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ABSTRACT

This conference paper describes the use of integrated media-oriented instruction in a self-contained class at Yokohama Municipal Elementary School in Japan. Three students with mild disabilities, in grades 5 and 6, participated in the project. Integrated media (IM) is defined as the linkage of text, sound, video, graphics, and the computer in such a way that the user's access is nonlinear and virtually instantaneous. The hardware (including two Macintosh computers, a CD-ROM, a digital camera, a videorecorder, and a scanner) and the software (including HyperCard, assorted HyperCard stacks, and several software programs) were placed throughout the room to provide easy access. Students became comfortable using these tools at any time they felt it would enhance their learning. Using the IM resources, students constructed puzzles, made movies, constructed toys and machines, made a map of Japan, and completed other activities. The paper concludes that the teacher's approach to incorporating IM into the curriculum dictates its effectiveness. Teacher training needs to focus on programming, knowledge of equipment, learning theory that supports use of IM, and instructional design techniques that enhance IM. The need for parental involvement in the project is also emphasized. (Contains 20 references.) (JDD)

Uses of Integrated Media Instruction in a Self-Contained Class for Children with Mild Disabilities

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This study examines the effects of Integrated Media(IM) instruction for children with mild disabilities and their teachers and discusses approaches to design and study of IM applications. The participants in the study were three children attending a self-contained class in the Yokohama Municipal Elementary School, Japan. It was found that IM instruction provided multi-dimensional learning experiences to help children with cognitive problems go beyond the traditional instruction, taking their learning in multiple directions rather than following a linear instructional path. Teachers reported that the data show on the monitor screen enabled them to more precisely determine whether children understood skills presented during the instruction. They also reported positive responses from parents who were impressed with what their children had accomplished.

1. Introduction

The nation's public school system faces the challenge to increase educational service options for students who have problems in learning that are not being met and to enhance the quality of ongoing educational service provision to students in regular schools. The number of at-risk children with reading and writing difficulties has been estimated at 5-6% of the total school population in a preliminary study of elementary schools (Yamada & Banks, in press). This study shows that approximately 6% of a sample population in elementary schools have difficulty in reading units of Chinese characters, in two phonetic systems, and in simple, logical calculation.

To enhance the outcomes of Japanese public education, the creation of more goals for students, the provision of curricula and instruction that stimulate students' learning, and the organization of schools to prepare students to function productively in contemporary society is vital. However, these changes require restructuring of the current goals, scope, and outcomes of education.

1.1 Computer Technology in Schools

Technology has the potential to transform the relationship between teachers and students and even to change the relationship between teachers and parents, but there are reasons to expect that this will not be the case with current and future technologies. This is because the power, versatility, portability, and utilization of today's technologies are altogether different from those of the past. An example of this change can be seen in comparing current video technology with the instructional television of the past. A large screen monitor in the classroom, connected directly to a multichannel cable system with a VCR and videodisc player, provides immediate access to a wealth of visual material and offers easy control over scheduling and sequencing. Using a digital camera and camcorder, low cost video production has become possible. These technologies bear little resemblance to instructional television of the past, with its narrow range of instructional software and limited versatility. However, integration of media and technology represents a potential transformation of the relationship between the teacher and the student, and even the physical appearance of the school. Interactive computer function has been added to existing media for a variety of student usage.

1.2 Integrated Media-Oriented Instruction

"Integrated media oriented instruction (IMOI)," allows students to manipulate and interact with information in ways that traditional tools do not allow. They learn to analyze, synthesize, and solve problems with information that they have taken control of as active learners. IMOI helps those students who have difficulty learning in traditional ways to tap their strengths so they can find ways to communicate and represent the knowledge and understanding they have of their world. IMOI also helps students to find new ways of applying knowledge to develop basic skills. Teachers need to be prepared for students to become problem solvers in an educational environment of integrated media-oriented instruction. In this paper, the phrase "integrated media (IM)" is defined as a combination of multisensory and multiple media. It is, " the linkage of text, sound, video, graphics, and the computer in such a way that the user's access to these various media is non-linear and virtually instantaneous (Hasselbring, Goin & Bransford, 1991).

