and (iv) Tool Choices.

The secondary research question, How do students use cooperative interactions to develop individual and shared original computer art images?, was simplified to the theme, Cooperative Interactions. Two categories were identified within this theme: Separate Images With a Partner, and Shared Image With a Partner.

Some of the sample students' computer art images, presented in the following sections, have been scanned and reduced for ease of placement within my thesis. The scanned images have less definition than the originals, but I have left them untouched.
I. Sample Student #1: Rubinjeet

Rubinjeet was born May 7, 1983 and during the time of the study she turned eleven. She was in grade five. Her partner, Andrew, was in grade four and was ten years old. Rubinjeet and Andrew had not chosen to be partners. When all other students had selected their partners, they, by deduction, became partners.

Rubinjeet was the only student in my class who initially did not want to participate in the research part of the computer art unit, but at the last minute she changed her mind. When I asked her why she had not wanted to participate she was not able to express why. Though this was not a factor in selecting her for the study, I found it interesting that when I used my criteria for selection, she was the best representative for the low ability group when doing computer art.

Rubinjeet, within the school setting, was a capable student when she applied herself to whatever work was before her. However, she was easily satisfied with her efforts and had to be encouraged to give more than the bare answer, being finished was important to her. She did not volunteer thoughts during discussion, even when she knew she had something to say. Her marks were average but she had the capability to improve her standing when she refined her work.

Rubinjeet had very high expectations at the outset of the study as she said, “I am hoping to learn how to draw on computers. Especially to be an expert on computer Art [sic].” She participated with
enthusiasm after being selected as one of the sample students. Being a sample student for the project appeared to increase her self-worth and noticeable changes occurred, that is she joined in class discussions, requested assistance from the teacher, and attended more than usual to the task of developing original computer art.

**Image Development: March 10th to May 12th:**

Rubinjeet was the sample student who represented the low ability student as she tackled developing original computer art using the ClarisWorks 2.1 software. Understanding her thinking towards computer art and how her thinking changed over the course of the study was my focus. Though the categories within the image development theme overlap, they have been separated in the following accounts to help clarify the findings.

**Rubinjeet’s Personal Connections to Her Images.** From the very first session Rubinjeet clearly expressed her pleasure at doing computer art. “I discovered that it is very fun. I really like it (Student Journal, March 10).” By March 17th she commented, “I really liked it. The first time I said no for computer Arts [sic] I was nuts. I later on said: yes for computer Arts. I enjoyed it.” This positive attitude did not change throughout the study. Rubinjeet had made a personal commitment to the developing of original computer art images.

Initially Rubinjeet was content with creating very minimal images and she was happy with what she produced. Rubinjeet’s March
10th image was a simple square with a basic triangle placed on top to produce 'a house' (See figure 1). When asked if she was going to do more, she was definite in her answer...she was finished. When asked two weeks later, March 31st, during her first out of class informal interview if this image was the same as she had in her mind, she responded, "It's the same." At this point Rubinjeet's personal connections were low, and she was not able to tell why she had chosen houses as her theme to develop during the study. However she knew she liked her image because "I like the way it has the straight lines and the way I drew it".

![Image of a house](image)

Figure 1: Rubinjeet's Image, March 10, 1994.

Session two's house image, March 17th, was still minimal. When asked what she would do differently she replied, "Well I would...I'd have to decide. I'm not sure (Informal Interview, Teacher Journal, March 31)." Rubinjeet planned her image moment to moment only.

Her April 7th journal entries showed that Rubinjeet's
commitment to computer art had become personal. She questioned,

*Will we be doing drawing [sic], painting only till the end of the Year [sic]?* and commented,

*I felt comfortable [sic]. I like Computer [sic] art so much that I wish I had a computer at home and kept on drawing and drawing, and painting and painting my theme: Houses!*

Her theme excited her and she had gained confidence as she learned how to develop her image the way she wanted to (See figure 2).

---

*Figure 2: Rubinjeet's Image, April 7, 1994.*

*When I reflected on session six, April 21st, it was clear that Rubinjeet once again was*
happy with the moment...several times during the period she felt her image was finished...definitely finished. She didn’t see anything she would change.

However, a major change of commitment was evident prior to the very next session, April 28th. Some extra computer time was used to work on computer art and Rubinjeet “did more on her image without me suggesting it (Planning for session seven, Teacher Journal, March 28).”

Rubinjeet demonstrated a personal connection to her theme that would continue throughout the study. She was looking beyond the moment to obtain information to include in her image. Some examples would be when she was asked how she had decided what to do she would reply:

- From my head...well I took a look at my house. (In Studio, Teacher Journal, April 28th).
- Well I thought of like when I go like when I go shopping or something I see doors that have not like just normal square doors they have like a hinges or something on the side. So I decided to make that (Second Taped Interview, April 29).
- Well I would change I would make the tree sort of like lines in 'cuz most trees have like bark on it and I would make that and I would draw some more sky and I would try to fill the whole page (Second Taped Interview, April 29).
Rubinjeet asserted her thinking in discussions and developed her image according to her plan: for example:

- ...but I don't want it like that. I want to change it (In Studio, Teacher Journal, April 28th).
- ...I think it would be better if I had designs in it (Second Taped Interview, April 29).
- I would change the window and I would put the like the yellow lines on the road and some cars on (Second Taped Interview, April 29).

Rubinjeet was now able to say why she did certain parts of her image. She had become more descriptive when she talked about her images and could express why she liked certain parts of her image and why she would change other parts. A personal connection between Rubinjeet and her image had formed and continued to grow during session eight, May 2nd, when her personal interest in swimming started to influence her image. "I liked the swimming pool because I like swimming and I like the Slide [sic] going in the pool (Student Journal, May 2)." She used freehand drawing for the slide, but she was not happy with it (See figure 3). Now the image Rubinjeet had in her mind was more detailed than the computer image developed on May 2nd. "It doesn't compares [sic] to the Image [sic] I have in mind about..."
During session nine, Rubinjeet "chose to revisit April 14 because it was very weak [sic] and it needed some touching a little bit (Student Journal, May 12)." However, her personal commitment to her theme had finished and though she revisited her earlier image, nothing was changed, but lots was added. In fact, she had used the bottom of the page as a new baseline and had added anything her neighbours
suggested until the space was filled, but the picture did not feel united (See figure 4). She was finished and in her own words, "I like the Picture [sic] and I wouldn’t never change anything on My [sic] image it is Perfect [sic] (Student Journal, May 12)." She was ready to go on to a new theme, Rubinjeet was finished.

Figure 4: Rubinjeet’s Image, April 14/May 12th

Awareness of Space Within Rubinjeet’s Images. Awareness of where the image was positioned, in relation to the whole page, was a difficult concept for Rubinjeet. After three sessions Rubinjeet’s images still indicated that “no attention to the size of the image outside of the
computer screen, (had been established) even though page set-up had been explained (Teacher Journal, March 31).” However, Rubinjeet was aware of space within her image and whether she liked the position of detail in her image as revealed in the first taped informal interview, March 31, when she explained why she did not feel her window was very good. Focus for Rubinjeet was definitely on the image she was developing and not on the finished page and the empty spaces around her image.

The tool that was used to enlarge and decrease the size of her image on the computer’s screen for ease of adding detail, or seeing the whole image was still misunderstood during the session on April 14th. Rubinjeet believed that by making her image smaller or larger by using this tool, that the finished product was also changing size. As a result, Rubinjeet’s April 14th computer image of the house was in a vertical position with a lot of empty bottom space.

Rubinjeet seemed only concerned for the image visible on the screen. There was no indication of planning the whole space during the April 21st session, until I informally discussed with her the need to look at the whole page.

By asking questions I helped her go further and finally a reminder to use her whole page pushed her to add a lawn and a pool...but then she was definitely finished (Teacher Journal, April 21).”
During the second taped informal interview, April 29th, I specifically asked Rubinjeet, "Would you do anything with the bottom part of the picture?" when talking about her two week draw image and she replied, "emmm, I'm not sure yet." Then when we were discussing her paint image I asked her, "If you had more time with this image what would you do next?" and she replied, "Well I'd finish it off and I'd make some trees and like [sic] a background." This was the first indication that she understood the need to include a setting for her image. In the same interview she explained about getting stuck, "Like I can't like decide what to do next. I try to fill the page but I can't so I just leave it that way and then I think..." Though when I asked her why it was important to fill the whole page she was quick to say, "Oh then I'm not wasting paper."

In session eight, May 2nd, Rubinjeet used the strategy of making existing objects bigger, "to fill space." Rubinjeet had used the whole space but not because she saw a need for using the space to develop her image. Even during the third taped interview, when Rubinjeet was asked what makes an image finished, she replied,

It filled up the whole page almost but and it looks nice...Well again it filled up the whole page and I don't know what makes it finished, but I think it's finished.

My external influence had pushed Rubinjeet into using the available space, but she had not made any personal connection to why she
Construction of Rubinjeet's Images. Rubinjeet's first image exploration, March 10th, showed limited use of tools. The house was purely an outline of a box with an outline of a triangle placed on the top. By March 17th she had added a window, two filled circles for a door knob and a peek hole, and two horizontal straight lines to represent the street. Limited detail still showed geometric formation only (See figure 1).

By session three, "Rubinjeet’s image was pattern filled shapes schematically representing the same peeked house in her previous work (Teacher Journal, March 31)." Rubinjeet planned her image based on what was happening on the screen. Her image was still very geometric, but the "fill" component was becoming more controlled. As her image continued to be developed on April 7th, she learned to use different fills or shading and then to control where empty spaces, or new fills would go by using the eraser. Rubinjeet creatively explored fill and texture options to develop her image (See figure 2). The presence of a baseline added ground that she had started to fill by using the spray paint to create a hedge.

Detail became important to Rubinjeet as she worked on a paint image on April 14th. She used text inside of draw to make a welcome mat. During the studio session, Rubinjeet became more independent as she asked me for help and then found the solution before I could
respond. She was actively involved in constructing her image. As she said herself, "I love it when I know what to do (Student Journal, April 14)."

Questions asked in her student journal, April 14th, were really old ones that Rubinjeet had forgotten. Until she had learned the answers through personal experience, she needed the opportunity to revisit these questions. However, as I reviewed her images from all previous sessions I was amazed at how much progress was evident. Even though she still limited the tools she used, her image development had gone from simple line imagery to creative use of line and texture in her images.

Continued development in skill and imagery was evident in her April 21st image. Rubinjeet was so easily satisfied with what she had done that it proved difficult for her to make changes. Though excited at knowing how she accomplished some changes and also being able to describe how, she was quite happy during the April 28th studio to have her partner not just help her by telling, but openly said, "Well I said you could do it for me (Teacher Journal)!"

Rubinjeet started to demonstrate that she was willing to change some things, even when she verbally said that she would not change a thing. During the second taped informal interview, April 29, I commented:

Now you told me you were finished with your image at the end
of this day and yet I noticed when we had extra time in another studio session that you went back into your image and you changed it. And when you went back into the next session on April 28th, you even changed it some more. Tell me, what changed your mind?

Rubinjeet responded, "Um, Well I thought I'd draw like a path, but I didn't get the path really good. Like in shape and I um made my ... I changed my tree."

By session eight, May 2nd, Rubinjeet started to plan major changes to her image, "I would change the path into a tree I would change the sun & turn the picture into a rainy day picture (Student Journal, May 2nd)." It was as if her mind was waking up and she was seeing what was around her. Except for the slide into the pool, Rubinjeet's image was full of geometric shapes and fill (See figure 3). Her door mat was standing vertical, but this was still the way she wanted it and she felt good about it. Her path in her last image and her slide in this image were her first attempts at adding freehand drawing to her images.

Rubinjeet demonstrated on May 12th that, though she played with making changes, sometimes she would not save the changes. She revisited her April 28th image and made several changes, yet it was saved 'unchanged'. When she revisited her April 14th image it "had no previous parts changed...but many things were added" (Teacher
Additions included freehand drawing, but geometric shapes and fill still dominated her image (See figure 4).

Rubinjeet's Tool Choices. During the first two sessions Rubinjeet used the straight line tool for the majority of her image. A brief experimentation with fill in session two continued in session three, as she used geometric shape tools to create outlines that were then filled with various textures. She experimented with the polygon tool and continued to add pattern through the use of fills. The most significant tool used was the eraser, as she used the eraser not just to remove unwanted areas, but to create areas that could then be left plain or filled with textures. The effect was a textured surface with controlled white spaces, or textures within textures. This use of the eraser as an image developer showed creative thinking. Rubinjeet had learned how to control the fill component.

