Assessing Student Learning of Content and Computer Skills in Instructional Technology

Mary L. Hallett
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Computer-based technology has been implemented in schools throughout America with the goal of improving student learning and teaching practices, and preparing individuals for a highly technical world. However, due to lack of research and proper assessment, technology's impact on education is virtually unknown. The purpose of the study was to create an assessment tool that would measure student learning of content and technological skills. Three case studies of fourth-grade students were conducted while completing Internet and multimedia activities. Utilizing the qualitative methodologies of interviewing, field notes, journals, student work, and written artifacts, data was collected on how computer technology impacts student learning and achievement. A rubric with performance indicators was developed to measure the content and technological skills students learned while completing computer-based activities. The advantages and disadvantages of integrating the Internet and multimedia software into curriculum, applying an assessment tool to new situations, and the future of educational technology are discussed.
Assessing Student Learning of Content and Computer Skills in Instructional Technology

Two and one-half years ago I made drastic changes in my life. After being an Office Manager for six years and an athletic coach for twelve years, I decided to pursue my two passions in life: technology and working with children. Educationally, I enrolled in the GMST program at St. John Fisher College to pursue a Masters degree in Mathematics, Science, and Technology Education and obtain a New York State teaching certification. Professionally, I resigned from my position as an Office Manager to become a Teacher Aid in a school district in order to network in the educational field. I was driven to become a computer teacher, to become a leader in Instructional Technology, a new yet growing field in education. My goal was to teach individuals how to use technology as a tool for managing information and how to use various software applications to accomplish specific tasks. In other words, I wanted to teach and assess individuals’ computer skills, as I had done while managing technology in business.

Reality soon set in, however, when I learned that the true purpose of instructional technology was not simply computer instruction and assessing computer skills. Rather, the purpose of instructional technology in my school district was curriculum integration, to develop computer-based lessons that would teach and reinforce the curriculum being taught in the classroom. Hence, my goal of becoming a computer teacher soon changed into a role of being a curriculum integration teacher.

After being a Teacher Aid for one year, I accepted a position as an Instructional Technology Specialist in an elementary school in Pittsford, New York. Although my role during the school year would later be curriculum integration, I spent the summer doing the “behind the scenes” of instructional technology. New computers needed to be installed, printers needed to be
networked. Server folders needed to be made for saving files, software needed to be upgraded according to licensing requirements, e-mail accounts needed to be set up for new faculty, and templates needed to be made for students to access. Communication systems needed to be implemented for sending out server files throughout the building and the school's Web site needed extensive revisions. Lastly, faculty needed training in order to utilize the equipment properly and effectively use the various applications installed in their classrooms and in the three computer labs I now managed. Although these responsibilities were overwhelming at first, they were extremely valuable in my ability to understand how to manage and implement instructional technology.

Installing software helped me to learn the different types of applications students would utilize in their computer-based lessons, such as multimedia, word processing, spreadsheet, drawing, and educational software. Installing computers and printers helped me to troubleshoot technical problems that would occur. Managing the server helped me to understand how students and faculty would save their files, and utilizing communication software helped me to develop resources and templates that would be used for student projects. In turn, I would not only be able to develop and implement computer-based lessons, I would be able to resolve the technical challenges that would occur while students completed projects. Knowing the technical responsibilities were complete, I was excited to switch gears in September and begin my role as what I initially believed to be a computer teacher.

At the end of summer, the Director of Technology and the Instructional Technology Specialists from each elementary school met to discuss our school-year responsibilities. Originally, I was enthusiastic to learn about the various computer skills I would teach students in the computer labs. I expected to be provided with a set of skills that students would be required
to perform and master at each grade level. I expected to be provided with a list of clear and precise objectives such as fifth grade students would be able to assess Web sites for validity, import graphics from other applications, create multimedia presentations, and develop spreadsheets with tables, graphs, and formulas. I expected that rubrics would be available to assess students' computer projects, focusing on the computer skills they would practice and later master. Lastly, I expected that students would receive a grade in computer lab for mastering specific skills that correlated to the goals and objectives of the lessons.

However, after discussing our roles it became clear that none of these goals, objectives and assessments even existed, for, our role as Instructional Technology Specialists was not to grade students on their computer skills. In fact, students would only receive an effort grade in computer class on their report cards. Rather, our role was to utilize computers as a tool for creating and implementing lessons that correlated to the classroom curriculum. Hence, students would not be assessed on how well they completed a computer-related task. They would be assessed on how well they exhibited their knowledge of a particular content area, using the computer as a tool for learning.

After being in my position for one and one-half years, attending multiple educational seminars and workshops, and researching literature on instructional technology, I soon learned that my personal experiences were similar to other school districts. Educators, administrators, and the government have been faced with the challenge of developing, implementing, and evaluating instructional technology programs throughout America, with the goal of preparing students for their future and enhancing student learning experiences and teaching practices. The challenge they have faced and are continually facing is how to evaluate and assess the effectiveness of technology throughout the educational system.
The purpose of this study was to develop criteria and an assessment tool to effectively evaluate how computer technology is impacting student learning of curriculum and technological skills. Literature continually states that there is little evidence to prove that integrating technology into the educational system is improving learning and student achievement. However, few qualitative studies have been conducted and few performance indicators have been developed to assess technology's impact on education. My goal was to develop an assessment tool that would measure the content students are learning while completing computer-based activities and the technological skills they are practicing and acquiring. The assessment tool would then measure how students are able to apply their technological skills to new situations, to create new opportunities for learning and achievement.

Literature Review

Defining Instructional Technology

Instructional technology, otherwise known as educational technology or information technology, is the theory and practice of design, development, utilization, management, and evaluation of processes and resources for learning (Ely, 2000). Information technology involves all computer-assisted learning, including the use of multimedia, the Internet, digital cameras, and other new technologies that are emerging in schools (Wilmore and Henrickson, 2001). Educational technologists design instruction, produce instructional materials, or manage instructional computing services and resources (Ely, 2000).

Computer-based technology has been introduced in schools not only to prepare students for an increasingly technological world but also to improve pedagogy itself (SMARTer Kids Foundation, 2001). The current emphasis of instructional technology is ensuring that
technology is used effectively to create new opportunities for learning and promote student achievement (NCREL, 2000).

Research and government education programs have emphasized two different aspects of integrating instructional technology in education. The first aspect focuses on integrating technology into curriculum. Here, instructional technology is used as a tool to teach and reinforce the content standards being taught in the classroom (ISTE, 2000; NCREL, 2000; Willis and Raines, 2001). The second aspect focuses on technological literacy. Researchers, educators, and the government are supporting the view that technology should not only be used as a tool for curriculum integration, but students should master specific computer skills that will help them succeed later in life (Cajas, 2000).

Curriculum Integration

Curriculum integration with the use of technology involves the infusion of technology as a tool to enhance the learning in a content area or multidisciplinary setting (ISTE, 2000). Educational technology requires the assistance of educators who integrate technology into the curriculum, align it with student learning goals, and use it for engaged learning projects (NCREL, 2000). Educators must accept the computer and its software not as replacements for content, but as useful extensions that complement content (Willis and Raines, 2001). If technology is to be used to produce improvements in student achievement, teachers must see a direct link between the technology and the curriculum for which they are responsible (NCREL, 2000; Byrom, 1998).