This article describes the use of technology in integrated media-oriented instruction in a self-contained class of a primary school in which four students receive special educational services. The rationale for providing media- and problem-rich environments that can be explored and discussed by students is given, and the implications of IM relating to current theories of learning and cognition in education for the handicapped are explored.

2. Integrated Media

Multimedia and integrated media are terms used interchangeably. Multimedia is said to be a term inherited from events of the early 1960s; a kaleidoscope of music, performance, slide show, mirrored balls, coloured oils projected on an overhead projector. Computers were first referred to as multimedia devices in 1984, at the Massachusetts Institute of Technology (MIT) Multimedia Laboratory. Originally used to designate important advances made possible by HyperCard, it appealed to those who were familiar with the word's original usage, and was at least partially reinvested with this meaning. In Japan, awareness of multimedia occurred during the late 1980s through computer marketing, with no such cultural referents. The term "interactive media" found common usage through its adoption as a byword for new telecommunications technologies such as ISDN. However, a lack of consumer interest has meant that for the time being, at least, most ISDN installations are in the provinces, a governmentally driven market, funded by regional development moneys.

Recent developments in information technologies enable us to use interactive video as well as text, sound, and graphics within a computer. A mode combining these types of media and interactive computer programmes can be referred to as "multimedia," "hypermedia," or "integrated media." Even before this, many researchers expected and stressed the many advantages of computerized instruction for children with learning difficulties (Cogen, 1969; Conners, Caruso, & Detterman, 1986; Bull, Cochan, & Snell, 1988).

The Cognition and Technology Group at Vanderbilt (CTGV) has been using the term "integrated media' rather than "multimedia" since 1991 because, as they suggest, "... it reminds us (that) our goal is to integrate media in ways that facilitate learning, which is different from the goal of simply multiplying the number of media available to learners (CTGV, 1991)"; and "... as we believe that it is less ambiguous and that it more adequately describes the process of using diverse media (Hasselbring, Goin, & Bransford, 1991)."

Researchers have reported the effectiveness of using computer controlled laser disc players (Sugai, Baba, Niizuma, Matsumura, Honda, Katou, & Sumida, 1984; Osksa, 1987; Hasselbring, Goin, Wissick, 1989; Hasselbring, Goin, Bransford, 1991; Munekata, 1992a), video tape recorders (Kuroki, Kabumoto, Hukano, Shigeto, & Munekata, 1990), small size robots (Munekata, 1992b), and digital video such as QuickTime (e.g.., Narita, 1993), video for Windows, and live movies. Higgins and Boone (1991) report positive results in using hypermedia CAI. Their CAI was focused on linkage of text, voice, and graphics. School teachers and companies have also published practical software such as discrimination learning software (Saito, 1993), and talking books (e.g., Living Books and William Morrow, Inc. 1993), which are currently in use.

The pedagogical opportunities provided by IM can be summarized as (1) developing vocabulary and reading vocabulary, (2) anchored instruction in meaningful contexts, and (3) fostering generation of knowledge (Hasselbring, et al., 1991). In addition, other research has shown that three major advantages in using the IM approach for students with learning difficulties. The first is visual support for comprehension (CTGV, 1991). The second is the promotion and facilitation of communication between teachers and students (Kikuchi, Matsumoto, & Takuma, 1991). The third is use of the IM approach so that the teacher can use meaningful contexts to teach specific topics (Hasselbring, et al., 1989; Kuroki, et al., 1990). It is clear that these results strongly encourage the use of IM technology in research and practice in special education.

Hasselbring, et al., (1991) have proposed two major problems in the application of IM technology to the teaching of children with learning difficulties - Navigation and Focused Attention. The first, to be solved immediately, is that a non-linear learning environment presents such a serious challenge to learners, especially the learning handicapped, that the child may be in danger of getting lost in a large "information space." The second problem to be overcome occurs when the child uses a two-screen rather than a one-screen IM system, because the use of the two-screen system involves switching attention.