Rubinjeet was aware of the tools available, as she stated during the first taped interview that, "I tried to use all of them but I couldn't...just the ones I needed for the image." On April 7th Rubinjeet's tool experimentation focussed on using the spray can for smoke, and adding detail with spray, filled arcs, and using rectangular shapes as a frame for an overlay of spray paint.

Further growth was evident when during session seven, April 28th, Rubinjeet demonstrated her ability to not only use the draw tools, but to add paint to draw. She used her knowledge of paint to add
During the second taped interview I asked Rubinjeet to explain what the difference between the draw document and the paint document was, she replied,

Well there's nothing different, but if I want like the door sort of ...but if I want whatever I want but it can't happen in draw, I go to the paintbrush and then make a box wherever I want the picture or the scene and then when I let go of the mouse it ...the draw tools come and then I draw whatever I want and then I go back to the arrow.

Though this was not a full answer to the question, it was an example of how she used the different components within a draw document, which were part of the concept.

Rubinjeet was not always able to explain how she had developed some parts of her image, and was quick to pass over it with a non answer. She recognized the ease of making circles and using fill on the computer and was impressed by the short time that was needed to use them.

When writing responses to the question, "What did you discover today?," Rubinjeet's comments in her student journal showed that she was not a risk taker. What she wrote was not really just discovered, but what she had learned how to use to the point where she felt 'safe' to make the comment. For example, in her May 12th journal entry, she wrote:
I discovered [sic] that if you go to the bottom wear [sic] it says 100%
you could go there and see your picture smaller or bigger. And.
[sic] if you did something wrong go to edit undo.

However, during the third taped interview Rubinjeet explained where
she had started from:

*Well, when I look back at the study well this isn’t really about
changing, but when I look back at the study I really didn’t know
how to fill in things and make gradients and all that. I just drew
plain houses with no things. It was just plain white and then I’d
be finished.*

Rubinjeet has learned to use the tools of the computer art software,
ClarisWorks 2.1, to develop her own original computer art at a level
that enabled her to share what interested her most about her images.

**Cooperative Interactions:**

Though student interactions were monitored throughout the
study, when the students combined their own images into a shared
image the research focus was specifically on student interactions. It
was important to remember that Rubinjeet was partnered with
Andrew because as the class paired off, these two students were left to
work together. As this was a realistic situation within a regular class
setting, I was especially curious as to how the partnership would
develop.

*Rubinjeet’s Separate Images With a Partner.* My reflections at
the end of session one already noted how “Rubinjeet and Andrew isolate themselves a lot from partner sharing. Off task behaviour is evident of the partner not on the computer.” Session one’s fifth still photograph showed Rubinjeet standing behind her chair, but attending to the computer screen while Andrew was working. This was not seen in any other group, but it was not necessarily wrong. However, the separation by space indicated the reluctance to help one another that was seen throughout the whole studio session.

During the second studio session I asked Rubinjeet about how she was helping her partner, and Andrew jumped in with “like I do with you (Teacher Journal, March 17).” This lack of support for one another was two sided though, as both needed to develop their interpersonal skills. However, once they became part of the sample group there was a notable change in how they interacted:

Andrew: “Check out this. What’s that?”

Rubinjeet: “Oh, what happened?”(Teacher Journal, March 31). Interaction increased even when Rubinjeet was not on the computer, but her eyes and attention still wandered. Photo number one for March 31 showed Rubinjeet consulting with Andrew as they attempt to build a more honest approach at communication.

Body language told a lot during the April 7th lab as Rubinjeet turned from Andrew and assisted her neighbour, and though she talked to Andrew her hands were crossed against her chest. I
questioned them when Rubinjeet wanted to move (change) Andrew’s image and Andrew pushed her hand away:

Me: *Are you doing something different today?*

Rubinjeet: *I’m helping.*

Me: *How?*

Rubinjeet: *I tell him how to do something if he doesn’t know how.*

Andrew: *No you just try to grab the mouse.*

Though interactions occurred they were fairly hostile as each wanted power, though there were times when they gave in to one another. For example:

Andrew: *Well it’s the best way you can get in there! You don’t do that. No. No. Click on one of your squares at a time.*

Rubinjeet: *Like that?*

Rubinjeet listened to her partner when she felt he could help her get what she needed for her image, though helping Andrew was not as easy. When Rubinjeet was not on the computer she attended less to what Andrew was doing than to those around her. However, Rubinjeet noted in her journal that she had helped her partner.

This “on-again-off-again” attitude toward helping their partner persisted through the time that they were working on their individual themes. Some days were better than others, but both students needed to work at the partnership. The person on the computer first could
affect the interaction the most, as he/she had the perfect chance to include the other person. Andrew’s body language, yawning and stretching, while Rubinjeet was on the computer during session seven, was followed by Rubinjeet half-laying on the counter while Andrew worked on the computer.

The second taped informal interview, April 29th, revealed Rubinjeet’s strategy for interaction. When asked how Andrew helped, she replied, “Well I sometimes I say to myself how do you do this and then he answers.”

Me: If you say it to yourself, how does he know?
Rubinjeet: I say it out loud and he hears it.
Me: I see, so you really aren’t saying it just to yourself?
Rubinjeet: No.
Me: Do you find it helpful having a partner?
Rubinjeet: Yes I do.

It appeared that this off hand manner of involving Andrew in her work seemed to be a less vulnerable way of asking for help because if he did not respond she would just ignore him.

When Rubinjeet felt that she was finished with her theme but still needed to revisit an image during the May 12th studio session, she became more flexible in responding not only to Andrew but to her neighbours as well. In her journal she credits how she finished her image as she wrote, “Well Andrew and Lisa gave me an Idea [sic] of a
trampoline [sic], swingset, tree, rathllooking [sic], stickman play soccer.”

Personal connection was not evident as she added things to her image to fill space and she just did whatever was suggested to her.

Rubinjeet and Andrew’s Shared Image. Sharing the same image developed a different response to partner interaction than previously experienced when working on separate images. Studio session ten found both students involved in the image development right from the beginning of the class. However, when I informally talked with them during the studio time I found that Andrew felt they were getting along and, though Rubinjeet did not challenge this, she was not happy. She clearly expressed her reason for this when she said, “I like to do a picture on my own.”

When I wrote reflections on the video done during session ten, I noted that, “Rubinjeet was directing Andrew even to the point of showing him using her hands to form the roof shape....When they have a joint picture to guide them, interaction is happening - positive yes, but is Rubinjeet only following instructions?” The still photos also revealed that Rubinjeet sat close and pointed to the computer screen when Andrew was on the computer, but Andrew also did the same when Rubinjeet was on the computer. Andrew even held the shift key down while Rubinjeet drew a straight line for the bottom of the roof.

However, Rubinjeet asserted her feelings in her journal to the point that her thoughts were more powerful than the interactions I
had observed. For example:

Question four: How do you feel about working with a partner to create an image?
Rubinjeet: *I feel good except I want to do my own I don’t like cats anymore or want them in My [sic] picture. So that is why I am not comfortable working with my partner.*

Question five: How do you feel about the picture you made with your partner?
Rubinjeet: *Well it is pretty good but I really don’t want [sic] to work on a picture together because it bugs me alot [sic] having a partner I don’t know why it bugs me but it does.*

I was not prepared for the change that occurred during session eleven, Rubinjeet was first on the computer and there was no sign of reluctance to work as a team. Her journal reflected the new attitude displayed during the studio time when she answered question four:

*After working with a partner for two sessions on the same image, how do you feel about working with your partner? Why? with “Well I think now that it is good to have partner because it tells you about lot’s [sic] of things you should do and do not [sic].”*

The shared image developed by Rubinjeet and her partner, Andrew, (See figure 5) showed that working with a partner had influenced the development of Rubinjeet’s image. More than one house had appeared in the shared image, and the house sizes and their
positions on the page added the feeling of depth. Andrew's cat theme had added another perspective and both students had enjoyed making suggestions for changing their shared image.

![Figure 5: Rubinjeet and Andrew's Shared Image, May 20-June 1, 1994.](image)

The June 1st student journal included question five: What do you think about working with a partner on a shared image? Why? and Rubinjeet shared two thoughts:

1. It is better to have to [sic] imaginations than one. Because your partner gives you Ideas [sic] and you can get to know them as well [sic] what they like from there [sic] topic.
(2) It is a very big help with a partner. because [sic] you can finish your Image [sic] faster.

Post conferencing with Bob on June 1st revealed that both Bob and I felt that Rubinjeet had made the greatest change when it came to student interactions. Rubinjeet had moved from showing hostility towards her partner and isolating herself, to working cooperatively on their joint image. Again, I was not prepared for the responses that Rubinjeet gave me during the third taped informal interview done at the end of the study.

Me: Tell me, what do you think about working with a partner?
Rubinjeet: I kind of like being alone, even at home I don't want to be with a partner or doing work.

Me: In your journal you were saying how much you liked a partner when you were combining your images.
Rubinjeet: Well when we were combining I like to work with a partner so they they'd have two images in one picture, but if we're doing if we're not combining I'd like to work by myself.

Me: ...If you had a choice between making a combined image with a partner or making an image by yourself which one would you want to do?
Rubinjeet: By myself.

II. Sample Student #2: Balwinder

Balwinder was born June 8, 1983. He turned eleven at the end of
the study and he was in grade five. His partner, D.J., was also in grade five, and though his exact age was not known, he was believed to be eleven years old. Balwinder and D.J. had chosen to be partners and worked well together.

Balwinder was chosen to represent the medium ability group when doing computer art. He was an English as a Second Language student with Punjabi as his first language spoken in his home. He had difficulty writing clear English. After the study had started, because of his weak spelling, he needed to read and correct his response journal entries one-on-one with me after he had had a chance to proofread on his own. This extra time to orally express his responses not only helped me understand his thinking better, but helped Balwinder learn to write more clearly.

Balwinder was an underachiever in the regular classroom, except in mathematics where he found a great deal of success. Balwinder did not have to speak English at home and this lack of application carried over to his class work. Balwinder needed to do language work at a level lower than his classmates to achieve success in any written work or reading assignments. He did not apply himself in any way to improve his situation unless I worked with him one-on-one. His school marks were below average in all but mathematics where he obtained high average marks.

However, Balwinder was able to actively and forcefully join in
discussions when he felt confident that he was right or he had something to say that was valuable to the discussion. Balwinder was personally involved in the computer art unit. He felt confident on the computer and was willing to take risks in the computer art studio more than he was in the regular classroom. He had a sense of accomplishment, as he felt he could do art on a computer when he felt he couldn't in a regular class. Finishing was not as important as it was for Rubinjeet.

Image Development: March 10th to May 12th

Balwinder was the sample student who represented the medium ability student as he tackled developing original computer art using the ClarisWorks 2.1 software. Understanding his thinking towards computer art and how his thinking changed over the course of the study was my focus. Though the categories within the image development theme overlap, they have been separated in the following accounts to help clarify the findings.

Balwinder's Personal Connections to His Images. A positive attitude towards computers was evident when Balwinder responded to the student journal pre-entry questions. "I like computers because it's fun....I wish I learn [sic] how to draw pictures [sic] on compters [sic] So [sic] if I get one I will no [sic] how to draw on miny [sic]."

Balwinder chose basketball as his theme. He was personally connected to his images through his love of playing basketball. During
the first taped informal interview, March 31, he was asked,

Me: *How did you decide what to do next as you were developing your image?*

Balwinder: *Well I have basketball pictures.*

Me: *Where did you get the pictures from?*

Balwinder: *I drew them.*

He also shared that he had magazine pictures, and books as well that he had drawn from. He proudly let me know that, "Yup. I copied, not traced. I looked at them and made the ball go through the hoop." His interest in basketball was personal and how he tackled his images was personal.

Balwinder's image developed slowly because he was learning how to use the tools and he focussed on the backboard, pole, and net for many sessions (See figure 6). By April 21st, he wrote, "I like the backboard the best because it takes more time and it's better." However, he admits that "The computer image is all was [sic] drifnit [sic] then [sic] the image in my mind." (The computer image is always different than the image in my mind.)