A plan for integrating the computer into curriculum needs to be developed, for, we cannot be clear about integration if we do not know what we are going to integrate (Cajas, 2000). Knowing all the different applications and aspects of software packages is necessary for effective...
integration to occur (Groves, Jarnigan and Eller, 1998). Effective integration of technology is achieved when students are able to select technology tools to help them obtain information in a timely manner, analyze and synthesize the information, and present it professionally (ISTE, 2000).

**Technological Literacy**

Cajas (2000) argues that integration, although important, should not be our priority today. The importance of technology in education should not be solely dependent upon its integration into science, mathematics, or other subjects. Rather, what is urgent to understand is that there are important technological ideas that all should know. Contemporary and future society depends and will continue to depend heavily on technology. Therefore, we need to clarify what technological ideas and skills all people need to understand to be able to participate in a technological world in a thoughtful and informed manner (Cajas, 2000). As Bill Gates (1999, p. 3) suggests, “Winners and losers in the business and wider community of the future will depend on..., how you gather, manage, and use information. Education is vital to this process of gathering, managing, and using information” (Wilmore and Henrickson, 2001).

A broad definition of technological literacy is the skills, conceptual understandings, and dispositions which enable students to use effectively physical and information technologies for academic, research, and vocational purposes (Rossiter, 1999). The U.S. Department of Education (1997) defines technological literacy as computer skills and the ability to use computers and other technology to improve learning, productivity, and performance. Technological literacy is essential for students learning in an educational environment that is increasingly emphasizing the use of technology. An approach to improve students' technological literacy is through the infused or integrated approach, where computer literacy is
Assessing Student Learning

integrated into subjects or courses and taught in a timely or contextually relevant fashion (Rossiter, 1999).

Meeting the challenge of technological literacy has been established as a critical goal for education in America (U.S. Department of Education, 1996). In 1995, the government focused its efforts on developing technological literacy in the American education system (U.S. Department of Education, 1997). President Clinton challenged our nation’s parents, teachers, government, community, and business leaders to work together to ensure that all children in America are technologically literate by the dawn of the 21st century. Under the President’s Educational Technology Initiative, four pillars of the technology challenge were developed. The pillars consist of every student having access to modern computers and learning devices, that all classrooms would be wired to one another and to the outside world, that educational software would be a central part of curriculum, and that teachers would be ready to use and teach with technology.

The National Educational Technology Standards (NETS) Project is an ongoing initiative of the International Society for Technology in Education (ISTE) to develop national standards for educational uses of technology. The project’s goal is to define standards for students, integrating curriculum technology, technology support, and define standards for student assessment and evaluation of technology use (ISTE, 2000). The NETS Project is funded by the U.S. Department of Education, the National Aeronautics and Space Administration (NASA), the Milken Exchange on Education Technology, and Apple Computer, Inc. The primary goal of the project is to enable stakeholders in PreK-12 education to develop national standards for educational uses of technology that facilitate school improvement in the United States (ISTE, 2000).
Six performance indicators for technology were created to develop technology-literate students: basic operations and concepts; social, ethical, and human issues; technology productivity tools; technology communication tools; technology research tools; and problem-solving and decision-making tools (ISTE, 2000). The first indicator, basic operations and concepts, consists of students using keyboards and other input and output devices efficiently and effectively. The second indicator, social, ethical, and human issues, states that students should be able to discuss common uses of technology in daily life, the advantages and disadvantages the uses provide, and personal consequences of inappropriate use. The third indicator, technology productivity tools, states that students understand general purpose productivity tools to support personal productivity, remediate skill deficits, and facilitate learning throughout the curriculum. The fourth indicator, technology communications tools, states that students can use such tools as telecommunications, Web tools, digital cameras, scanners, and multimedia for collaborative writing, communication, and publishing activities to create products of their acquired knowledge and personal interests (ISTE, 2000).

The fifth and sixth indicators are technology research tools and technology problem-solving and decision-making tools. Students can use telecommunications and resources to participate in collaborative problem-solving activities, self-directed learning, and extended learning activities. They can determine which technology is useful and select appropriate tools and resources to address tasks and problems (ISTE, 2000).

The International Technology Education Association (ITEA) identified twenty standards for technological literacy under the following five categories: The Nature of Technology, Technology and Society, Design, Abilities of a Technological World, and The Designed World. ITEA is a professional organization of technology teachers whose mission is to promote
technological literacy for all by supporting teaching of technology and promoting the professionalism of those engaged in the pursuit (ITEA, 2002). The ITEA standards for technological literacy reflect the challenge of how different technology communities are pushing for a place in education by asking that their knowledge and skills be included in the standards (Cajas, 2000).

In contrast to ISTE and ITEA, Knuth, Amenta-Shin, and Ciesemier (1999) listed six core technology competencies and skills. The competencies include: Computer Hardware, Noncomputer Hardware, Software Applications, Information Tools, Network Tools, and Multimedia and Presentation Tools. Professional development, training, and adequate support are crucial to the mainstreaming or widespread adoption of technological literacy strategies approaches (Rossiter, 1999). Students cannot be expected to benefit from technology if their teachers are neither familiar nor comfortable with it. Teachers need to be supported in their efforts to use technology (NCREL, 1999).

Professional Development

For teachers to implement technology in the classroom to increase learning and improve student achievement, a well-planned professional development program for technology use is essential. The program needs to be tied to the school's curriculum goals, designed with built-in evaluation, and sustained by adequate financial and staff support (NCREL, 2000).

Teachers' preparation and training to use education technology is a key factor to consider when examining their use of computers and the Internet for instructional purposes. Teachers are more likely to use technologies when they have access to adequate equipment and connections, and feel better prepared to use them. Teachers who spend more time in professional development trainings feel better prepared than their colleagues (Smerdon et al, 2000).
Staff development training must be hands-on, ongoing, and developmentally appropriate (Groves, Jarnigan and Eller, 1998). Teachers need time to plan, practice skills, try out new ideas, collaborate, and reflect on ideas. They need ample opportunities to practice with the technology and gain confidence in use (NCREL, 2000). One in-service training session does not begin to address the need for experiential learning when it comes to computer technology. Teachers, like children, need time for processing and reflection (Groves, Jarnigan and Eller, 1998).

Another important component of professional development is access to on-site technical support personnel who are responsible for troubleshooting and assistance after the technology and lessons are in place (NCREL, 2000). Increased use of technology in schools requires a robust technical infrastructure and adequate technical support. To promote teachers’ use of technology, school administrators should ensure that adequate numbers of computers with Internet connections are available to teachers and that access times are not limited (NCREL, 1999).

Before technology is purchased or teachers participate in professional development trainings, the educational goals for students should be determined: what do students need to learn and how can technology promote those learning goals (NCREL, 1999). School districts must then purchase the type of technical equipment necessary to meet the learning goals and provide for ongoing maintenance and upgrades. Such a vision of learning is critical in the technology planning process. It should be the driver of decisions concerning which technology is purchased and how it is used. Without a vision of learning there is little hope that technology will contribute to improved student learning (NCREL, 2000).
Barriers to Computer Use

In 1994, the President and Vice President of the United States urged federal officials to explore how to encourage greater and more effective use of modern computers and communications in the nation's schools. In July of that year, the U.S. Department of Education asked the RAND’s Critical Technologies Institute (CTI) to assist in the GOALS 2000: Educate America Act, to develop a strategy for effective utilization of new technologies in American classrooms. A series of workshops were held over an 18 month period to discuss the five issues that were and are continually challenging schools today: benefits, costs, effectiveness, implementation, and evaluation (U.S. Department of Education, 1995).