As mentioned above, there are few researchers in this field; few teachers and other staff with adequate knowledge of IM, and limited quantities of software products and equipment for IM use in the classroom. It is obvious that a greater research effort focused on using IM for children with learning difficulties is required.

3. Method

3.1 Subjects

The participants in the study were three students (A, B and C) attending a self-contained class for students with mild disabilities in the Yokohama Municipal School, a school with an enrolment of 500 pupils from first to sixth grade. The children were integrated with their age peers for extra curricular activities after school hours.

Student A (6th grade) was highly motivated to attend the self-contained class and participate in classroom activities. His articulation was good, he was friendly and cooperative with his classmates and teachers, has a good vocabulary, and spoke with adults using age-appropriate manners. However, student A had learning difficulties with math, reading, and language. At present, remedial focus is on practicing addition, subtraction, counting, sorting, and constructing. He has an alternative keyboard with a hiragana layout, and his father reports that the keyboard meets his son's need for writing letters and sentences on the monitor screen.

Student B (5th grade) was able to read, write and calculate very well, but had a verbal communication disorder and was emotionally unstable. He was verbal, but was usually reticent during group instruction sessions; he rarely initiated a conversational turn and, therefore, much of the detail of his spontaneous language abilities was unknown. He was able to play the xylophone superbly, and occasionally demonstrated his skills in concerts with his younger sister. At present his is provided with additional remedial language learning at a private Juku. He has no problems with math drill and practice, and demonstrates an interest in problem solving features of computer software such as 'Edmark's' products.

Student C (5th grade) had low self-esteem, and various other learning difficulties, although the specific nature of her learning difficulties was unknown. She was motivated towards school, and demonstrated an intense interest in working with software on the Macintosh; she had a tendency to work independently while her peers worked on certain software products. Her verbal communication skills were age-appropriate.

Figure 1 A small class

In addition to teacher assessment of performance, subjects A, B, and C were evaluated on the following prerequisite computer skills: (a) on a verbal command to look at the screen, the student was required to manipulate a mouse and browse the screen, (b) on being shown a mouse button, the requirement was to manipulate it to drag down the 'pull-down' menu, and (c) on a verbal command, the student was required to perform various tasks on a screen.

3.2. School

The subjects' school is located in an economically affluent, culturally homogenous section of Yokohama, the fourth largest city in Japan. The community is said to be one of the most prestigious residential areas in the city. The school enrollment is relatively small (500 approx.), and most classes have a teacher-student ratio of 1:35. Only four students have been identified in this school as handicapped, and are placed in the self-contained class with a teacher-student ratio of 2:4.

3.3. Teachers

Two teachers (A and B) volunteered to participate in the study. Teacher A has 10 years teaching experience with mildly handicapped children, and had been at the school since 1991. Teacher B has 15 years experience, but no special training or certification in special education. She has been at the school since the spring of 1994. In terms of computer experience, Teacher A was familiar with word processing, but not with instruction in word processing. Teacher B had neither experience in computer use for management, nor in instruction.

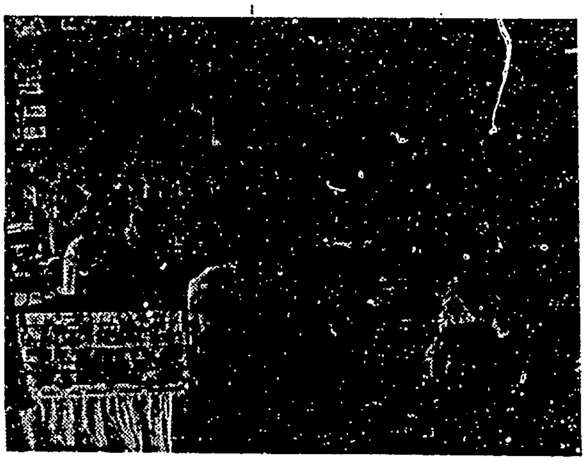


Figure 2 Teacher/student rario is 1:1..