By May 2nd, Balwinder desired to make a real game with people on the court. His frustration he encountered with adding people changed his attitude towards his image and in his journal he wrote, "I would never do this image [sic] but if I did I would change the people. Yet, on May 12th he did revisit the image and worked on the person
and he worked with confidence. When I discussed this with him he explained how the person was coming down from a shot and his arms were relaxed because he was waiting for his shot to go in. Balwinder's image had captured the 'feel' Balwinder explained he had after he shoots. In his May 12th journal entry he commented, "I do like it because it is like I wanted it to be" (See figure 7).

Balwinder's personal connections to his images were constant throughout the study. During the third taped informal interview at the end of the study, he still descriptively demonstrated his involvement with his image. For example:

Me: How do you feel about this image?
Balwinder: **Good. Fine, because I learned how to draw the person and he’s wearing a vest and all that. He just shot the ball and then got back. He’s going to see if he scored it and he’s waving like this to everybody and he’s looking....He’s like putting his hands to the side of him and like wishing he could get the ball in. Because he just shot it and he’s waiting for everyone because he’s a Bull’s player.**

His involvement with his image was so real to him, that Balwinder physically demonstrated what he said to me.

Awareness of Space Within Balwinder’s Images. Balwinder was only conscious of his basketball pole, backboard and hoop for most of the study. He explored these shapes almost to the point of absorption. He was not concerned with using the whole page, even during the seventh session.
However, during the second taped interview, April 29th, we discussed the page space in terms of whether the image should be horizontal or vertical. This concept of space was important to Balwinder as it directly affected his image. As he explained about one of his images, it needed to be “Vertical because it’s just one hoop and if I had more of [sic] people in then I would like it horizontal.” In another image he chose to do it horizontal, “Because it has two hoops and they’re on both sides of them and if I’d had it vertical I wouldn’t have had enough space.” His awareness of space to fit the image was evident.

Though I encouraged Balwinder to look at developing the background for his images, when I looked at his May 2nd image, he had once again focussed on improving the parts. During the studio time on May 12th I commented on the fact that the picture was only on the bottom half of the page. He dismissed my concern quickly when he said, “I wanted it like that.” He was finished and he did not want to do more.

Construction of Balwinder’s Images. The number three still photograph from March 17th showed Balwinder as he concentrated on drawing on the computer. He was so involved that even his tongue moved while he drew. Balwinder focussed on his work, though production was slow in order to include details. Balwinder often erased and redrew. For example, during the first taped informal
interview, March 31, when he was asked what else he was planning to add to his image he replied, "Uh. If I could have like two hoops and like people in here and one shooting and trying to score."

Constructing an image involved seeing what happened and adding to it. He admitted that his image was different than the one in his head, and when I asked him what was different about it he told me, "Uh I wanted it like a little boy that jams, right. I tried coming in like uh but I put it on late. The other thing got away, like a spring here so he could jump on it." Balwinder was able to see his mental image and his computer image and compare them. He was constructing his images one section at a time.

I noted in my March 31st journal entry that "I had offered an answer to a question Balwinder had asked in class...he heard me...but was much more excited about sharing a solution he had found." I was excited with him as I sensed his power of knowing and his strength at being able to verbally express what he had done. Balwinder had started to build his own cognitive toolkit to help him solve his own problems.

I had not expected to find a student so connected to his partner's image, that they would share ownership of each other's image. However during the April 7th computer lab, when Balwinder commented to D.J., who was on the computer, "We're going to do another one." I realized that the construction of D.J.'s image had
become personal for Balwinder. Balwinder was making suggestions and holding D.J.’s idea book. He was fully involved.

My in-studio notes from April 14th indicated that Balwinder was still experimenting with trying different ways of representing the parts of his image, the pole, backboard, and hoop. Balwinder had really refined these parts until they were placed exactly the way he wanted. On April 21st Balwinder commented to me, “I’m going to make a basketball coming in from one side, and then a team.”

This was a major turning point for Balwinder as he left the familiar parts of his image and attempted to add people. Later in the class I went back and asked Balwinder how his players had turned out. His frustration was evident as he replied, “I’m going to make them stick men, because I can’t make them very good.” His frustration was also noted in his journal when he wrote, “I got mad at the computer because it wouldn’t do what I wanted it to do.” Balwinder abandoned this image because drawing people proved too hard!

During the second taped informal interview I asked Balwinder what sort of things he did when he ran into trouble. His reply showed that he knew his options: “I ask my partner and they know the answer then I’d ask them and if they don’t then I call you.” It was refreshing to hear the ‘they’ in his comment as I was well aware that he had included at least two others beyond his partner in helping him with his concerns. I continued,
Me: And what happens if they suggest something to you that you don't like?

Balwinder: Then I'd try it.

Me: You would try it even if you don't like it?

Balwinder: Even if I didn't think it would work but maybe it did you never know.

When Balwinder was in the computer studio during session nine, May 12th, he added a person to his image (See figure 7). He was still happiest with the hoop, pole, and basketball, but he was learning how to draw a person. Though I had observed Balwinder practicing how to draw people, it was not until the final taped informal interview at the end of the study that I learned the whole story about his computer people.

Me: How did your partner help you with this image (See figure 8)?

Balwinder: He drew the arms.

Me: He drew them. On your picture?

Balwinder: Yuh.

Me: How does that make you feel?

Balwinder: Fine, because I couldn't do it.

Me: Did you try?

Balwinder: Yeah.

Me: Okay. If you were on your own now Balwinder would you
know how to do that?

Balwinder: Yes.

Me: Good. What's different?

Balwinder: Because then I didn't really know how to draw the arms and when I seen [sic] them I tried and then it started working, so I drew it.

Me: So it helped to see somebody else trying first?

Balwinder: Yuh.

Figure 8: Balwinder's Image, May 2, 1994, revisited with his partner.

Me: Okay. Same period when you thought you had finished with that, you went back to your first image which had two basketball poles and hoops and a ball and you added a person (See figure 7). Who drew the person?

Balwinder: I did.
Me: *You did! So you took the information that you learned*

Balwinder: *Yeah.*

Me: *and tried it.*

Balwinder: *Yeah.*

By watching his partner draw part of his basketball player Balwinder had gained the knowledge and confidence he needed to draw his own basketball player. Balwinder had taught me to consider more options in my teaching, never had I knowingly permitted a student to draw on someone else’s work.

**Balwinder’s Tool Choices.** Balwinder had an advantage when learning about the graphic tools as his partner, D.J., had previous experience with another program (SuperPaint) on his home computer. Balwinder also used a computer whenever he visited his cousin, though he admitted that he had not done much art. However, with Balwinder’s keen interest in learning about the tools and his partner’s experience, he was involved immediately in exploring the tools. This attitude of exploration continued throughout the study, as Balwinder focussed on experimenting with many options for developing his image.

By March 17th he had already noted in his journal that he had, 
"... discovered how to flip by going to Eide (Edit).” Though he actually had to go to ‘arrange’ on the menu bar in order to flip images, the fact that he was already flipping images impressed me. At the same time
Balwinder was also admitting that he needed to learn how to make correct lines. I believe this divergence in thinking was a result of observing his partner and interacting with him as they worked. However, once Balwinder learned how to do something he was more than capable of verbally expressing how he controlled the tools to develop his image. During the first taped informal interview, March 31, Balwinder shared the following:

Me: ...let's look at your second week's image and maybe you can tell me a little about that. I noticed you changed the page setup so that it was horizontal.

Balwinder: I wanted it like that so I could have like two hoops but one didn't come.

Me: You did two?

Balwinder: Yah.

Me: How did you get the second one?

Balwinder: I went to edit...cut...then I went to paste and then I went to horizontal flip.

During the April 7th computer studio, Balwinder used spray paint to give the 'swishing' motion of the ball as it headed for the hoop (See figure 9). “It's exciting to see Balwinder experimenting with the tools to express his feelings into his image (Teacher Journal).” By April 14th he knew enough to choose the 'draw' or the 'paint' component of the software based on the tools he felt he needed to
develop his image.

Figure 9: Balwinder’s Image, April 7, 1994.

Balwinder was willing to ask for help when he needed it. When he asked, the question was very specific to what he needed to know to accomplish a change in his image. In session six he said to me, "I want to make the spray paint, but it won't work" (Teacher Journal, April 21st)." He was open to learning about the tools as the need to use them arose.

When Balwinder made an error and lost most of his work during the April 28th studio time, I hoped he had learned to save his material often. However, I was impressed with how quickly "he remembered how to redo most parts of his image from his earlier exploration (Teacher Journal)."

During the second taped interview Balwinder and I talked about how he was able to use "paint" features inside of a "draw" document. Again, he was able to explain exactly what he had done. Balwinder had clearly become
knowledgeable about the tools he had used to create new images.

Cooperative Interactions:

Though student interactions were monitored throughout the study, when the students combined their own images into a shared image the research focus was specifically on student interactions. However, Balwinder and D.J. had chosen one another as partners and from the very moment they started the computer art unit they worked as a unified team.

Balwinder's Separate Images With a Partner. The first still photo taken during session one showed D.J. on the computer working with fills while Balwinder closely attended to what was happening. D.J.'s prior experience was evident while Balwinder was an enthusiastic partner who wanted to learn.

D.J.'s willingness to help Balwinder was a strong force in Balwinder's learning, though both were quick to claim what they did know. My journal notes from March 17th included this dialogue:

D.J.: Move that right to the hoop.
Balwinder: I'm just going to make lines and then make the cage.
What's that?
D.J.: I've got to erase this.
Balwinder: Then go to the arrow.
D.J.: I know that.

This cooperative interaction continued in session two and was
seen clearly in the third still photo of the session. The picture shows Balwinder holding his tongue between his lips as he intensely drew. D.J. was leaning in totally focussed on what Balwinder was doing. By the third session the partners were more than comfortable with one another, yet they needed to be reminded to keep their discussion on task. In spite of the bond that had already formed, Balwinder wanted advice from me as well, as he was not always willing to take D.J.’s advice. His journal notes reflected his appreciation, “I liked how you and Mr. Best and you helped.”

The April 7th studio session showed another strategy Balwinder would use periodically throughout the study: he was letting D.J. direct him. The following dialogue was recorded in my journal:

D.J.: Try drawing a man.

Balwinder: Okay, what do I need to make a man? A circle. I want to start with a face.

D.J.: Do you know how to?

I left them as D.J. started to direct specific steps to help Balwinder.

Cooperative interaction included an extended group during session five. Just as Balwinder had drawn in myself and Mr. Best, D.J. was interacting with P.J. Phil, and Balwinder did not seem to mind. On April 14th, Balwinder was still directed by D.J., but Balwinder did not just accept his advice:

D.J.: No, I think the hoop needs to be bigger.
Balwinder: *Up...up...no.*

My journal notes from this session's video review noted the power of the two way cooperation that Balwinder and D.J. had formed.

*Balwinder is attending to and involved in his image development as D.J. works on his jet theme. D.J. asks Balwinder for his opinion. Balwinder leans in, points to the screen image, he involves himself totally as he works to help D.J.*

However, when Balwinder's partner was absent on April 21st, he had a harder time concentrating and he noticeably missed his partner. He needed extra encouragement from me to confront problems he encountered. I noted in my journal reflections, *"It appears that the extra stimulus of his partner to develop an image has been more of an encouragement than I realized. His partner was missed today."* When D.J. was also absent during the next session, Balwinder drew in the assistance of his neighbour, P.J. Phil. In order to help, P.J. Phil guided Balwinder. This outside interest brought Balwinder back to active involvement. For example:

Balwinder: *Okay, do I rotate again?*

P.J. Phil: *No it won't work.*

Then Balwinder asked me, *"How do you get the arc to go down?"*

Me: *Try starting at the other end.*

Balwinder: *Oooh! That worked.*

Balwinder was away again. *Talking with others stimulated his*
thinking and his productivity (Teacher Journal, April 28).” This strategy of including others to problem solve continued through the whole session, and when P.J. Phil’s turn came to be on the computer, Balwinder interacted with Robert, P.J. Phil’s partner. Balwinder recognized the need for interaction to help him problem solve and he opened up to those nearest to him.

D.J. attended the May 2nd session and Balwinder let him direct the activity. When Balwinder did not agree, he was quick to say why. As was noted in my May 12th journal, Balwinder “uses his partner’s suggestions for “his” benefit and modifies and even rejects ideas if they don’t fit into the idea he has for his image.” However, it was D.J. that encouraged Balwinder to tackle his problem of drawing people in his images. D.J. was a powerful encourager and both of their cooperative interactions helped Balwinder gain control of the computer images he wanted to develop.