Lack of professional development for technology use is one of the most serious obstacles to fully integrating technology into the curriculum (NCREL, 2000). Educators are often left to their own resources in the areas of funding equipment, seeking support for acquiring skills, adapting existing curriculum to a new way of teaching, and meeting frequent frustration at the limitations of the technology and lack of institutional support (Georgi et al, 1998).

Although most teacher education programs provide some computer education for teachers, many do not have up-to-date equipment or faculty with technology expertise (Willis and Raines, 2001). In 1999, the barriers to the use of computers and the Internet for instruction most frequently reported by public school teachers were identified. Lack of release time for teachers to learn how to use computers or the Internet (82 percent), not enough computers (78 percent), and lack of time in schedule for students to use computers in class (80 percent) were the three primary obstacles that effect technology use and integration (Smerdon et al. 2000).
Proposed Benefits and Uses

Recent National Assessment of Educational Progress scores confirm that despite enormous expense and effort, the country has not yet solved its student-achievement problem (Gratz, 2001). "Education in America is off course and we need to use every tool that exists to improve things. Under the circumstances, it would be negligent not to use computers in attacking the problem" (Bennett et al., 2001).

Five main arguments underlie the campaign to computerize our nation's schools. First of all, computers improve both teaching practices and student achievement. Secondly, computer literacy should be taught as early as possible, otherwise students will be left behind. Thirdly, to make tomorrow's work force competitive in an increasingly high-tech world, learning computer skills must be a priority. Fourthly, technology programs leverage support from the business community. Lastly, work with computers, particularly the Internet, brings students valuable connections with teachers, other schools, students, and a wide network of professionals around the world (Oppenheimer, 1997). In other words, technology brings greater access to learning and teaching resources, which would not otherwise be possible. Technology does not isolate; it brings people together.

The SMARTerKids Foundation (2001) proposed four benefits of technology in education. Technology provides greater access to learning and teaching resources, increased student learning, improved literacy skills, and promotion of active and collaborative learning. Terry Crane, an Apple vice-president, stated that technology encourages students to collaborate more than in traditional classrooms. Students learn to explore and represent information dynamically and creatively, communicate effectively about complex processes, become independent learners, and become more socially aware and confident (Oppenheimer, 1997).
Johnson (1996) identified three uses of technology. The first use for computers in schools is to enhance professional productivity. The second use is for automating instruction using drill and practice software. The third and final use of technology in schools is as an information processing and productivity tool. Similarly, Means (1994) identified four functions of technology used for learning. Technology can tutor, explore, be applied as tools, and communicate.

Technology is used as a tutor when it does the teaching directly, typically in a lecture-like or workbook-like manner, such as educational games and software. Technology is used to explore when it allows students to move through information or obtain demonstrations upon request, such as utilizing the Internet to conduct research. Technology is applied as a tool when students create, compose, store, and analyze data, such as utilizing spreadsheets. Lastly, technology is used to communicate when students and teachers can send and receive messages and other information through networks and other technologies, such as e-mail (NCREL, 2000).

Evaluating Technology’s Impact

Nearly $25 billion has been spent on K-12 educational technology in America since 1991 (Slowinski, 2000). Ninety-nine percent of all public school teachers report having computers available somewhere in their schools (Smerdon et al, 2000). The ratio of students per instructional computer in public schools is six to one. Sixty-three percent of U.S. public school instructional rooms, including classrooms, computer labs, and library or media centers, are connected to the Internet and 95 percent of schools currently have access to the Internet (Williams, 2000). Yet, technology's impact on education is virtually unknown (Slowinski, 2000).
Since educators first began to use computers in the classroom, researchers have tried to evaluate whether the use of educational technology has a significant and reliable impact on student achievement (Honey, Culp and Spielvogel, 1999). Computers, networks, printers, scanners, file servers, and CD-ROM drives are common in most schools in quantities which should suggest the investment is having an impact on education (Johnson, 1996).

Judging the impact of technology requires an understanding of how it is used in the classroom, what learning goals are held by educators, knowledge about the type of assessments that are used to evaluate improvements in student achievement, and an awareness of the complex nature of change in the school environment (NCREL, 1999). Ongoing evaluation of technology and student achievement, based on the educational goals, helps to ensure that the technology is appropriate, adaptable, and useful. Such evaluation also facilitates change if learning goals are not being met (NCREL, 1999).

In December, 1995, J. McKenzie posed the questions, “Did anybody learn anything. Why has there been so little assessment of technology programs?” (McKenzie, 1995). Assessment has been horribly neglected in most places as schools have installed billions of dollars of computers and other technologies during the past two decades (McKenzie, 1998). Mainly because of the lack of sustained funding sponsorship, research in technology education has been sparse (Lewis, 1999).

Researchers are beginning to meet the more complicated task of investigating the impact of technology use in meeting new expectations for what students should learn. They are examining students’ ability to understand complex phenomena, analyze and synthesize information, and build representations of their own knowledge. This model of integrated
technology-support learning emphasizes the ability to access, interpret, and synthesize information instead of rote memorization and the acquisition of isolated skills (NCREL, 1999).

Most research on technology and student achievement has used traditional standardized assessments to measure changes in student performance. This research has focused on students' knowledge of isolated facts but has paid little attention to how well students think (NCREL, 1999). Rather than trying to describe the impact of technologies, as if they were the same, researchers need to think about what kind of technologies are being used in the classroom and for what purposes. To measure the effect of specific technologies on student achievement, assessment methods and instruments should be appropriate to the learning outcomes promoted by those technologies (NCREL, 1999).

Assessing Student Work

The fundamental role of assessment is to provide meaningful feedback for improving student learning, instructional practice, and educational options. Good assessments must be aligned with specific standards and learning targets, and affect what is important for students to know and be able to do (RMC Research Corporation, 2000).

The key to effective performance and valid scoring is setting standards and criteria in advance. Educators need to start with content standards to develop their assessments. The standards have learning expectations that generally fall into one of four categories: concepts and information (what students should know), skills (what students should be able to do), communication (how students can articulate concepts and skills), and transfer (how students can apply information and skills in new ways or to different subject matters). The two ways to articulate standards are to develop clearly stated quality indicators or performance descriptions of
what each standard represents, and samples of student work or anchors that demonstrate how the sample met or did not meet the performance standards (RMC Research Corporation, 2000).

Assessment empowers us to modify, customize, and improve the program midstream. The RMC Research Corporation (2000) identified four steps in designing an assessment: decide on a format, specify the purpose of the assessment and the standards it will measure, specify performance descriptions and develop rubrics or other indicators for each level of performance, and clearly articulate the performance task (RMC Research Corporation, 2000). In contrast, McKenzie (1998) defined seven stages educators need to go through to make assessment effective: clarify outcomes, select or construct instruments, pilot assessment, interpret early findings, modify assessment, modify program, and repeat the cycle (McKenzie, 1998).