Preparation of the teachers was undertaken by one of the researchers. First, a variety of instructional software was demonstrated to familiarize them with aspects such as mouse manipulation, icon-driven desktops, file management, and hardware components, etc. In contrast to the teachers, the three children had no difficulty in the use of the mouse and desktop management. In fact, the reverse occurred - the teachers learned from the students.

3.4. Hardware and Software

The hardware was part of the Yokohama City Public School's computer resources. They included a Macintosh LC with internal and external hard disc drive, a Macintosh Classic with internal hard disc drive, a CD-ROM, a digital camera, a VHS recorder, and a scanner.

The software used in the class included HyperCard (ClarisWorks, 1987), assorted HyperCard stacks, Kid Puzzle II (Musical Plan, 1993). Kids Studio (Cyber Puppy Software, 1994), KidsWorks II (Edmark, 1993), Science House (Edmark, 1994), Thinking Things (Edmark, 1994), Maze Mania (Blue Sky, 1994), and Yearn 2 Learn Snoopy (Image Smith).

3.5. Parental Cooperation

Parental participation and cooperation was one of the features of the study. Two parents of the subjects owned personal computers and used them with their children at home. They also were actively involved in a monthly meeting sponsored by a local Macintosh user's group for the handicapped. This exposure to hardware and software for the handicapped and the sharing of information with other members of the group seemingly empowered them. The enthusiasm shown by the children in the use of computers has convinced school administrators and classroom teachers that the computer in the classroom is an effective tool for students with communication problems and cognitive malfunctioning. As an extension of home instruction using computers, one parent donated a monochrome computer to the class, but an additional colour computer was purchased because a monochrome machine was not sufficient to provide IM instruction and learning.

3.6. Instructional Criteria

When technology is viewed as a tool to facilitate active learning and teaching for the handicapped, the following criteria were employed to explore the impact of IMOI in the class for mildly disabled students.

3.6.1. Classroom Management

The classroom was set-up with the conventional tools and resources for learning arranged to provide the students with ease of access rather than being located in isolated areas of the room, or having to be pulled out for various activities. Similarly, technological tools were placed throughout the room to provide easy access and so students did not require the permission of teachers, nor specific directions. Students became comfortable using these tools at any time they felt it would enhance their learning. Computer equipment is attractive, and its buttons, gadgets, and sounds intrigue children.

3.6.2. Invitation to Technology

Two teachers were advised that their students were using computers at home, but were unaware of how they used them, or what software and hardware was available. One of the researchers supplied equipment and gave time for them to discover how hardware is booted, what happens if a certain button is pushed, what a programme looks like, and what it can do. The classroom was arranged with conventional tools and resources for learning for ease of access and not placed in isolated areas of the school. Student's computers were placed throughout the room so that students could use them without specific teacher direction. Teachers were instructed in the use of the scanner, cam recorder, and digital camera. These devices provide a variety of instructional materials which are familiar to students; for example, student's still pictures, drawings, sounds, and video.

3.6.3. Student Autonomy

Once the physical environment was established, students had free access to all software stored on the hard disc, and were free to explore what was available. They switched the machines on and off, and learned how to navigate the software. In other words, they had complete control of, and access to the technology. Teacher intervention was limited to supplementing the child's learning with pencil and paper. On occasions, teachers encouraged the students to work on a certain piece of software through which teachers intended to teach reading, language, and math skills. Students took turns in using the machines. In this way, teachers led the learning process, and students followed.

Figure 3 Children can explore..

3.6.4. Access to Software

In the classroom, teachers use educational software in an integrated fashion, rather than as fragmented pieces of instruction. Students learn through topics that incorporate different curriculum areas and competencies that mesh in the development of various concepts. A number of HyperCard-based pieces of software were introduced to the class. Teachers allowed their students to explore what software was all about. On occasions, teachers examined and learned how to use them before they were tried by their students. These software programmes were teacher-made with themes relevant to the child's learning needs.