Balwinder and D.J.’s Shared Image. The cooperative interaction strategies experienced during the development of individual images was extended and enriched during the development of a shared image. D.J. and Balwinder chose to share tasks rather than each person taking equal time on the computer. D.J. drew the parts he felt good at and Balwinder did the parts he felt he could do. Both were more involved in the process and the image and both said they liked a shared image better than doing separate images. As the eighth still photo of session
ten showed, "Balwinder and D.J. actively explaining to me that they're both drawing the parts that they know how to draw. Their enthusiasm is evident in their faces and their hand gestures (Teacher Journal, May 20)."

D.J. was absent for the second studio for developing their shared image, May 27th. Balwinder asked me for help as his neighbours were too involved with their joint image to help him. However, Balwinder kept control and did what he could when he ran into a problem, "He seems more in control of his emotions when something unexpected happens 'I can fix it.' (Teacher Journal, May 27)." Balwinder focussed on small detail he wanted to clean up in his last week's image. Although he made no major changes he felt that the image was finished. For the first time Balwinder noted the absence of his partner when he wrote his journal, "I discovered that if your partner is not there it is very hard to finish [sic] because he can give you some detail."

D.J's return on June 1st encouraged some additional changes in their joint image. "D.J. has been able to stimulate Balwinder into making improvements...but Balwinder is making and adding to decisions too! (Teacher Journal, June 1)" The combining of their two themes, basketball and jets, was not as difficult as I had expected (See figure 10). Balwinder and D.J. saw "air" as the combining agent. The jet in the air, with a parachute jumper advertising Jordan's, and Jordan in the air making a jump shot made a believable image. This was the
first time Balwinder had used the whole page, but then the whole page fit this image. Balwinder had been an enthusiastic participant who was most effective at developing original computer art when he was working with his partner.

III. Sample Student #3: PJ Jenn

PJ Jenn was born on September 16th, 1983. She was ten years old and in grade five during the study. Her partner, Elaine, was also in grade five and eleven years old. PJ Jenn and Elaine had chosen to be partners and they usually worked well with one another.

PJ Jenn was an academically high achiever. She was able to do her school work beyond her grade level. When asked to present her work to the class or share how to do something with another student
she responded in a very capable manner. I always appreciated her effort to do her best. She enjoyed learning.

Though PJ Jenn always listened intently to discussions she did not join in unless required. She was quiet and reserved when interacting with other students. I never observed PJ Jenn in any rambunctious activity in or out of the classroom. When she gave her word to do something, it was done. Her feeling of responsibility was well developed.

PJ Jenn was chosen to represent the high ability group when doing computer art, as she has critically thought about her image and sets goals for further work. This emphasis on planning and then producing work of high quality was reflective of PJ Jenn's work and learning in all subject areas.

**Image Development: March 10th to May 12th**

PJ Jenn was the sample student who represented the high ability student as she tackled developing original computer art using the ClarisWorks 2.1 software. Understanding her thinking towards computer art and how her thinking changed over the course of the study was my focus. Though the categories within the image development theme overlap, they were separated in the following accounts to help clarify the findings.

**PJ Jenn's Personal Connections to Her Images.** A positive attitude towards computers was evident when PJ Jenn responded to the
student journal pre-entry questions. "I like them and thier [sic] fun...I am hoping to learn how to draw pictures that look nice and (are) easy to do." By the end of session one PJ Jenn confirmed her feelings about computer art when she wrote, "it was fun, it was exciting".

This was a new experience for PJ Jenn and when I did the first taped informal interview she told me, "I'm hoping to learn how to do pictures that look realistic." PJ Jenn had taken advantage of knowing that she could choose her own theme to develop. Not only did she know that she wanted to work on African elephants she had researched them.

PJ Jenn: Yes. I've looked in an encyclopedia for pictures and the difference between African elephants and Asian elephants.
Me: What have you found so far?
PJ Jenn: That African Elephants are bigger than Asian elephants so I've decided to do African Elephants.

PJ Jenn explored the shapes of the African elephant by looking at the back of the elephant the first session, the whole elephant the second and third session and then the front of the elephant in session four. She was very focussed as she made the computer a tool to understand the development of her elephant theme.

Even though her first image (See figure 11) appeared imaginative to me, PJ Jenn saw the realism in the presence of the elephants feet. Realism was important to PJ Jenn and even when she
developed her sun with a wavy pattern, she explained, "Well the sun sort of looks wavy when you look at it and that was the closest um that it looks (First Taped Informal Interview, March 31)."

![Figure 11: PJ Jenn's Image, March 10, 1994.](image)

PJ Jenn continued throughout the development of her individual theme to find ways of making her image look real. "I liked the trees on my image best because they look like really like protein-rich a cacias (Student Journal, April 21)” (See figure 12). In the same journal entry PJ Jenn responded to the question of how her computer image compared to the image she had in her mind by saying, “It compares good [sic] it’s almost [sic] how I want it in my mind.” Though PJ Jenn wanted realism, she was happy when her image gave the impression of realism. During the second taped informal interview, April 29, she told me that she had changed from line drawing to using fills because, "Well I wanted things to look more realistic and have a like patterns and stuff like that so I used the fill."
When I reflected on this second taped interview I noted in my journal that:

PJ Jenn was very accepting of her work. Even earlier images are seen by her as good for what she knew then. PJ Jenn knew what she wanted to focus on and didn’t get distracted. Time between sessions thinking about the image occurred and upon reentering the studio changes were made.

Reasoning was almost always a driving force for PJ Jenn. Knowing
why she liked the baby elephant best had to do with what she was trying to say in her May 2nd picture (See figure 13), rather than the tools she needed to use. She wrote in her journal, “I like the baby elephant [sic] because I think that it shows that baby elephants [sic] are not as big as the full grown elephants [sic].”

Figure 13: PJ Jenn’s Image, May 2-14, 1994.

Moving on was not as important to PJ Jenn as stopping and finishing. Additionally, when time allowed, she revisited an earlier
incomplete image. PJ Jenn was personally connected to her theme throughout the study and she worked hard to learn ways of creating more realistic images.

**Awareness of Space Within PJ Jenn’s Images.** After the first four exploratory images where PJ Jenn focussed only on the elephant, the remainder of her images included full compositions. Though I repeatedly asked leading questions to draw out a conscious awareness of how she was dividing her page, it became obvious that PJ Jenn just balanced her space naturally. Her innate understanding of balance within her images made her efforts powerful and she used all the available space.

During the April 21st studio I recorded this dialogue in my journal.

Me: *What are you planning to do to the trunk?*

PJ Jenn: *Well I’m trying to make it sort of overlap the rest of the picture but it’s not really working. So I’m going to have it behind the tree.*

Me: *So overlapping is important to you.*

PJ Jenn: *Yes.*

Me: *Why?*

PJ Jenn: *So the trees look like they’re behind the elephant and the elephant is up front.*

PJ Jenn was able to use placement of her images within the space of the
page to reinforce what she wanted to say through her picture. She was aware of what her whole image would look like and tackled her images in a unique way. From the studio on April 28th I noted in my journal:

Me: *Where are you going to start?*

PJ Jenn: *Probably at the top and work my way down.*

PJ Jenn learned how to set her margins to establish how close to the sides of the page her image could go and still get printed. During the second taped informal interview I recorded an example of how well this concept of space had been learned.

PJ Jenn: *Um...I think I erased one of the trees because um I thought it wouldn't fit on the picture so I erased one of the trees.*

PJ Jenn had a good sense of how to use the space within the page and used her understanding to develop strong compositions based on her elephant theme.

**Construction of PJ Jenn's Images.** By the second session, March 17th, PJ Jenn wrote in her journal, "I think it was fun because of all the different [sic] textures ant [sic] thickness [sic] you can do to make your picture more interesting." Constructing her image meant learning how to use the computer as a tool to achieve the affect PJ Jenn wanted. Though frustration was evident when she was stuck on zoom during the March 31st studio, after she and her partner had tried various options, she asked me for help, listened, learned and moved on quickly. Detail was so important to her that she had enlarged her
image 800% to make sure she had done everything she could to present her picture accurately.

PJ Jenn was very systematic in how she explored her theme. She knew what she wanted to learn next and she tackled it. PJ Jenn was able to express this clearly to me during the first taped informal interview on March 31st.

Me: What do you plan to do next?
PJ Jenn: Well I plan to try and focus on the head part of the elephant.
Me: How did you decide what to do next?
PJ Jenn: Well I've done a lot on the back part of it so my next step would probably be to go to the front part and try to work on that for a while.

At the end of the interview I noted these reflective notes in my journal.

- Critical thinking is evident as PJ Jenn works to figure out what would (work) look the best.
- PJ Jenn has definite ideas of what she wants, but accepts computer made situations.

With PJ Jenn so concerned about realism I had been surprised by how relaxed she was at leaving some things just because it was the way it had turned out on the computer. Other detail was more important to her and she would focus on those details instead. One example that
stands out in my mind was when PJ Jenn worked on developing her May 12th image and some lines had broken free from the elephant, which had allowed some of the fill to go outside of the lines. When I asked her about this during the last taped interview she replied, "I had moved the tree a lot, so and sometimes it accidentally moved so it was hard to put it back right into one place." She just simply accepted this because she understood why it happened and could honestly move on with her image. However, other times she stopped and changed what she felt was in her control to quickly change, an example from my journal would be this dialogue from the April 7th studio setting (See figure 14):

Me: *You changed the trunk?*

PJ Jenn: *I erased it.*

Me: *Why?*

PJ Jenn: *It was straight and I wanted it bumpy.*

Figure 14: PJ Jenn's Image, April 7, 1994.

PJ Jenn used predrawing as a guide to her image development and during the April taped interview she shared her reasoning with
Me: Did it help to have a composition roughly done before you went into the studio?

PJ Jenn: Yes because I knew how to put things and I could be really serious about the picture instead of doodling.

Me: Okay. Do you think that it would be easier to do a composition directly on the computer now, or do you still want to use a composition idea...that you prepared ahead of time?

PJ Jenn: I'd still like to do a picture before going to the studio. It helps a lot.

Me: Okay. Do you need a lot of detail on these pictures that you do ahead of time?

PJ Jenn: No. Just like the regular stuff. Like the basic pictures not little itzy bitzy details.

However, PJ Jenn also noted in her May 12th journal entry that, “I first followed the pencil picture and then I asked my self [sic] what else can I do to make this picture realistic [sic].”

PJ Jenn consciously changed the view of her African elephant in each new image. She was forever challenging herself, and she could always explain why she did or did not do something. In my May 2nd entry I wrote:

- one elephant is leaving the picture with only the back showing.

PJ Jenn: I wanted to get in the whole baby elephant and less of
PJ Jenn developed her images in a serious manner and she found it difficult to stop an image before it was finished. I did not push PJ Jenn to leave an image and move on to the next assignment, she finished one image before starting another. Her interest in realism continually focussed her desire to learn more. PJ Jenn’s images were rich in detail and always reflected a personal connection with her interest in African elephants.

**PJ Jenn’s Tool Choices.** Exploring tools during session one and two included both line drawing and fill. In our first taped interview PJ Jenn explained the checkered pattern she had used on her first image (See figure 11). “Well I thought it would look uh realistic but it really doesn’t look that realisitic [sic].” It took PJ Jenn until the fourth session, April 7th, to let go and experiment with the paint features, yet her image that day did not utilize her new knowledge. Again, she focussed on line drawing, but she extended her knowledge of the line tools and successfully captured the sense of both wrinkly skin and movement (See figure 14).

By April 21st I noted in my journal that PJ Jenn’s journal entries were production oriented. Her responses focussed on learning the tools of the program. Yet I knew from watching her that her image was of utmost importance to her. However, she did not have trouble with understanding her theme. It was the tools she needed to develop her
theme that most concerned her. By the end of the April 21st session, PJ Jenn commented in her journal, "The patterns on fill would be allot [sic] harder if you did it by hand on the computer all you have to do is click on it." During the second taped interview, April 27th, I was surprised when PJ Jenn acknowledged that she had been encouraged to explore the use of fill during the pre-entry sessions.

Me: How do you feel you learned about the fill?
PJ Jenn: With a um...when you show us the and answer the questions before we go into the studio.