The first stage in creating assessment is to clarify expectations and then convert them into something that is observable, palpable, and measurable. The second stage is locating instruments that have been field-tested and proven to offer reliability and validity. The third stage is piloting or field-testing the performance tasks that have been devised and refine and improve them based upon observations. The fourth stage is asking who, what, when, where, and how questions to learn about and interpret early findings. The fifth stage is to modify the assessment. Having reviewed the data, the next step is to question how the assessment procedures can be tightened and improved. The sixth stage is to modify the program, to suggest ways to change the delivery of the technology program in order to achieve better results. The last stage is to create an ongoing and continuous cycle to gather data about performance (McKenzie, 1998).

The problem with traditional standardized tests is that they do not address the wide range of skills learned in school and needed for functioning effectively in society (Georgi et al, 1998). Therefore, new forms of student assessment are designed to demonstrate what students are
learning and what they can do with their knowledge. Known as alternative or authentic measures, these assessments require students to perform in some way, by writing, demonstrating, explaining, or constructing a project or experiment (U.S. Department of Education, 1996).

Focusing attention on performance standards allows teachers to provide students with more usable and timely feedback (RMC Research Corporation, 2000). The Office of Technology Assessment defines performance assessment as testing methods that require students to create an answer or product that demonstrates knowledge or skills. Performance assessments may include open-ended or constructed response items, performance-based items or events, projects or experiments, or portfolios (U.S. Department of Education, 1996). Performance-based assessments attempt to bring instruction and assessment closer together in an effort to ensure that real world skills are observed, practiced, and mastered (Georgi et al, 1998).

Performance assessments typically illuminate students' skills, conceptual understandings, ability to apply knowledge and skills, performance execution abilities, and process abilities. A rubric is an example of an assessment scoring guide that describes student work at different levels of performance. Rubrics articulate what students are to learn and the quality of student performance that is acceptable (RMC Research Corporation, 2000). Rubrics can be a valuable tool while conducting research and assessing student learning.

Method

Overview

With prior approval from administration, faculty, and parents, three case studies of fourth-grade students of low, medium, and high academic abilities were conducted at Mendon Center Elementary School in Pittsford, New York. Utilizing the qualitative methodologies of interviewing, field notes, journals, student work, and written artifacts, data was collected on how
computer technology impacts student learning of curriculum and technological skills. Lesson plans and resources were developed and modified for students and teachers to complete computer-based activities that were integrated into social studies and English language arts curriculum. A performance-based assessment tool was developed to measure the content students learned and the technological skills they practiced, acquired, and applied while completing the integrated lessons and activities. The collected data was then analyzed and organized into meaningful categories.

**Selecting a Grade Level**

Prior to conducting the study, either fourth or fifth grade students were going to be selected since computer technology would be integrated across the curriculum, the students had not yet mastered technological skills, and the students were more accessible than the younger grades. In grades Kindergarten through second, students typically utilize KidPix Studio Deluxe (KidPix), a multimedia software tool, to practice such skills as counting, grouping, sequencing, patterns, spelling, and writing. In third grade, students solely utilize UltraKeys, a typing program that teaches students the computer keyboard and assesses typing skills. In fourth and fifth grade, students are given the opportunity to learn new skills while conducting research via the Internet, developing multimedia presentations, and creating word-processing documents, timelines, and spreadsheets. They also attend computer lab twice per week for 45 minutes per class, compared to Kindergarten through third grade who attend once per week, 30 to 45 minutes per class.

A meeting with the fourth-grade level chair was organized to explain the purpose of the study and to evaluate if the teachers would be interested in having their students participate in the study. The grade level chair expressed interest in participating but also recommended discussing
the research project with the five other fourth-grade teachers at an upcoming grade level meeting. A schedule of the two main computer labs was generated prior to the meeting in order to evaluate which classes overlapped with one another (see Table 1).

Table 1

**Fourth Grade Computer Schedule**

<table>
<thead>
<tr>
<th>Time</th>
<th>Lab</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:15 AM</td>
<td>1</td>
<td>Hastings</td>
<td>McDonald</td>
<td></td>
<td>Boyer</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Classroom 3)</td>
<td>(Classroom 5)</td>
<td></td>
<td>(Classroom 2)</td>
<td>(Classroom 6)</td>
</tr>
<tr>
<td>11:30 AM</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>Hastings</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(Classroom 3)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>Sullivan</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(Classroom 4)</td>
<td></td>
</tr>
<tr>
<td>2:30 PM</td>
<td>1</td>
<td>Warner</td>
<td>Boyer</td>
<td>Warner</td>
<td>Miller</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Classroom 1)</td>
<td>(Classroom 2)</td>
<td>(Classroom 1)</td>
<td>(Classroom 6)</td>
<td>(Classroom 5)</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Sullivan</td>
<td></td>
<td>Miller</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Classroom 4)</td>
<td></td>
<td>(Classroom 6)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

At the grade level meeting, the six teachers were willing to participate in the study but three of the six teachers, Mrs. Warner, Mr. Boyer, and Ms. Hastings expressed more interest and willingness to support it. As a group we decided that those three teachers would have one student from each classroom participate in the study in order to effectively observe each student. The three teachers were in Computer Lab 1 and did not overlap one another, making the environment consistent and individual observations possible. One question was left unanswered at the end of the meeting on whether students should be pre-selected based on academic level or whether they should be randomly selected from the three classrooms. The principals clarified this issue while gaining permission to conduct the study.
Gaining Permission

Permission to conduct the study was granted by administrators, teachers, and parents. An introductory letter was developed to introduce myself as an Instructional Technology Specialist and graduate student, to state the purpose and length of the study, and to clarify student selection procedures and expectations (see Appendix A1). A permission form was developed granting permission for students to participate in the study from February through March, 2002 (see Appendix A2).

The introductory letter and permission form were reviewed by the school’s principal, assistant principal, and fourth-grade teachers prior to being distributed to one-half of the fourth-grade students. The principals expressed the importance of creating a generic letter that could be distributed to all students. Since students of low, medium, and high abilities would be included in the study, they did not want the students to be pre-selected. Rather, the letters would be distributed to all of the fourth-grade students in the three classrooms and then three students would be randomly selected from the returned permission slips. Once modifications were made to the letter and permission form, the fourth-grade level chair reviewed them and made no additional changes or modifications.

The letters and permission forms were then distributed in the three classrooms at the end of the day for students to take home and review with their parents. The teachers briefly explained the purpose of the study and asked their students to sign and return the permission form if they were interested in participating in the study. Of the 68 forms distributed, 10 were signed and returned. All candidates were females (see Table 2).
Table 2

<table>
<thead>
<tr>
<th></th>
<th>Warner (Classroom 1)</th>
<th>Boyer (Classroom 2)</th>
<th>Hastings (Classroom 3)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td># Distributed</td>
<td>23</td>
<td>22</td>
<td>23</td>
<td>68</td>
</tr>
<tr>
<td>Boys Returned</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Girls Returned</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Total Returned</td>
<td>5</td>
<td>1</td>
<td>4</td>
<td>10</td>
</tr>
</tbody>
</table>

**Sampling**

From the ten permission forms returned, three students were selected to participate in the study based on their academic level and classroom teacher. Students of varying academic abilities were chosen in order to analyze if the computer can be utilized as a tool for learning for students who may be challenged by the curriculum or specific technologies. The returned permission forms were labeled and distributed into three piles, according to the students’ classroom teacher. Not knowing each student’s academic strengths and challenges, the classroom teachers labeled each student as a low-, medium- or high-achiever in the upper right corner of each form. Teacher and student pre-assessment interviews were later conducted to clarify each student’s academic abilities and prior content and technological knowledge.