3.6.5. Exploratory Learning

In many cases, mouse-driven software programmes were easy to use; a menu or home card provides different sub-programmes and a link to the menu when the student has finished. Interface features of HyerCard, for example, are buttons and icons. Students find them on a screen and navigate them by clicking buttons. HyperCard programmes are called "stacks." Many teachers who work with Hypercard know stack guidelines in making stacks. One is to make stacks easy to navigate.

This means that an effective navigating system answers five basic questions (Apple Computer, 1989):

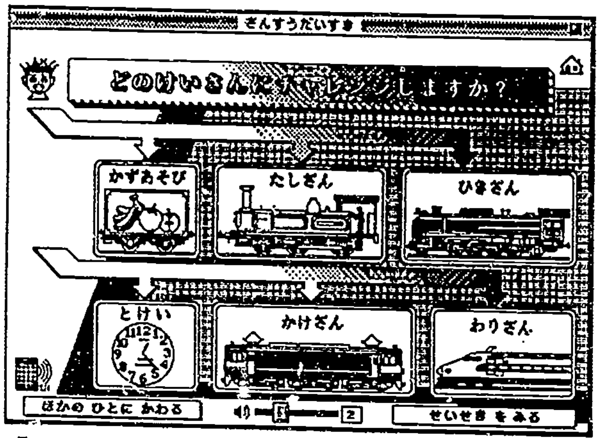
(1) What is in the software material?
(2) Where am I now?
(3) Where can I go?
(4) How do I get there?
(5) Where have I already been?

The need for easy, efficient navigation can help students and teachers determine the software's structure, in particular if the software contains a variety of tasks or complex information. A tree structure has been adopted for exploratory learning in the classroom that allows students and teachers the choice among several branches to follow the path that interests them. In this tree structure, this might be represented with a menu metaphor that in turn utilizes sub menus.

A tree structure students can easily navigate.

	Home Card	
Software 1	Software 2	Software 3
Software 4	Software 5	Software 6

Using this system of navigation, students and teachers were able to find what software to work on, what happens if a certain button is pushed, what a programme looks like, and what it can do. They could not be asked to accomplish specific tasks when there were many intriguing components for them to try out.



F.gure 4 Menu driven home card.

4. Outcomes

There were many results of the student's use of integrated media-oriented instruction on the computer. They researched a variety of instructional materials stored on the internal and external hard disc drives. They asked teachers and parents to click an activity icon. Teachers explained that students were able to see the explore and discover mode in each activity. Students pointed-out the framed pictures, explaining that when one of the characters was there, they could freely explore the situation to discover what happened. They were instructed that there were no correct or incorrect answers, and that they were free to experiment. They used two Macintosh machines, and while waiting for their turn, they even encouraged each other, and exchanged simple ideas.

A series of Edmark software brought to students a world of learning and hours of entertainment. Its fun-filled characters, animated pictures, friendly speech, and engaging music began a process of exploration and enquiry that allowed them to make sense of the world. As they engaged in more activities, they discovered the sequential nature of events, understood how things worked and predicted outcomes. They developed the fundamental skills of scientific literacy. This software has particular pedagogical characteristics that place more cognitive control in the hands of the student. The software allows students to determine the course of the activity or project. In general, a computer-based activity that facilitates language skills, scientific literacy, and math skills should have the following characteristics:

(1) Ease of use - the teacher and student can share control of the computer.

(2) Flexibility of outcomes - There should be a product (e.g., a game, drawing, or story that can be varied within a session, or from session tosession).

(3) Flexibility of content - It is desirable for students to be able to tailor the computer activity to their own interests, as well as their language, scientific and math abilities.

These characteristics are in contrast to those identified as priorities for CAI software, such as clearly specified instructional objectives, prompt feedback concerning accuracy of response, and automatic student performance records.