The only use of preset geometric shapes occurred when PJ Jenn drew the sun in her images. Freehand drawing dominated her images and with the addition of fills she was able to express her African elephant theme the way she wanted to. This was explained succinctly by PJ Jenn when she shared her ideas during the second taped interview.

Me: And last day we started a second image because you had chosen to use paint before you were asked to do one in draw. How did that feel when you had to use the draw program then?
PJ Jenn: Okay, but most of the pictures I do with the um different line tool to um like the just the squiggly line tool. I don’t really use most of the shapes so then I fill the thing...the picture in so.

Following the same conversation a little further, PJ Jenn
explained how she was able to use the paint tools inside of her draw document. With her knowledge of both graphic components of ClarisWorks 2.1 she was able to let her image tell her what tools to use.

Me: I noticed that the image you did last day that you had some fill in areas but you also have the paint program operating on top of the draw program.

PJ Jenn: Yes, because um when I was trying to do this part (the top of the tree) top of the tree I was trying to fill it in, but the fill kept on going on this side instead of inside of it, so I put a box around it and did it with the paint program (See figure 13).

PJ Jenn constantly challenged herself to learn more about the computer tools and about her theme so that greater detail could be attained. Her cognitive toolkit had acquired some tools for solving problems that she would encounter during the development of her own original computer art images.

**Cooperative Interactions:**

Though student interactions were monitored throughout the study, when the students combined their themes with their partners, the research focus was specifically on student interactions. PJ Jenn and Elaine had chosen one another as partners, but their partnership was not predictable. They started the computer art unit as a unified team, however boundaries were established and feelings fluctuated.

**PJ Jenn's Separate Images With a Partner.** PJ Jenn and Elaine in
the first session of the study both interacted with one another as well as observed what their neighbours were doing. The program was new to them and they both were keen to use every minute to learn, and thus interaction was high. A noticeable difference occurred in the second session when some features of the draw software were already familiar. The eighth still photograph taken on March 17th shows that PJ Jenn observed what Elaine was doing, but she had moved back away from the computer in a lounging position, yet she kept her eyes on the computer screen.

Both students interacted with one another sporadically during the March 31st studio session. Elaine assisted her neighbor and involved me in her quest to learn. My reflections from reviewing the video of that session revealed the different approaches to partner interaction that occurred for most of the study between PJ Jenn and Elaine.

- **PJ Jenn was not fully attending while Elaine worked on the computer.** She would often look at her neighbors image and then glance back at Elaine’s work.

- **At times Elaine attended intently on PJ Jenn’s work, with her hand on her chin and her eyes focussed on the screen while PJ Jenn worked.**

- **When PJ Jenn worked on their image, Elaine would usually be involved in a discussion which included pointing to the part of**
the image being discussed.

While PJ Jenn was on task Elaine would sometimes be learning from her neighbors.

I summarized what I had experienced during this session when I reviewed the third still photograph:

PJ Jenn is letting Elaine discuss fill options with her. Positive interaction is limited...but more successful when Elaine isn’t on the computer...PJ Jenn seems to be a more independent worker.

(Teacher Journal, March 31st).

Interaction seemed to occur more when PJ Jenn was exploring how the tools worked, than when PJ Jenn was developing her images. The exploration of the paint options as seen in the fifth still photograph, taken on April 7th, showed both students attending to the screen. Elaine tried to continue interacting with PJ Jenn during the April 14th studio session, but as my teacher journal indicated, “PJ Jenn still isn’t talkative with her partner, though Elaine talks out what she’s planning even when PJ Jenn doesn’t answer.”

This off hand manner of interaction was established now and when I reviewed the April 14th video, it was clear that both PJ Jenn and Elaine were not fully committed to one another. Both Elaine and PJ Jenn would even walk away to observe other students while their partner was on the computer. However, they both stayed aware of their partner’s image.
When the need for support arose they assisted one another. The first photograph taken on May 12th showed positive support for one another. I noted in my journal: “Both PJ Jenn and Elaine are actively consulting, though it’s PJ Jenn’s image on the screen. Direct participation with one another happens when there is a concern of one partner, who then involves the other.” This was the greatest strength of their partnership when they were working on their individual images. When they needed help, they got it from one another.

PJ Jenn and Elaine’s Shared Image With a Partner. A combined image helped strengthen interactions between PJ Jenn and Elaine. I noted significant change during May 20th’s studio session:

- They both agree they’re talking more together.
- This is especially good to see as they were watching each other before, now they are interacting to create the image.
- The fact that they aren’t yet comfortable with someone else’s opinion being considered is understandable as up until now they were basically technical support for one another.

When PJ Jenn responded to questions four and eight in her journal she revealed both her concern for working with a partner and her sensitive understanding that her partner’s feelings needed to be included.

Question four: How do you feel about working with a partner to create an image?
PJ Jenn: I think it is good but it has a few flaws like one person wants to do something one way but the other person wants to do it another way.

Question eight: Any additional comments you would like to make: ie. How much time do you feel you and your partner need to complete a computer picture? How do you know when you’re finished?

PJ Jenn: I think we need more time than 2 sessions and I know when we are finish [sic] becaus [sic] if it’s everything I want and everything Elaine wants then we are finished.

I was not prepared for how PJ Jenn and Elaine dealt with their combined image on May 27th (See figure 15). They were both detached from the process of developing their combined image when their partner was on the computer, though they were available if needed. PJ Jenn’s answer to question three in her response journal enlightened me as to why this had occurred.

Question three: Today, how did you and your partner decide what to do next on your image?

PJ Jenn: Before we went in the computer room we planned who would do what and where.

Though working with a partner was not what either PJ Jenn or Elaine indicated they would choose to do (question six), PJ Jenn’s comments for question five were all positive.
Question five: What do you think about working with a partner on a shared image? Why?...

PJ Jenn: 1. If you did something wrong your partner can correct you. 1. because if you left it there it might wreck your picture. 2. helps you learn what your partner likes 2. because if they don’t like something they would tell you 3. if you don’t know how to do something 3. because they might know how to

In PJ Jenn’s post journal she surprised me when she suggested that next time I did this unit I should “have two shared image [sic]
instead of one". Again during our last taped interview PJ Jenn found it hard to say no to working with a partner, though she found it necessary to say why she learned to doing images on her own.

Me: Do you think now that if you were given, let's say we had another month of school and we were going to go into the studio and do some more computer art, would you want to do an image on your own?

PJ Jenn: Yes.

Me: or with a partner?

PJ Jenn: Well, both sort of because um doing it with a partner is a lot of fun, but doing it alone has [sic] you more time for you to make your own decisions.

Me: So you found it a little harder to make decisions with a group?

PJ Jenn: Well no, but sometimes they have, we have different ideas and we have an argument about it 'cuz one person wants one thing and the other wants another.

PJ Jenn increased her interactions with her partner when doing a joint image, but she was still content to withdraw to the background when her partner was on the computer developing the part of the image that they had predecided was hers to develop.

Reaching Stride: Students Attaining Class Empowerment

All my students had developed their own original computer art
and at the end of the study they all, individually, wrote their thoughts in their student response journal. This was their final post journal entry and my last chance to learn more about them and their experiences, but I also wanted them to help me look ahead to the next class of students who would experience a computer art unit. They knew that how they responded to the questions would affect how I taught.

Question one: Do you like using computers? Twenty-three students said yes, zero said no, and one said “sort of”. Here is a sample of how they answered “why?”:

Jessie: “Yes because computers some time [sic] look neater. No because they take a long time.
April: One thing is becouse [sic] if you whated [sic] to make 5 copies you could copy that.
Elizabeth: I like using computers because they are fun and interesting!
Jessica: Because computers help me learn.
Andrew: because it’s a lot more fun than drawing by hand.
Sandman: I like useing [sic] computers because you can learn a lot of things.
Pepper: I like using computers because it can be alot [sic] better than using a pencil all the time.

Question two: If you use a computer outside of school...
The student responses to this question remained the same as reported in the pre-entry journal.

Question three: During this study did you learn what you wanted to learn about computer art? Twenty-three students said yes, zero said no, and one student said he had learned part of what he had wanted to learn. 95.8 percent of my students had achieved their goals during the study. Some of their responses were:

Royal: *I did learn part of what I wanted to learn.*

Jenkins: *Well yes because I was looking forward to learning how to (do) different shapes and patterns.*

Kelly: *Yes I learned a fair amount on computer art and thats [sic] good for me.*

Question four: What did you learn about Computer Art Images? Most of the responses talked about the tools they had learned to control, but student thoughts also included how they felt about some of their images and their feelings. Some student responses were:

Pepper: *- I learned how to use the tools better - How to set my margins [sic] better - I learned what Paint and Draw were - I learned how to draw elephants better.*

Kim: *I learned that it is hard to draw Computer Art images at first, but if you practice Computer Art images it will easy [sic].*

Elizabeth: *I learned that they are fun, Interesting [sic] to look at, fun to imagin [sic] doing them before doing them and it’s fun to*
try out new things on them!

Lisa: I learn [sic] you need time, practice [sic], thoughts, (and) ideas.

Question five: What would you like to learn about Computer Art another time? Some of my students still answered this question in a general way, while the majority (sixteen out of twenty-four or two-thirds of the class) wanted to learn about specific situations. At the beginning of the study one hundred percent of my students had answered a similar question in general terms, for example: I want to learn how to draw on the computer. Some of my students' current responses were:

Jessie: I would like to learn how to make houses & People [sic] neater than they are now.

Pepper: I would like to learn how to write a story about maybe my image and then on the back put a really big picture of my theme making it look like it's popping out like a pop-up.

Jenkins: I would like to learn how to write in black fill pattern with a pencil and how to write in a different angle (I don’t think you can do that).

Here was a student that had even mentally attempted to answer his own question. My students had thought beyond where they had been as they started to plan where they would go next.

Question six: Which did you prefer, working on a separate
image or a shared image with your partner? When I had asked this question at the end of session twelve, four students had said a separate image and twenty had said a shared image. Now, after allowing some time between the end of the study and filling in this post journal entry, one of the four changed her vote. However, this time a new category had appeared as three students voted for a separate image, twenty voted for a shared image, and one student wanted both!

When they were asked “Why?” some responses were:

Bruce: I liked it because when we made an image it looked weird and creative.

Pepper: I preferred working with a partner on a shared image because when every one [sic] person had one idea and the other had another you could put each idea together.

Ice Cube: separate because than [sic] you don’t disagree with each other.

PJ Jenn: ...I like working alone sometimes but not all the time.

Question seven: Did it help to learn on your own image before working on a shared image? Twenty of my students said yes, three said no, and one said maybe. The majority valued this experience, however here are some of my students thoughts:

Rubinjeet: So you are prepared when your [sic] doing a shared Image [sic].

Sandman: Yes because then you know how to use every thing
[sic] on the tool bar and you know of all the neat stuff it can do.

Kim: because when you explore on your own you discover some thing [sic] new.

PJ Jenn: (No) because I would have to ask my partner alot of question [sic] if we started with sharing.

Question eight: Suggestions for the teacher to use when starting a new class on Computer Art? Most of these responses affirmed what had been done during the computer art unit, however some new suggestions were presented and some strong feelings were expressed.

A sample of the responses included:

Pepper: I liked the idea of demoing, [sic] Try to start with a [sic] hour each.


Jessie: I Suggest [sic] you don’t start of [sic] with a theme that you just get them to do what they whant [sic] to draw and in the middle get a theme.

April: ...You could show them some stuff that we as a class discovered during the study and show them more stuff erliarly [sic] than you did with us so they can go in at there [sic] time and do what they want. - demenstrat [sic] all the tools and ask them if they know what its [sic] called.
Judy: ...Don’t make the journal entaries [sic] so long...

Balwinder: - more time - come in two times a week - I would suggest that there was more time too in the studio.

I appreciated all my students comments and many included steps we had taken during the computer art unit in their comments. However, these last examples focussed on changes that the students suggested. I felt that their voices should be heard and reflected on last, as they enriched my understanding (research) that would help me plan our next computer art unit (action).