In Mr. Boyer’s classroom, only one permission form was returned. By default, that student was selected to participate in the study. The student, Alyson, was labeled as a medium-achiever. A high-achiever, Sarah, and a low/medium-achiever, Lisa, were then randomly selected from Mrs. Warner and Ms. Hastings classrooms. The three candidates and their teachers were notified that they were selected to participate in the study. Arrangements were made to have lunch with the three participants the following day so we could introduce each other to the group and clarify roles and expectations. During lunch, the purpose of writing
journals was discussed and journal books were distributed to the three participants. Two thank you letters were developed for the 10 students who returned their permission slips to show appreciation for their willingness to participate in the study: Thank You Letter for Selected Students and Thank You Letter for Non-Selected Students (see Appendix A3 and A4). The letters were distributed and sent home at the end of the day.

Selecting the Curriculum

Computer integration into the content areas occurs depending on the curriculum being taught in the classroom. During a meeting with the fourth-grade level chair, upcoming curriculum was discussed in the content areas of social studies, science, English language arts and mathematics. The curriculum being taught in the fourth grade classrooms during February through March focused heavily on North American explorers. By default, computer technology would be integrated into this curriculum, which became the focus of the research study.

The North American explorers' curriculum is built from New York State social studies standards and objectives. Like most fourth-grade curriculum, New York State English Language Arts (ELA) standards and objectives are also incorporated since reading, writing, listening, and speaking activities are involved in the student learning process. New York State also mandates standardized ELA and social studies tests in these areas.

Integrating Technology into Curriculum

Knowing the curriculum, computer-based activities needed to be developed or modified and integrated into the curriculum. The grade level chair, classroom teachers, and I mutually agreed to have all fourth-grade students conduct research via the Internet on the explorers and then develop a multimedia presentation from their acquired knowledge. These were the same computer-based projects as the previous year. Since the social studies textbooks in the
classroom had limited information, the Internet would allow students to acquire additional information on the explorers. Each student would be assigned one explorer to research and then share their acquired knowledge with the class through a slideshow presentation. The multimedia presentation would allow students to display their acquired knowledge in a meaningful and creative manner that would incorporate social studies, E.L.A, and technological standards and objectives.

While integrating computer technology into curriculum, software to complete the computer-based activities needed to be evaluated, valid Internet sites needed to be reviewed and modified, and existing lesson plans needed to be tested against upgraded software. The browser Internet Explorer had been installed throughout the building and was utilized to conduct research via the Internet. Although multimedia software such as Microsoft PowerPoint, HyperStudio, and KidPix were installed on all of the computers in the computer labs, KidPix was chosen to be utilized since the teachers and students had familiarity with the program. None of the fourth-grade teachers were proficient in Microsoft PowerPoint or HyperStudio, which would make integration and their teaching practices challenging.

Two resource pages were modified on each North American explorer in AppleWorks Word Processing. One resource page contained hyperlinks to Internet sites containing information on the life and journeys of the explorer, which needed modifications due to Internet links breaking and changing (see Appendix B1 for an example). Students were not initially given the opportunity to conduct searches on the Internet due to time constrictions and lack of Internet filters. The second resource page contained graphics of the explorer, which had been copied and pasted from the hyperlinked Internet sites. The graphics included pictures, maps, ships, and flags of the explorer. Students would later import these graphics into a four-page
slideshow presentation. Both resource pages for each explorer were placed on the server and were accessible to students and faculty throughout the building. An e-mail was sent to the six fourth-grade teachers and two computer paraprofessionals to communicate that the exploration project was ready for use.

Fact Sheets were developed for note-taking purposes (see Appendix B2). They were distributed to students in their classrooms to record information taken from social studies textbooks and the Internet. The sheets listed specific criteria for each student to complete, which made their expectations clear and concise. After conducting research for three class periods and completing the fact sheets, blank slideshow sheets were distributed to students in their classrooms to plan their slides and then later create a slideshow presentation in the computer lab over four class periods. Since graphics become imbedded and cannot be resized once students click outside of an imported picture in KidPix, students needed to plan where graphics would be placed prior to typing information and formatting each slide’s background. The slideshow sheets also gave students a platform to organize all of their researched and acquired information.

The ISTE NETS Learning Activity Template (ISTE, 2000) was utilized to develop new lesson plans to effectively integrate computer technology into the curriculum, using the agreed upon activities (see Appendix B3). Computer-based lesson plans were also modified for creating the slideshow in KidPix (see Appendix B4). These lesson plans would play a key role in the fourth-grade teachers’ ability to facilitate the computer-based lessons. They contained detailed instructions on how to complete specific tasks such as creating a new folder, importing graphics, saving to the server, and developing a slideshow with transitions and sound effects. The six classroom teachers, two computer paraprofessionals, and I utilized the lesson plans throughout the project.
Setting

Mendon Center Elementary School services approximately 800 students in grades Kindergarten through fifth and two special education classes. With a faculty of 100 educators, special services (speech, reading, math lab and resource room), specials (computer class, library, physical education, health, music and art), and extracurricular activities are provided for all students to enjoy and learn from.

The computer-based activities for this research project took place in one of the three computer labs in the building. The lab has 26 iMacs and four Apple laptops connected to a server and network. One LaserJet and five color printers are available for printing student work. A television is located in the front of the room to provide a visual of the lessons and to help students follow directions while completing computer-based activities. Computers are aligned in five rows because of cabling and safety issues.

Students were assigned seats by their classroom teacher in the beginning of the school year and remain in those seats throughout the school year, unless a group project is involved. Since the Internet and slideshow activities were not collaborative learning projects, students remained in their assigned seats while completing their activities. Students rotated seats when the slideshows were complete in order to share their products and acquired knowledge about each explorer with fellow peers.

Data Collection

Five types of instruments were used to collect data: interviews, field notes from observations, student journals, student work, and written artifacts.

Interviews. Two pre-assessment interview tools were developed to learn each participant’s academic strengths and challenges, prior knowledge of the curriculum being
integrated, and technological skills: Teacher Pre-Assessment Interview Form and Student Pre-Assessment Interview Form (see Appendix C1 and C2). The three classroom teachers of the participants were interviewed one-on-one in their classrooms. Responses to the questions were immediately recorded in ink on the interview worksheets and then typed. The participants were interviewed one-on-one during a lunch period in a private room. Their responses were also recorded on the interview worksheets and then typed in an organized and detailed fashion.

During one of the teacher pre-assessment interviews, the classroom teacher mentioned that the high-ability participant, Sarah, was involved in a differentiated project with a group of six students and a Project Challenge teacher, who specializes in differentiated instruction. An informal interview was then conducted with the Project Challenge teacher to learn about how the curriculum was being differentiated and the activities the students would engage in. Students were assigned an explorer who had impacted the world, in addition to learning about the six North American explorers. They were given a choice of presenting a speech or monologue, writing a journal, creating a scrapbook, or staging an interview after collecting, categorizing, and synthesizing information researched from the Internet. Their products would later be presented in their classrooms.