The following is a sample of classroom activities focusing on IMOI:

1) Construct puzzles
   Scan student's still pictures and make puzzles using digitized images
   Decide size, jigsaw patterns, and number of pieces, placemat with shapes and piece rotation
   Apply puzzle pieces on placemat by rotating pieces
   Assemble student's puzzle

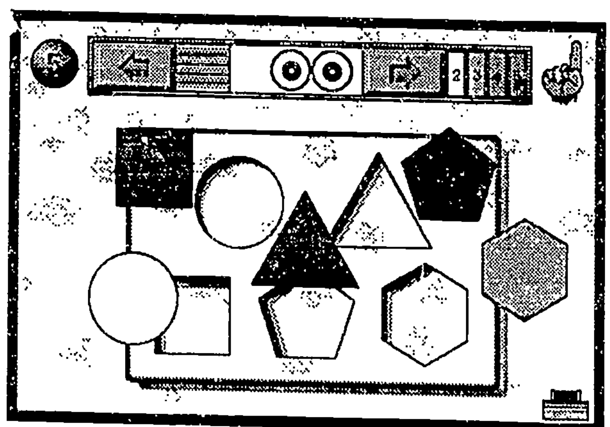


Figure 5 "Shpe Mania"

2) Make movies
   Observe differences in a group of related pictures
   Apply logic to order pictures in a series

Discover that some groups of pictures make sense
Examine a sequence forwards and backwards
Explore how things in nature change over time

3) Sort pictures into categories
Group pictures by attributes or scientific classification
Discriminate attributes
Identify similarities and differences
Discover how plants and animals are classified
Hear the names of some animals and plants
Sort plants and animals

4) Construct toys and machines
Discover that an object is made of parts
Follow a pattern to construct an object
Create unique objects from a set of parts
Understand that some complete objects can perform functions
Analyze, predict, and test which parts are needed to build a specified object

5) Replay sounds
Watch a percussionist play each instrument and listen to its sound
Discriminate sounds
Memorize sounds in a sequence
Listen to instruction for replay
Remember and repeat sound patterns in a sequence

6) Go shopping
Click the fax or phone for the customer's request
Look carefully at the attribute of each item in a store
Recognize, compare, and contrast attributes

7) Make a map of Japan
Observe differences in the shape of prefectures
Move each prefecture piece and apply to where it goes
Hear the response of the piece movement
Examine the completion of a map of Japan

Three students helped each other direct the action as they took turns. Illustrations helped students see the effect of their word choices in relating images to text. The learning opportunities students exploited were:

Development of auditory discrimination
Enhancement of visual and auditory memory
Creation of patterns
Remembering and repeating of patterns
Completion of patterns

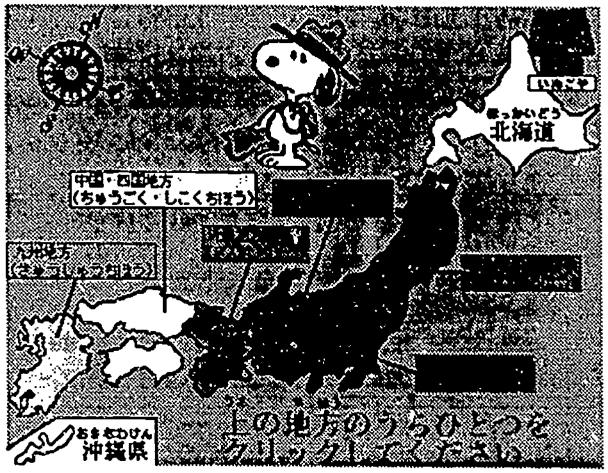


Figure 6 "Make Japan map"

Recognition, comparison, and contrasting of attributes
Development of skill in visual scanning
An increase in creativity and musicality
Discovery of similarities and differences in shapes
Understanding that print and pictorial symbols carry meaning
Development of listening and visual comprehension strategies
Recognition of the names of letters
Association of letter name with letter sound
Recognition of words with the same beginning sound
Relating images to text
Understanding that stories have characters, setting, and actions
Matching of words
Enrichment of vocabulary
Use of vocabulary to define positional relationships
Recognition of the elements of a story
Reinforcement of positive social skills

5. Implications

5.1 Teacher Training

To use the advantages of IM to enhance instructional events, teachers and administrators msut make decisions about hardware, software, and training issues. Apart from the usual educational funding problems, other questions about hardware and compatibility arise.