Summary of My General Findings

As I investigated my overarching research question, Computer art in an elementary school computer studio: How do students develop original computer art images?, I found that besides a change of focus from production to ideation my students’ images were affected by their personal commitment to their images, how aware they were of space within their images, how they constructed their images, and the tool choices they made. Cooperative interactions affected the development of their images, but the amount of effect varied from one student group to the next and whether my students were developing individual images or shared images. The significance of my findings are discussed in Chapter Five.
CHAPTER FIVE
ANALYSIS OF THE FINDINGS:
SHARING DISCOVERED PATHWAYS

As a Teacher: My Instructional Format

When the study concluded and I analyzed my experiences, teacher benefits (ordered from significant to most significant) included: The development of my technical skills when I used the graphic components within ClarisWorks 2.1; a greater understanding of the creative potential of ClarisWorks 2.1; the systematic development of a computer art unit where my student’s “voices” had been responded to; the enrichment of my teacher knowledge about my students thinking processes; an increased understanding of how my student’s thinking affected their own original art; and the transformation of my personal pedagogy. The changes to my pedagogy will be explained in the sections dealing with the research questions within this chapter.

As a Researcher: My Data Gathering

As a researcher/teacher I was now aware that I learned more about my class when my students were active participants in my enquiry. When wanting to know their thinking and be immediately responsive to their comments, I had found the use of informal interviews with my students to be a powerful tool. Student response journals were also an effective way to communicate with my students, as they allowed me to direct my students’ reflections to specific
situations or questions that I needed to understand from their perspective. I used their responses from these journals to guide my planning for the pre-entry sessions. By using my students' responses as they wrote them during these pre-entry sessions, I assured my students that their thoughts mattered.

The thoughts of my critical friend directly affected my study. Though prior to this study I was determined that teachers should be able to do research in their own classrooms without outside assistance, the value of an outsider, and in this case a "critical friend," proved invaluable. I still believed that a teacher can research in their own classroom without an outsider, but if the opportunity to work with someone else arose I would now choose to have an outsider involved. However, it was imperative that the outsider and the researcher/teacher felt comfortable as partners in the research situation (See Appendix F for why I valued my "critical friend").

My Students: Class Findings at Entry Level

The computer art unit had extended my students' learning environment, as none of my students had Macintosh computers at home. All of my students were interested in learning computer graphic skills and were directly involved in planning their learning experiences based on personally chosen themes. While exploring the computer graphic tools during the first sessions assisted my students in gaining control of the tools, the sessions did not allow for adequate
time to develop completed compositions. My students’ questions were dominated by how to use the computer graphic tools. These findings reflected a positive start to the computer art unit, as all participants were actively involved in their experience.

Research Questions Explored: My Three Sample Students

When I looked at my three sample students and their partners, I found it interesting that my three sample groups consisted of one group that had two girls, one that had two boys, and one group that had one girl and one boy. This was not part of my “research” plan for this study, but the concept of gender was something I need to be more aware of in my future research.

A second look at my three sample students and their partners revealed another unplanned factor. The groups chosen represented two Caucasians, two Indo-Canadian, and one Caucasian and one Indo-Canadian. My awareness of ethnicity within my class had grown over the years, however, these combinations were not preplanned by me and this aspect was not reported on during this study. Again, ethnicity is something that needs to be part of my future research.

Even though I did not plan these factors, my student combinations turned out to be an accurate representation of my class’s configuration. My sample students were the main focus of my study, however how they interacted with their partner was also reported on. My findings were analyzed within the two themes of image
development and cooperative interactions, and then as a response to
the research question, How does the student's original computer art
change over the course of the study?

Image Development: March 10th to May 12th

The development of original computer art images by my students
was a complex process. I divided my findings into categories that
represented the main points discovered about image development
purely for ease of reporting the findings, however I knew that these
categories were interdependent of one another.

Personal Connections to Their Images

When student interests and their own experiences are the themes
of their graphic images they enjoy creating their images (Thomas and
Silk, 1990; Wilson and Wilson, 1982). These images can communicate
to other students how they feel about their theme. However, as
Thomas and Silk have said,

The information presented in a drawing seems to be determined
by three factors: children’s knowledge of the drawing topic itself,
their interpretation of what aspects of that information are
important to present and their capacity to produce a drawing
showing that information (1990, p. 106).

For Rubinjeet, the impact of choosing her own theme and
exploring it for a set time had shifted her personal development. She
was now a conscious observer who noticed detail she had never seen
before. Her personal connections to her images had grown and empowered her to show, through her images, what was exciting her, namely pattern and texture. I knew that she had much more to learn about houses, but she had learned what she wanted and she wanted to go back through the discovery process with a new theme, cars. I sensed that she wanted to try out her new knowledge at its present level. I wondered if her new theme would take her image development further.

Balwinder was a reluctant reader/story teller and yet the descriptive language, expressive tones, and body language that he used when he talked about his images represented the strongest communication skills I had seen from him all year. Thomas and Silk's (1990) suggestion of connections between pictures and cognition and Wilson and Wilson's (1982) concept of telling stories through drawings were reflected in Balwinder's enthusiastic talking about his images, as if he was reliving his basketball experiences.

However, my third sample student, PJ Jenn, had formed personal connections with her theme through doing research. Realism was important to her and she organized her exploration of African elephants so that she had systematically learned to draw the front, the back, the head, and the full body. Her completed compositions reflected what she wanted to say about her theme, and she always challenged herself to try a different viewpoint in each new image. I
found that PJ Jenn spoke about her images as expressively as Balwinder had. Such a strong connection to her theme through graphic images and not a real life situation impressed me.

The development of a theme was an important factor during this study. When I informally interviewed the students their responses indicated that they knew far more about their themes than their images showed (Thomas and Silk, 1990). Though Wilson, Hurwitz and Wilson (1987) named five factors that influenced drawing development, emphasis throughout the grades was placed on using a theme and expressive elements. Only part of the time, they encouraged the use of media, sensory, and formal content. I encouraged my students to include all five factors: to start with a theme, to express their feelings within original images, to learn to use the computer graphic tools, to deal with emotional content, and to discuss line, texture, and composition.

The portfolios my students developed over the time of the study included a variety of resources that helped them develop their theme by being aware of different ways of viewing their subject (Wilson and Wilson, 1982). I was glad that the computer art unit had committed my sample students to twelve sessions working on the same theme. A variety of images had been produced and the end results for all three students were richer ideation and more complex drawings than they had produced for me before.
Awareness of Space Within Their Images

As an art educator my training had taught me to use the whole page when I was developing my image. I, therefore, felt that my students should do the same. I was surprised by how both Rubinjeet and Balwinder responded to my directive comments. Rubinjeet just complied by adding things without a thought for how they connected to her image, but she had filled her page. Balwinder just simply ignored my request and presented his image the way he wanted. Howard Gardner provided a reason for Balwinder’s response when he said, “We can perhaps say that the child is aware of practices, canons, standards, and options, but they do not dominate his thought and action: he can take or leave them” (1980, p. 142).

Wilson and Wilson affirmed the need for children to have “reasonable boundaries to fit the size of their ideas” (1982, p.13). They also made the suggestion that different shapes and sizes of paper “may well lead to ideas and inventions that would be less likely to occur on standard shapes of paper” (1982, p.13). The work of Dalton and Burton (1995) reaffirmed that different shapes to draw on could stretch student representation of their ideas.

My thinking and my pedagogy changed as now I saw the boundaries of the page, the computer screen, as not necessarily the boundaries of the image. In the future my students could define the boundaries for themselves, creating a boundary that enhanced their
ideas of their image. I felt a sense of anticipation as I wanted to get back to the studio to share with my students this new freedom to create without the confines of the full page image, unless it was chosen by my students.

PJ Jenn had chosen to use the whole page. I did not ask her why she had used the whole page, and now I felt that was a missed opportunity. Did she choose to use a whole page? Did I influence her, as I had Rubinjeet? Would she have chosen a different boundary had I been more open, as Balwinder had done? These are questions I will need to explore in my future research.

PJ Jenn, unlike either Rubinjeet or Balwinder, developed her compositions with an innate awareness of how to balance her images within the space, so that the visual weight was equal on both sides. This concept of the innate ability to create well-composed pictures was supported by Thomas and Silk (1990). They also stated that, "...Piaget argued that the ability to organize space in terms of a co-ordinate reference system is one of the more significant achievements in children’s cognitive development" (1990, p. 86). PJ Jenn was my designated high ability student and her images had confirmed my choice.

Construction of Their Images

My students were at the age when realism was important and they strived to have their images recognized as realistic (Thomas and Silk,
1990). As they constructed their images I often asked them if their computer image looked the same as the image they had in their mind. The responses varied from a simple yes, to the idea that the one in their mind had more detail, and occasionally the response would indicate that the computer image was better than the one that was in their mind.

How computer images were constructed varied amongst my three sample students and it became apparent that, "...the processes children use to construct drawings are at least as important as any supposed underlying mental image in determining the form of the finished drawing" (Thomas and Silk, 1990, p. 71).

From doing informal interviews with my students I knew that their mental images directly affected the construction of their computer images. However, I discovered that the process they used significantly affected their finished image as well.

Rubinjeet's method was inductive in nature in that she started with her house theme by drawing a simplistic house and then added on. As her computer skills increased, she added texture and pattern to the house, and eventually to the objects she placed around it. Everything was done one step at a time and planning was moment by moment.

Balwinder concentrated on one part of his image at a time, therefore he constructed his images inductively as well. He constantly
made changes to his image. Until he had explored his options he seemed reluctant for even a section of his image to be finished. Later Balwinder copied how his partner used the graphic tools and created his own person within a new image (See figure 7).

Once again my training as an art educator had imprinted the message: Do not allow your students to copy. Do not let other students draw on the work of others. Yet, Balwinder had successfully mastered how to draw a person because he had watched D.J. draw on his image and then later he had copied how he had seen it done. Balwinder’s person was uniquely his, it was not a clone of the person his partner had drawn. The foundations of my pedagogy had been shaken and I started to question the ‘do not’s’ that I had used as my guide.

Wilson and Wilson (1977, 1982) are strong advocates for allowing students to copy from other children, artists, photographs and especially other major art pieces. Though the Wilsons have concerns for the children who are not able to change the copied image into a version that is uniquely theirs, or find copying easier than creating their own (Gardner, 1980; Wilson, 1982), they see the benefits of copying. Their commitment to their philosophy of copying was evident when Wilson, Hurwitz and Wilson (1987) published a teaching text devoted to, as their title declares, Teaching Drawing from Art.

Thomas and Silk reviewed both the traditional position of not
allowing copying and the position that copying could assist students and decided that:

"The available evidence, in our view, suggests that it may be important to encourage children to develop their own solutions to graphic problems, while not preventing them altogether from copying new graphic formulas which they can adapt in their own work" (1990, p. 153).

After my experience with Balwinder I have become open to students using copying to facilitate their learning. However, I concur with the conclusion of Thomas and Silk.

My future teaching would emphasize the utilization of problem solving to help my students develop their images. Though, when I was aware of my students copying other graphic images I would encourage them to find a way to modify or extend the copied image to create a unique version that was their own. I would no longer say no to copying. My pedagogy had been changed.

PJ Jenn constructed her images in a completely different way than either Rubinjeet or Balwinder. Though "There is...a common tendency to start drawing near the top of the paper and to move from left to right"(Thomas and Silk, 1990, p. 76), I was not prepared for the way that she developed her images. PJ Jenn knew what she wanted her finished image to look like before she started and then she deductively constructed her image. Predrawing her images in pencil strengthened
her deductive construction method.

Drawing on the computer created some construction problems for PJ Jenn when she did not always reserve space for sections that were to be added on top. For some later images PJ Jenn would stop her downward direction and draw main parts that she did not want to move once she had completed them. The computer medium had made PJ Jenn rethink how she constructed her image so the process would be easier.

My current research findings made me realize that I had only started to understand how my students constructed their images. How many different ways do my students construct their images? Which methods of construction encourage aesthetic ideation images? I am convinced that focusing on how students construct their images would be a good topic for future research.

Their Tool Choices

Even though Gardner was talking about artists in general, his comments reflect how my students responded to the computer graphic tools they used in ClarisWorks 2.1. "The more they work with and explore the medium, the more they intuitively know its possibilities and the more readily and tacitly they can integrate themes and elements, which, even in a first sketch, resonate with one another" (1980, p. 269).

Rubinjeet relied on geometric shapes to create her images, which
allowed her to limit her tool choices. When she started to see a need to add texture and patterns to her images, she concentrated on the fill tools. Freehand drawing was nonexistent until she tried drawing a path. Rubinjeet had been quick to abandon freehand work and go back to her filled geometric shapes. However, her creative use of the eraser indicated that she had become open to more explorative ways of using selective graphic tools, to strengthen the textural focus she had for her images.