From a technological perspective, students would be allowed to utilize search engines while conducting research and would learn an additional skill of copying, pasting, and saving graphics from the Internet into server folders. These graphics would be utilized while creating a classroom project and multimedia presentation. Additional Internet pages with hyperlinks were created and placed on the server for the students in the differentiated group to access. In the computer labs, students would conduct research while utilizing the hyperlinks and fact sheets.
They were required to complete a four-page slideshow presentation as their peers, utilizing the graphics they had saved into their folders.

Field Notes from Observations. Participants were observed while completing the Internet and multimedia projects in order to observe them in their natural context, monitor verbal and nonverbal cues, and record notes on their learning experiences. Field notes and drawings were constructed during and immediately after class. During class, key phrases and words about my observations were jotted down using a pen and paper, including what participants did, technological challenges they faced, questions they had, and peer interactions. Immediately after class, full, organized field notes were constructed and typed utilizing Microsoft Word on each participant's learning experience and social interactions. The drawings were elaborated on after class to show the participants' use of space and social interactions.

Student Journals. The participants were instructed to record their learning experiences in journals at home for homework. Since each computer class is only 45 minutes and other content areas were scheduled throughout the day, students did not have time to reflect on their experiences during and immediately after class. In their journals, students were instructed to reflect on what they did during their computer-based projects, why and how they did their work, and what they learned. They were also asked to reflect on their interactions with fellow peers and teachers. These expectations were clarified at the first lunch meeting.

Student Work. Students in grades one through five are provided with server folders to save their computer-based projects into. All student work for this research study was saved into their folder, printed, and analyzed utilizing a newly created assessment tool, the Exploration Rubric. The hand-written Internet notes taken on the fact sheets and blank slides were copied and analyzed.
Written Artifacts. The instructional technology lesson plans and resources were saved and later reviewed in order to evaluate their impact on the learning process. The Exploration Rubric served as the main resource for evaluating technology's impact on student learning and achievement.

Developing the Assessment Tool

After meeting with the grade level chair, attending a grade level meeting, conducting the pre-assessment interviews, and creating computer-based activities for the curriculum, the Exploration Rubric was developed to measure student learning of both the content and technological skills. Using New York State and ISTE NETS technology standards, objectives were developed to clarify the curriculum and technological skills students would be learning while completing the computer activities. The objectives were turned into specific criteria that measured student learning and performance.

Since students were producing a product of their acquired knowledge, a performance-based assessment tool was created in the form of a rubric. Known as an alternative assessment, the Exploration Rubric would measure what students know and are able to do, without requiring students to complete a traditional standardized test. The rubric was continually modified throughout the research process. If time permitted, students would be given a choice of an anchor activity each computer class after meeting the assessment criteria, such as practicing typing skills utilizing UltraKeys or playing an educational software game.

Analyzing Data

Marshall and Rossman (1995) identified five phases of data analysis: organizing the data; generating categories, themes, and patterns; testing the emergent hypotheses against the data; searching for alternative explanations of the data; and writing the report. These five phases were utilized to analyze the data collected through the interviews, field notes, journals, student
work, and written artifacts. The raw data was then organized into meaningful categories in order to understand the learning experiences of the participants, to evaluate the effectiveness of integrating computer technology into curriculum.

Results

PRE-ASSESSMENT INTERVIEW RESULTS

Overview

The completed Teacher Pre-Assessment Interview Form and Student Pre-Assessment Interview Form for Sarah, Alyson, and Lisa were critical in my understanding of their academic and personal profiles, technological skills, and prior content knowledge of exploration. The results of the student profiles and technological skills are outlined under each participant, since each participant exhibited unique characteristics, qualities, and skills. In contrast, the results of the participants' prior knowledge of the exploration content are grouped together since all fourth-grade students participated in the same curriculum-based activities in their classroom and in the library. The pre-assessment interview results are summarized in a newly created table.

Case Study 1: Sarah

Student Profile

During the teacher pre-assessment interview, Mrs. Warner identified Sarah as a high-achiever, someone who is organized and conscientious, learns material easily, takes risks, and has excellent work habits. Sarah's academic strengths include reading, mathematics, and writing skills. Her academic challenges include difficulty in higher-level thinking skills, such as making inferences and problem-solving. Mrs. Warner stated that these are common challenges of fourth-grade students.
During the student pre-assessment interview, Sarah identified her favorite subjects as social studies and spelling. She stated that the subjects are easy to learn and interesting to study. She enjoys learning about historic events and spelling new words at home and in school.

**Technological Skills**

The results of the teacher pre-assessment interview indicated that the exploration unit is the first unit to include conducting research via the Internet in Mrs. Warner's classroom. Therefore, Sarah had not practiced Internet research skills in school this year. Mrs. Warner felt the Internet would be a valuable tool for gaining additional information on each explorer, such as family life, ships, and encountered problems. Since social studies textbooks have limited information, the Internet would allow students to acquire new knowledge on each explorer.

From the beginning of the school year, students in Mrs. Warner's classroom had completed word processing projects on the computer to prepare for mandated New York State ELA exams. They practiced writing skills, completed spell checks, formatted text, imported graphics, and saved to the server. Students also practiced UltraKeys, the typing program that teaches students the keyboard and assesses typing skills. The exploration Kid Pix slideshow presentation was the first multimedia project for students this year. Hence, Sarah had not practiced multimedia skills in school prior to creating the exploration slideshow.

The results of the student pre-assessment interview indicated that Sarah conducted research via the Internet at home this year and in previous years. She completed a Planets project in third grade, which required students to research facts about the different planets utilizing bookmarked Web sites. She felt the purpose of the Internet in education is to "teach her things since textbooks don't always have all of the information or extra links that take you to
more facts and information." She stated that she is able to open Internet sites independently and asks questions if needed.

The skills Sarah has mastered in KidPix include formatting text, importing and creating graphics, and developing slideshows. She can independently add and enlarge stamps, create pictures, use the toolbar, and develop multimedia presentations. For example, at home she completed a slideshow with her sibling, utilizing the Genies stamp set. Sarah mentioned that creating graphics in KidPix is not as easy as writing with a pencil and her typing skills slow her down. She felt an advantage of utilizing KidPix is "all the things are lined up so little kids can use it too." When asked what new computer skills she would like to learn this year she stated that she would like to conduct research via the Internet on the human body.

Case Study 2: Alyson

Student Profile

During the teacher pre-assessment interview, Mr. Boyer identified Alyson as a medium-high achiever, someone who is cooperative and compromising and has a consistent work ethic. Alyson’s academic strengths include building on skills and concepts, particularly in mathematics. She prepares well for tests and projects and hands in homework on time. Her academic challenges include writing skills and difficulty in higher-level thinking which, again, is a common challenge among fourth-grade students.

During the student pre-assessment interview, Alyson identified her favorite subjects as science and mathematics. She stated that she enjoys doing experiments in science class and mathematics helps her learn new and better skills.
Technological Skills

The results of the teacher pre-assessment interview indicated that students in Mr. Boyer’s classroom had not completed any computer-based projects involving the Internet. Therefore, Alyson had not practiced Internet skills in school this year. The classroom teacher emphasized the fact that social studies textbooks have information limited to their pages. He stated that utilizing the Internet in the exploration project would allow students to “find additional information on the click of the button. However, the Internet would be challenging because students don’t always know where to go to find information.”