Most important, the decision of IM lies in the hand of teachers. How the teacher incorporates IM into the curriculum dictates its effectiveness. Therefore, teacher training needs to involve, not just programming and knowledge of equipment, but also an introduction to learning theory that supports the use of IM and instructional design techniques that enhance IM. Teachers need to be taught in settings that model appropriate, effective use of the technology.

How computer literate does a teacher or media specialist need to be to learn how to use IM? A teacher must feel comfortable with the technology, but does not mean a teacher has to take numerous courses in computers and related technologies. Teachers with little computer background can use a videodisc player and a remote control or barcode reader to present video-based material to their classes.

A teacher with little or no experience using a computer can author a multimedia programme if provided with a least a week-long workshop in authoring. Teachers with little technology background have to realize that it will take them longer than other teachers to learn some of the basic skills such as mouse manipulation and file management.

5.2 Teacher Reactions and Observations

There is a tendency for some teachers not to allow students to handle all of the equipment for fear that it might be damaged or instructional materials stored in the hard disc might be lost. However, it was found that it is important to give students the initiative and responsibility for the equipment and software materials.

The first semester that teachers started using computers in their classes, it was in a class with two teachers and four students. They had no other adults helping them with the planning and implementation of activities. In the middle of the semester, some parents with another resource outside the school, including software retailers, began to offer technical support. This made the task a lot easier because they could 'feed-off' each others ideas. Also, preparation time for instruction was halved.

Another important outcome was that nobody failed. Since there are many options when using technology, everyone can find a way to succeed. Educators will need to change their paradigms of instruction, realizing that a pencil is not the only tool for representing what has been learned.

5.3. Parental Cooperation

Parental involvement in the study should be examined. Parents were supportive and willing to volunteer whenever teachers needed assistance in fixing hardware and software problems. Because students have easy access to all folders and instructional materials shown on the screen, they sometimes unintentionally "screw up" the desktop, and sometimes throw things into a trash can and empty it.

Figure 7 "Look, dad. I did it.."

Teachers did not interfere in students' handling of the equipment. Rather, they encouraged students to take ownership of equipment and software. In fact, parents had taught their children to turn the machines on and off, and to operate every component. Parents also brought in new software programmes and demonstrated them to teachers. Teachers knew how capable parents were in the use of computers. Allowing parents to demonstrate the software first provided teachers with valuable experience and also saved them time. Even students sometimes became experts on a specific piece of software and helped their teachers to access it.

6. Conclusions

This paper has created a picture in which nothing went wrong and nothing went right. There were many occasions that seemed like real problems: Instructional materials disappeared, system crashes occurred, memory and hard disc capacity was small, no colour appeared, and so on. This often happened in the beginning, but teachers realized that failures were part of the process and, as such, were not failures at all, but part of a process which had to happen.

Parental support and involvement in the activities of the class were a part of student learning. They combined their commitment to their children's education with the power of the computer. Teachers were convinced that parents were powerful partners to empower students and teachers as well. Students and their parents shared contexts by relying on memory. Parents naturally helped children relate the past to the present to enable them understand new information and concepts. They shared events on a screen that was mutually explored. It appears that students often learn well when they and their parents as mediators share context that can be mutually explored (Feuerstein, Rand, Hoffman, & Miller, 1980).

Students engaged in a variety of activities during the course of instruction by using greatly increased sound and graphic capabilities of the computers. They developed fundamental skills in math, language, science, and positive social skills. IMOI provided engaging activities that helped students practice sequencing, sorting, memorizing, observing, predicting constructing, replaying, classifying, discovering, counting, calculating, and so on. Students were also mutual mediators by monitoring the performance of their peers to encourage as much independent performance as possible. In that supportive environment, they were able to explore and discover the sequential nature of events, to understand how things work, and to predict outcomes in a media-rich instructional environment. That is what IM is all about.

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