Balwinder overcame most of his technical concerns, by being able to repeat previous solutions in new situations, as well as modify the solution when needed, allowed. However, when stuck with a problem he could not solve on his own, Balwinder tried any suggestions offered by those who were available to share their thoughts. His images were a blend of geometric shapes, but with the addition of the basketball player Balwinder started to do some freehand drawing. Balwinder had become a competent user of the ClarisWorks' graphic tools by the end of the study.

At first, PJ Jenn had limited her tools more than either Rubinjeet or Balwinder. Whether she had worked on a paint document or a draw document, her focus had been on creating line drawings. She gained control of all the line tools available and freehand drawing was used within all of her images. PJ Jenn had learned to use fills to add greater realism to her line images by adding textures that were as close
as she could get to the way she saw her subjects/objects.

All three sample students gained control over some of the computer graphic tools. Knowledge of the tools that they needed, to say what they wanted about their image, were acquired. As Thomas and Silk stated, "...children may find drawing satisfying if it provides them with a sense of mastery over the medium as well as the topics and situations portrayed" (1990, p. 65). My students had been more than satisfied with their experiences with computer graphics.

**Cooperative Interactions**

As the study progressed, I realized that what I had earlier called cooperative learning might be better discussed as cooperative interactions. Therefore, the term cooperative interactions replaced cooperative learning for the purposes of writing this study.

While the students developed their individual themes, they worked with a partner. How they socially interacted with one another was important for me to monitor, as well as how they interacted as they combined their separate themes into a shared image.

**Separate Images With a Partner**

Three distinctively different groups were represented by the sample students and their partners. During the time that the individual images were being developed, the students were learning how to use the ClarisWorks graphic components for the first time. Initial support to help each other learn how to use the tools had been
Rubinjeet and her partner, Andrew, both had strong wills and both had needed to learn how to work closely with one another. The fact that a noticeable change in how they interacted after being selected as one of the sample groups indicated that they had greater awareness and control of their behavior than they had been first willing to use. Body language between these partners had been more often negative than supportive, and one incident of physically pushing her partner’s hand away had been observed.

Rubinjeet would attend to Andrew when he knew how to help her, but he was not always eager to help. At these times, Rubinjeet used the strategy of talking out loud and then if Andrew did not answer her she would not be hurt, and if he did respond she would listen to him. However, Rubinjeet could not be relied on to help Andrew either. When working on individual images Rubinjeet and Andrew only had moments of cooperative interactions. They learned new computer skills more often from observing how their partner worked on the computer. Until the time they started their shared image, they had simply tolerated one another, with moments of shared interactive learning.

How different it had been when I observed Balwinder and his partner, D.J., as they positively interacted through the entire study. Though Balwinder was not always willing to take his partner’s advice,
he was always willing to listen. This cooperative attitude was mutual, as D.J. always listened to Balwinder. They mutually respected each other’s opinions and sought each other’s suggestions when tackling something new.

Balwinder trusted D.J. and would allow him to direct some parts of his image development step by step. Open communication was evident and appreciated as they had forged a positive working relationship. However, when D.J. was absent, the negative side to this relationship became evident. Balwinder was not as productive with D.J. absent. He relied on D.J. to converse about what was happening. The need to know answers to problems he could not solve himself could have caused major stumbling blocks, but he forged ahead by asking questions of myself and his neighbours. I believe the positive interaction with his partner had made it easier for him to reach out to others when his partner was absent.

Compared to Rubinjeet and Balwinder, PJ Jenn had an on-again-off-again cooperative interaction that occurred with her partner, Elaine. When a new tool or a new strategy was used, both partners would attend to one another. At these times, student-student interaction was high.

PJ Jenn and her partner showed their lack of full commitment to one another when they pushed their chair back and distanced themselves from their partner, when their partner worked on the
computer. At times these two even walked away and observed other students working on their computers. However, when their partner needed to discuss strategy or needed advice they immediately attended to their partner’s query. This had been a relaxed, interactive relationship where neither partner felt committed to constantly attending to her partner.

Definitely there was room for improvement in the interactions between Rubinjeet and Andrew, but improvement had occurred. Balwinder and D.J., on the other hand, had a powerful interactive partnership. However, when his partner was away Balwinder’s overly dependent nature on his partner appeared as a deficit, until Balwinder developed the strategy of including others when he needed help. The relationship between PJ Jenn and Elaine had seemed positive, but not constant. They learned to help each other when asked.

Regardless of which pair I looked at, the final conclusion was that student-student interaction with a partner had helped the students develop their individual images. The degree of help needed from a partner was dependent on the individual. Learning to be a flexible resource for a partner, appeared to be the most valuable form of student-student interaction a partner could offer.

Their Shared Image

Positive student-student interaction was necessary for my students to have success completing a shared computer image. Kakas defined
this form of student interaction as "communication that is structured by teachers (small-group projects requiring collaborative efforts and peer-tutoring activities)" (1991, p. 21). My sample student pairs all dealt with the shared image experience in a different way, but in the end all three pairs agreed that they preferred working with a partner when developing a shared image.

Both Rubinjeet and Andrew interacted with one another about their shared image in a more positive manner than when they were working on an individual image. By what I observed, interaction between Rubinjeet and Andrew could now be labelled as cooperative interaction. Rubinjeet's response journal listed some supportive comments for working with a partner. However, when I informally interviewed Rubinjeet well after the study ended (June 17th) her desire to do her own image and her reluctance to have someone else's image merge with hers was evident. After critically reflecting on this fluctuating data, I remembered that Rubinjeet had enjoyed doing the shared image, and I had seen and heard her excitement in the studio. I now determined that, with more experiences of constructing shared images with different partners, Rubinjeet would probably become a stronger advocate for working with a partner.

Balwinder and his partner developed even stronger bonds as they positively interacted while developing their shared image. Throughout the sessions they had been model students who had
demonstrated enthusiastic involvement. Who was on the computer was determined by what needed to be done next, and who they felt would do the best job. The person not on the computer continued to interact by giving suggestions or answering questions. It would be interesting to follow these two students again to see how they would interact with new partners.

I am left with the questions, how can I help establish partners that would work as well as Balwinder and D.J.? On a second pairing of partners, what would happen if I picked their partner? If I let them pick a new partner, what would happen?

During the first session to develop a shared image PJ Jenn and Elaine were more focussed on watching what they each did while they were not on the computer. They needed to work on developing strategies to feel comfortable with acknowledging each other's opinions within their shared image. PJ Jenn and Elaine did pre-entry planning and once the first session had established their starting place, both students were content to wait their turn on the computer. They knew what they wanted to do and they did it, but interaction after the first session was only when requested. Time on the computer was dependent on the image, not on the amount of available time shared equally.

Developing shared images proved to be a more powerful way of building cooperative interactions between a student and his or her
partner. How else could a teacher intervene to encourage cooperative interactions when doing computer graphics? Do my students need to learn the technical skills of computer graphics by doing individual themes? Could my students start with shared images and learn the tools together? Further research is needed to understand the potential benefits of student-student cooperative interactions on student artistic development.

How My Student's Computer Images Changed During The Study

Rubinjeet's computer images developed into full page compositions which had started as simple geometric shapes with the position of the chimney reflecting the schemata of early childhood (Gardner, 1980) (See figure 1). Filling the geometric shapes with appropriate patterns and using the eraser as a creative tool to add patterns within patterns enhanced her images. Though there was only an occasional hint at freehand drawing, Rubinjeet was aware of her options.

Balwinder concentrated on detail in his images as he experimented with many different ways of presenting the basketball pole, backboard, and hoop. The addition of unique people to his images represented a significant change not only to his image, but to his confidence in tackling new content.

PJ Jenn used line to develop her images. Concentrating on changing the view of her elephants and the setting, kept her focussed.
By adding fill patterns that were as close to realistic as PJ Jenn could find, her images became more complete.

The three sample students created images that demonstrated their ability to control the computer graphic tools they had needed to develop their own original computer art. Each of the sample students learned how to interact with their partner, and when needed, other classmates.

My Students: Attaining Class Empowerment

The impact of the computer art unit on my students had been impressive to observe, but the voices of my students had a chance to be heard when they completed the post-entry in their student response journals. The responses were positive towards working on computers and student goals for working with computer graphics had been met during the study. When asked about what they had learned, the students had started to share thoughts and feelings about their image. Specific situations, that my students wanted to learn about in computer graphics, could now be stated clearly by two-thirds of the class. They knew what they wanted to learn.

Perhaps the most significant response was when the majority of the students (87.5%) reported that they preferred working on a shared image. However, this did not mean they did not want to do separate images, in fact, they indicated that doing separate images had helped them when they worked on a shared image. Future computer art units
should have both individual and shared images, but the number of
shared images should be increased.

The general format of instruction and studio time was appreciated
by students. Some students wanted to know more about the tools at a
faster pace, however not all students would be able to handle large
amounts of information without trying it. A possible solution would
be to have students in the studio stop and share significant 'finds' with
the class.

**Compared Findings Based On Previous Studies**

Chia and Duthie (1993) reported that interactions between paired
girls were more cooperative than interactions between paired boys.
Even boy-girl groups appeared more cooperative than paired boys. By
referring to what happened with my sample students and their
partners, my findings did not reflect the same results. In my site
specific study, the group of two boys interacted the best, and the group
of two girls interacted better than the boy-girl group. However, the
discrepancy between the two studies findings could be the difference in
cultures or simply the fact that the number of students observed were
low. Further research is needed to determine the effect gender has on
student interactions while working on a computer to develop original
images.

Chia and Duthie (1993) also reported that when their students
constructed computer images, both inductive and deductive thinking
had been observed. My findings supported theirs as I found that both inductive and deductive thinking had occurred and in one instance, a combination of thinking had been used.

Concern for the ownership of computer art images, that was experienced in Freedman's (1982) study, was not experienced during my investigation. I believe a significant factor in eliminating this concern was the presence of more computers in a studio setting. This allowed computer image production to occur with two students to one computer, rather than one computer for the class. However, the fact that my students had each chosen a different theme and that Freedman's students all had the same theme was probably a contributing factor as well.

In both my current study and Freedman and Relan's (1992) study, image development increased as students became more familiar with computer tools, and their concern for production problems turned to an emphasis on ideation. However, I was not able to determine production and ideation comments/actions in terms of statistics as Freedman and Relan had done. Production type comments dominated my students' written response journals, and though ideation comments had been expressed more during informal interviews, they had rarely been recorded in their journals. I concluded that the age of my students and their previous artistic experiences had been a factor in the way they talked and wrote about their image.
Implications for Theory, Practice, and Research: A Place To Start From

The summation of the main points learned while researching how my students learned to develop original computer art in a studio setting have been listed below, with the full knowledge that the comments are site and situation specific. Conclusions have been placed beneath the research question they refer to.

The secondary research question, How do students use cooperative interactions to develop individual and shared original computer art images?, findings include:
1. Students exhibit more cooperative interactions with a partner when developing a shared image than when working on individual images.
2. When creating a shared image, each student’s time on the computer is usually determined by what needs to be added to their image next, rather than dividing the time in two.

The primary research question, How does the students’ original computer art change over the course of the study?, findings include:
1. Students with strong personal connections to their themes benefit from an extended time to develop their images.
2. The development of student portfolios during theme development extends students’ understanding of their topic from a variety of viewpoints and enhances image development.
3. Some students have an innate awareness of how to balance the composition of their drawings, but others need assistance in learning
how to balance compositions.

4. The mental images of students increased in complexity when they were personally connected to their theme.

5. When developing their images, students should be encouraged to do their own problem solving, but if they copy teachers should encourage them to extend the copied image.

6. Students who construct their images deductively may need to modify their approach when parts of their image overlap.

7. When students construct their own personal cognitive toolkits for the computer, they are more prepared to develop their own original computer art.

8. Students' images develop at different rates, but all students' ability to create more authentic original computer art does evolve over an extended computer art unit.

The overarching research question, *How do students learn to develop original computer art images?*, findings include:

1. Students with low personal connections to their image can increase their connections by choosing their own theme and developing several image variations. Increasing students' personal connections to their images increases cognitive learning and desire for skill development.

2. Students with low communication skills (reading and/or writing and/or speaking) when personally connected to their themes will grow in oral communication skills as they share about their images.
3. Students' use of boundaries, shape and size, for their computer images need to enhance their ideas for their image.