The results of the student pre-assessment interview indicated that Alyson conducted research via the Internet in school and at home last year. As in Sarah’s experiences, Alyson also completed the Planets project. She stated that she was comfortable searching Web sites and had worked in groups in the computer lab to find information on different topics in third grade. When asked what she thought is the purpose of the Internet in education, she replied, “To help people learn more interesting facts, better skills, and find more information.”

From the beginning of the school year, students in Mr. Boyer’s classroom had completed the same word processing and UltraKey projects as students in Mrs. Warner’s classroom. Hence, Alyson had not practiced multimedia skills in school prior to creating the exploration slideshow. The results of the student pre-assessment interview indicated that Alyson did multimedia projects at home this year. For example, she and a friend completed a slideshow of the arctic and dessert in KidPix. She stated that she learned how to do a slideshow from her second grade teacher. The skills she has mastered in KidPix include typing using the typewriter tool, drawing graphics, opening and saving files, and creating multimedia presentations. She
stated that KidPix is a useful tool because “you have a chance to switch things around and have the freedom to create, draw, and have fun.”

When asked what new computer skills she would like to learn this year Alyson stated that she would like to learn how to create a spreadsheet and a timeline. She had seen graphing and timeline computer-based projects hanging in the fifth grade hallway and was eager to learn how to create them on the computer. At the end of the interview I asked if she had any additional information to share with me. She said, “You’re a good teacher.” I asked, “Why?” She replied, “You help students understand what they are doing on the computer.” She then shared that she’s involved in student council, community organizations, and the school’s ASSETS program, which promotes respect and responsibility among individuals.

Case Study 3: Lisa

Student Profile

During the teacher pre-assessment interview, Ms. Hastings identified Lisa as a low/medium-achiever, someone who is internally motivated, a hard worker, and socially adept. Lisa’s academic strengths include knowing what is expected of her and striving to do well. For example, she failed a science test and met with the science teacher to review the entire test. She has average mathematics skills and is challenged by reading comprehension and writing thoughts into complete sentences. As in Sarah and Alyson’s profiles, Lisa is also challenged by higher-level thinking skills.

During the student pre-assessment interview, Lisa identified her favorite subjects as mathematics and English language arts. She stated that she likes learning mathematics because she has a good math teacher, enjoys writing stories, and is good at memorizing words in spelling.
Technological Skills

The results of the teacher pre-assessment interview indicated that students in Ms. Hastings classroom had completed a computer-based project involving the Internet this year. In art class, they conducted research on the different types of masks. Unlike Sarah and Alyson, Lisa had practiced Internet research skills in school this year. Ms. Hastings commented on the Internet’s impact on student learning. She stated that the Internet “is a way of finding different information. Students need to sort through and read lots of information and decide what is important and relevant. The Internet helps with reading comprehension,” a weakness of Lisa.

The results of the student pre-assessment interview indicated that Lisa conducted research via the Internet in school and at home this year and last year. As in Sarah and Alyson’s experiences, Lisa also completed the Planets project in third grade. At home, she researched information on animals in order to learn about the raccoons in her backyard. She stated that she is able to research the Internet independently. When asked what she thought is the purpose of the Internet in education, she replied, “To help people learn more information because books are limited, and for studying biographies.”

From the beginning of the school year, students in Ms. Hastings’s classroom had completed the same word processing and UltraKey projects as students in Mrs. Warner and Mr. Boyer’s classrooms, but also completed two KidPix projects. They designed totem poles for a Native American unit, which incorporated writing skills using the Kid Pix typewriter and drawing and formatting skills. They also created pictures for their lockers. The results of the student pre-assessment interview indicated that Lisa created KidPix projects at home. The skills she has mastered in KidPix include typing using the typewriter tool, drawing graphics, importing stamps, and formatting text. She stated that she had not created a slideshow independently,
would need assistance with the exploration slideshow presentation, and that KidPix is challenging because projects take a long time to complete, for, it is easier to draw by hand.

When asked what new computer skills she would like to learn this year she responded that she would like to learn how to type faster using JumpStart Typing (another computer-based typing program that reinforces typing skills) and print pictures taken from the digital camera. At the end of the interview I asked if she had any additional information to share with me. She responded that she would like to learn more about computers and downloading text and graphics from the Internet.

Case Study 1, 2, and 3: Sarah, Alyson, and Lisa

Content Prior Knowledge

Prior to the exploration unit, students in Mrs. Warner, Mr. Boyer, and Ms. Hastings’ classrooms engaged in the same social studies projects in their classrooms and library. They recently completed studying a unit on the Native Americans and Iroquois. They learned about how explorers traded with the Iroquois and their relationship with the Algonquins. The North American exploration unit would be an extension of the Native American unit, which would later lead into a Revolutionary War unit.

As an introduction to the exploration unit, students in the three classrooms completed a spice poster in their classrooms and were taught the story of Marco Polo in the library. They read about the North American explorers and answered reading comprehension questions from the back of social studies textbooks. They had class discussions about text and pictures, listened to lectures, and recorded notes during classroom and library activities. They discussed the meaning of exploration results and were encouraged to make inferences from the information read and discussed. None of the participants had knowledge of the North American explorers
prior to classroom, library, and computer-based activities. The exploration unit was new content that would be learned within the three learning environments. The only difference in the participants’ activities is Sarah would also be required to learn about an additional explorer who impacted the world while completing the differentiated activities established by the Project Challenge teacher.

The teacher and student pre-assessments clearly enabled me to understand each student’s academic profile, technological skills, and prior content knowledge. Considering that I randomly teach 750 students in grades Pre-K through five, the assessments enabled me to have some background knowledge on Sarah, Alyson, and Lisa and evaluate how the computer-based activities would impact each student’s learning experiences of content and technological skills. The pre-assessment interview results of the three participants are outlined in Table 3. They were critical in developing the Exploration Rubric, which would later measure student learning of content and technological skills.
### Table 3