4. Students construct their images by using inductive thinking, deductive thinking, or a combination of both.

5. Mental images are used by students to construct their compositions.

6. Using pencil and paper predrawings can help students create images on the computer, but some students prefer working directly on the computer.

7. Different levels of student ability cannot always be determined by the tool choices that students make when developing computer images, because they will only use the tools needed to develop their image.

From my perspective as a researcher, in order to grow in understanding within my class, my process of coming to know how to do research will continue to evolve as I start again to research my concerns and my interests. From my perspective as a teacher, my pedagogy has been transformed for having done this study, as I have a clearer understanding of how my students develop original computer art images. Future key research questions for me include: What would happen if the students determined the shape and size of their images' boundaries when developing their computer art images? If the teacher changes the shape and size of the boundaries set for image development, how would the students' computer images be affected?
What percentage of students use copying as one of their learning strategies? How many different forms of copying are used? When students are paired, how many different ways can they develop a shared image? Of the methods tried, which one most effectively encouraged the use of student-student, cooperative interactions? As I explore these new interests within my art class, my classroom will be a richer learning environment.

The results from my study affirmed my decision to use qualitative research in the form of action research to explore the computer art studio. Both the students and I, the teacher/researcher, obtained a deeper, richer understanding of the learning experiences explored within the computer art unit. My students became co-learners, whose voices were heard and responded to by me, their teacher, and I became a learner taught by my students to understand, from a different perspective, the experiences we shared within our class (See Appendix G for my reflective overview: An Alpine Experience). The result for me, as the action researcher/teacher, was an awareness that by using action research within my class, research based learning was both meaningful and exciting.

This study has laid the foundation for future research on how students develop original computer art. The themes of image development and cooperative interactions, as well as the categories under each, are all worthy of separate future research. To list only a
few: What affect does the students’ personal connections to their theme play in producing original computer art images? What percentage of students use inductive thinking and how many use deductive thinking when they develop images on the computer? When students are permitted to copy as they produce their computer art, how can a teacher encourage them to modify the image so it becomes their own?

These questions could be asked for not only computer art, but also for the traditional art mediums. Questions answered for computer art could then be compared to the traditional art mediums. Choosing one question to begin with will be a difficult choice, but my professional curiosity will demand that I select one to develop through future research. The richness of my findings have raised more questions than were answered.
References


Croft, R. S. (1993-1994). What is a computer in the classroom? A Deweyan philosophy for technology in Education. Educational


Appendix A

Questions From Student Response Journals

Student Journal: end of session 1 (March 31, 1994) and repeated for sessions 2 to 5:

1. What did you discover today?
2. What new questions do you have?
3. Comments on Today:

Student Journal: end of session six:

1. What did you discover today?
2. What new questions do you have?
3. What part of your image did you like best? Why?
4. If you were to do this image again, what would you change? Why?
5. How does your computer image compare to the image you have in your mind?
6. Does your image have parts that were easier to do on the computer than if you were drawing by hand? If yes, why is it easier on the computer?
7. Any additional comments you would like to make:

Student Journal: end of session seven:

1. What did you discover today?
2. What new questions do you have?
3. How did you decide what to do next?
4. If you were to do this image again, what would you change? Why?
197

5. What part of your image did you like best? Why?

6. Does your image have parts that were easier to do on the computer than if you were drawing by hand? If yes, why is it easier on the computer? If no, why isn’t it easier?

7. How does your computer image compare to the image you have in your mind?

8. Any additional comments you would like to make:

Student Journal: end of session eight:
1. What did you discover today?
2. What new questions do you have?
3. How did you decide what to do next?
4. If you were to do this image again, what would you change? Why?
5. What part of your image did you like best? Why?
6. Does your image have parts that were easier to do on the computer than if you were drawing by hand? If yes, why is it easier on the computer? If no, why isn’t it easier?
7. How does your computer image compare to the image you have in your mind? Do you like the new image? Why or why not?
8. Any additional comments you would like to make: ie. What do you plan to do next day?

Student Journal: end of session nine:
1. What did you discover today?
2. What new questions do you have?
3. How did you decide what to do to finish your image? What makes an image finished?
4. If you were to do this image again, what would you change? Why?
5. What part of your image did you like best? Why?
6. Which image did you choose to revisit? Why?
7. Now that you’ve revisited your picture, do you like the new image? Why or why not?
8. Any additional comments you would like to make: ie. What did you think of having 45 minutes each in the lab?

Student Journal: end of session ten:
1. What did you discover today?
2. What new questions do you have?
3. How did you and your partner decide what to do next on your image?
4. How do you feel about working with a partner to create an image?
5. How do you feel about the picture you made with your partner?
6. What part of your image do you like best? Why?
7. When you work on this image again next week, what would you change? Why? or if you don’t think you’ll change anything why not?
8. Any additional comments you would like to make: ie. How much time do you feel you and your partner need to complete a computer picture? How do you know when you’re finished?
Student Journal: end of session eleven:
1. What did you discover today?
2. What new questions do you have?
3. Today, how did you and your partner decide what to do next on your image?
4. After working with a partner for two sessions on the same image, how do you feel about working with your partner? Why?
5. How do you feel about the picture you completed with your partner? Why?
6. What part of your image do you like best? Why?
7. When you revisit this image next week and save a second version: (a) what would you change? Why? (b) What would you add? Why?
8. Any additional comments you would like to make: ie. What do you think about revisiting this image next week to use it as the beginning of a second picture?

Student Journal: end of session twelve:
1. What did you discover today?
2. What new questions do you have?
3. Did you finish your shared image: ___today? ___ last day?
4. Did you try a second picture (a revisit) by making changes to your shared image?
   If yes, what do you think of your new image? Why?
   If no, what did you do instead? Why?
5. What do you think about working with a partner on a shared image? Why? (Use a T-chart to share as many thoughts as you can.)

6. If we were to do another picture would you want to: (check one please)
   - work alone on your own theme
   - work with a partner on your own theme (each person does a picture)
   - work with a partner developing one picture together

Why did you choose this one?

7. Any additional comments you would like to make:
March 31, 1994:

First Journal Entry Prior to Study:

1. Do you like using computers? Why or Why not?

2. Do you use a computer outside of school? (not Nintendo/Sega)

3. If yes, please fill in the following:
   (a) Is the computer you use in the home? or?
   (b) What kind of computer(s) do you use?
   (c) How many hours per week do you use it?
   (d) Do you use the computer for doing Art work?
   (e) If yes for (d): What programs have you used to do Computer Art?

4. What are you hoping to learn about Computer Art by the end of the study? (If you need more room, please turn over and continue on the back. Thank You.)
Appendix C

Computer Art: Criteria For Choosing Sample Students

Image Development: Process/Response/Product

I. Low Ability:
   a) simple use of tools to develop images
   b) can save images and recall them to the computer screen
   c) can use the tools to start developing images
   d) reluctant to explore a variety of tools
   e) limited creative images
   f) images have remnants of the Preschematic Stage:
      i) There is a relationship between the child’s idea and product
      ii) shapes tend to be geometric
   g) some Schematic Stage evident:
      i) base line may appear as theme is developed
   h) Questions that give Evidence of Knowledge and Comprehension:
      i) Knowledge: - What is...? What did...? Where was...?
      ii) Comprehension: - Describe... Tell how...

II. Medium Ability:
   a) limited use of a variety of tools
   b) images have a creative element evident
   c) Schematic Stage evident:
      i) objects start having more detail
      ii) an understanding of spatial relations is evident
iii) in the same picture objects may appear from different points of view

d) Comprehension and Knowledge levels have been understood as in the Low group, but additional work is occurring.

e) Questions that give Evidence of Analysis and Application:
   i) Analysis: - Why is...? In what way might...? Which of these would...?
   ii) Application: - When might you...? Where could you...? Which would you use if?

III High Ability:

a) creative thinking evident
b) a variety of tools used expressively
c) evidence, through observation, of synthesis and/or evaluation in process or response
d) starting to create something that they know
e) some Post-Schematic Stage indicators:
   i) overlapping and relations between objects
   ii) attempts to show depth through object size
   iii) emphasis is on detail
f) Knowledge, Comprehension, Analysis, and Application levels have been understood, but additional growth is evident.
g) Questions that give Evidence of Synthesis and Evaluation:
   i) Synthesis: What would happen if...? Devise a plan to...
How can you explain...? How many ways can you think to...?

ii) Evaluation: Is...accurate? Why do you think so? How well did...? What is the most important...? Why? How well did...? What are the chances that?
Appendix D

Computer Art: Criteria For Choosing Sample Students

Interaction During Image Development: Process/Response

I. Low Interaction:
   a) Their talk about their own work is limited.
   b) Little, if any, of their talk is about the work of others.
   c) Influence of others on their work is minimal.

II. Medium Interaction:
   a) They ask questions of themselves and/or their partners.
   b) They interact with their partners for both application and analysis.
   c) They talk about their own work.
   d) They talk about the work of others.
   e) Their partner influences their work.

III. High Interaction:
   a) They talk about their own work.
   b) They talk about the work of others.
   c) Their partner influences their work, but they are also curious about what other groups are doing.
   d) They observe and ask questions of students besides their partners.
Appendix E

Final Questions From Student Response Journals

Post-Journal Entry for Computer Art Study:

1. Do you like using computers? Why or Why not?

2. If you use a computer outside of school:
   (a) Is the computer in the home? or?
   (b) How many hours per week do you use it?
   (c) If you use your computer for doing Art work, what programs have you used?

3. During this study did you learn what you wanted to learn about computer art?

4. What did you learn about Computer Art Images?

5. What would you like to learn about Computer Art another time?

6. Which did you prefer, working on a separate image or a shared image with your partner? Why?

7. Did it help to learn on your own image before working on a shared image? Why or why not?

8. Suggestions for the teacher to use when starting a new class on Computer Art?
Appendix F

Why I Valued My “Critical Friend”!

1. The strength and encouragement of another person: when you stumble or hesitate someone knows what you are after and encourages you to push past that moment to the completion of the ‘common goal’.

2. Two perspectives on the same scene varies: a diverse view allowed me to see more/know more/learn more.

3. Bob was a data gatherer: When present he recorded through photographs and video so that I could see and analyze the tape and photographs when I was out of the studio setting...what had happened?

4. Bob was a technician: keeping the technology running - trouble shooting, and helping ‘me’ to learn how to trouble shoot.

5. Bob was someone to reflect with: to bounce ideas off.

6. Perhaps the biggest reason I, as a researcher, experienced success and growth during the computer art unit was the fact that my ‘critical friend’ was already a friend/a teacher/an enthusiastic learner/a willing partner. I valued him as a team player, a computer expert, and a lifelong learner. I felt comfortable working with my ‘critical friend’.
Appendix G

An Alpine Experience

Computer Graphics

When starting out, I need to:

determine my destination,
select my supplies, and
pick my path for the upward climb.

As experience dictates, I need to:

adapt my equipment and adjust my thinking,
repair injuries, and even prevent further, then
choose the path to follow, or create my own.

Having reached elevation, I need to:

set up camp to welcome the night,
reflect on my accomplishments, and
plan for the day.

Awakening on more even ground, I need to:

remember the way, by retracing my footsteps...then
explore the environment, and
experience the pleasure.

In the midst of a sudden storm, I need to:

collect my knowledge from the moment,
perceive the adventure, and
learn to move on, when the sun’s out once more.

From the warmth of the fire, I need to:

sleep soundly and awaken refreshed,
travel on through discovery, and
pause...to reflect on the landscape.
When meeting a traveller, I need to:
    share in the excitement, of
    hearing his story, and
    the merging of minds.

Yet when we plan for tomorrow, I need to:
    prepare to change my direction,
    overcome road blocks, and
    accept unknown surroundings.

When getting a fresh start, I need to:
    stop and get my bearings,
    test the wind, and
    find my own way.

With confident footsteps, I need to:
    set out for the meadow, and
    knowing I can do it -

    I sing on the way.

The splendor before me
    It's Mine for the taking
    I... play in the moment
    I... share my delight!
    It's... such a sight!

The climb was exhausting,
    the view so breath taking.
I'll... never forget it.
    This... experience of Mine!
    After... such a long climb!
        And now I've... crossed over the line!

    It's Mine!

(Written by Joanne Bell, assisted by Lorrie Miller, who through her singing helped transform the last two verses).