**Pre-Assessment Interview Results**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Case Study 1: Sarah</th>
<th>Case Study 2: Alyson</th>
<th>Case Study 3: Lisa</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Student Profile</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Characteristics</td>
<td>High-achiever</td>
<td>Medium-high achiever</td>
<td>Low-medium achiever</td>
</tr>
<tr>
<td></td>
<td>Organized</td>
<td>Cooperative</td>
<td>Internally motivated</td>
</tr>
<tr>
<td></td>
<td>Conscientious</td>
<td>Compromising</td>
<td>Hard worker</td>
</tr>
<tr>
<td></td>
<td>Learns material easily</td>
<td>Consistent work ethic</td>
<td>Social skills</td>
</tr>
<tr>
<td></td>
<td>Takes risks</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Excellent work habits</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Academic Strengths</strong></td>
<td>Reading</td>
<td>Building on skills and concepts</td>
<td>Strives to do well and improve work</td>
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<tr>
<td></td>
<td>Mathematics</td>
<td>Mathematics</td>
<td>Average math skills</td>
</tr>
<tr>
<td></td>
<td>Writing Skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Academic Challenges</strong></td>
<td>Higher level thinking</td>
<td>Higher level thinking</td>
<td>Higher level thinking</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Writing skills</td>
<td>Writing sentences</td>
</tr>
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<td><strong>Favorite Subjects</strong></td>
<td>Social studies, Spelling</td>
<td>Science, Math</td>
<td>English, Math</td>
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<tr>
<td><strong>Internet Activities</strong></td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>In School this Year</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>In School 3rd Grade</td>
<td>Yes, independently</td>
<td>Yes, independently</td>
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</tr>
<tr>
<td>At Home</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Multi-media Activities</strong></td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>In School this Year</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>At Home</td>
<td>Yes, independently</td>
<td>Yes, independently</td>
<td></td>
</tr>
<tr>
<td>Prior Acquired Skills</td>
<td>Typewriter/text, stamps, graphics, toolbar, slideshow</td>
<td>Typewriter/text, stamps, graphics, toolbar, slideshow</td>
<td>Typewriter/text, stamps, graphics, toolbar</td>
</tr>
<tr>
<td><strong>Prior Computer Activities</strong></td>
<td>Word Processing, Ultrakeys</td>
<td>Word Processing, UltraKeys</td>
<td>Word Processing, UltraKeys, 2 KidPix projects</td>
</tr>
<tr>
<td><strong>Content Prior Knowledge (from classroom and library activities)</strong></td>
<td>Native American Unit, Story of Marco Polo, Created a spice poster, Readings and discussions</td>
<td>Native American Unit, Story of Marco Polo, Created a spice poster, Readings and discussions</td>
<td>Native American Unit, Story of Marco Polo, Created a spice poster, Readings and discussions</td>
</tr>
</tbody>
</table>

### CREATING THE EXPLORATION RUBRIC

**The Impact of the Pre-Assessment Interviews**

The teacher and student pre-assessment interviews played a key role in developing the newly created performance-based assessment tool: the Exploration Rubric. After conducting the
pre-assessment interviews, I was able to identify the social studies curriculum fourth-grade students were learning in their classrooms and the type of information students would need to learn outside of the classroom. The value of the Internet being utilized as a tool for additional information on exploration, the North American Explorers, and other explorers who impacted the world became clear. Understanding the value and purpose of the Internet enabled me to bookmark Web sites that were pertinent and relevant to students' needs. In turn, I was able to develop assessment categories and criteria that clearly stated educational learning goals and objectives.

The teacher and student pre-assessments also impacted the technological assessment criteria to be included in the rubric. Through the interviews, I gained an understanding of the prior computer-based projects students had created during school and at home, and the technological skills the fourth-grade teachers and students had practiced and mastered in various software applications. From that understanding, I was able to determine the type of software to be utilized for creating student work and identify computer skills to be incorporated into the projects.

Supporting Teachers and Providing Resources

The level of support teachers would need in order to integrate and support their students was also clarified. In turn, not only did I understand the importance of developing lesson plans and resources, I understood the technological support I would need to provide teachers in order for them to gain confidence in computer use. As stated by Groves et al (1998) and NCREL (2000), teachers need to know the different applications and aspects of software packages for effective integration of technology to occur. Teachers need time to practice skills and try out new ideas in order to gain confidence in use.
The Process and Final Draft

While developing the assessment tool, I reviewed the curriculum and computer skills and then identified the standards to be incorporated into the exploration unit. I reviewed standards from three sources: New York State ELA and Social Studies standards, New York State Mathematics, Science, and Technology standards, and ISTE NETS standards. I then listed the standards relevant to the exploration project on the unit lesson plans (see Appendix B3). The standards were then turned into objectives and performance indicators or criteria in order to measure student learning of content and technological skills.

Three rating categories were chosen to evaluate students' performance: Excellent (Met all criteria), Good (Met most criteria), Incomplete (Missing a lot of criteria. Make modifications). These categories were not assigned numeric values because students in my school district receive an effort grade in computers. However, grades could be assigned to each level of performance, if required (e.g. Excellent = 90-100%, Good = 80-90%).

A Rating column was created in order to assess students' knowledge of each criteria. A Teacher’s Comments column was developed in order to provide ongoing feedback to students and to elaborate on each student’s progress or areas in need of improvement within each criteria. Categories such as “Expert,” “Emerging,” and “Novice” were not utilized with specific expectations because of the age of the students. Since participants in this study are fourth-graders, I felt it was more appropriate to clarify the performance expectations and provide feedback relative to their performance. The rubric was not distributed to students prior to completing their computer-based Internet and multimedia presentations because of ongoing modifications. The final draft of the Exploration Rubric is displayed in Table 4.
## Table 4

**Exploration Rubric**

*Excellent = Met all criteria  Good = Met most criteria  Incomplete = Missing a lot of criteria. Make modifications.*

<table>
<thead>
<tr>
<th>INTERNET</th>
<th>Expectations and Criteria</th>
<th>Rating</th>
<th>Teacher's Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Research Skills</strong></td>
<td>Launched Internet Explorer and opened bookmarked hyperlinks.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Used correct keyboarding techniques to access information on the Internet.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Content</strong></td>
<td>Recorded factual, pertinent and interesting information pertaining to explorer on provided Fact Sheets.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Following Directions</strong></td>
<td>Respectfully followed the directions of teachers when learning research and note-taking skills.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### KIDPIX SLIDESHOW PRESENTATION

<table>
<thead>
<tr>
<th>Expectations and Criteria</th>
<th>Rating</th>
<th>Teacher's Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Content</strong></td>
<td>Slideshow demonstrates knowledge of explorer's early life, voyages, results of exploration, and tributes or legacies. Student demonstrates complete understanding of researched information throughout multimedia presentation. Information presented is clear, relevant and accurate.</td>
<td></td>
</tr>
<tr>
<td><strong>Mechanics</strong></td>
<td>Student uses correct punctuation, grammar and spelling Information is typed in complete sentences.</td>
<td></td>
</tr>
<tr>
<td><strong>Design Elements</strong></td>
<td>Slideshow contains all elements stated on Fact Sheets and Blank Slide Sheets: 4 slides, text, 3 imported graphics and a background. Text is legible throughout presentation. Background is creative and includes the use of tools: stamps, pencil, paintcan, and/or paintbrush. Imported and created graphics explain and reinforce slide text and presentation.</td>
<td></td>
</tr>
<tr>
<td><strong>Following Directions</strong></td>
<td>Student respectfully followed the teachers' directions when learning new computer skills and doing a skill for the first time as a group.</td>
<td></td>
</tr>
<tr>
<td><strong>Presentation Sharing</strong></td>
<td>Student interacted with peers in an appropriate way when sharing slideshow presentation.</td>
<td></td>
</tr>
</tbody>
</table>
RESULTS FROM OBSERVING EACH PARTICIPANT

Overview

As mentioned in the Method section, I constructed detailed field notes in order to observe and document each participant’s learning experiences of content and technological skills, the challenges they faced while completing the computer-based activities, and their social interactions with fellow peers and teachers. The results of the participants conducting research via the Internet, completing the multimedia slideshow presentation, creating other computer-based activities, and applying the Exploration Rubric to new situations are outlined and discussed.

Case Study 1: Sarah

Conducting Research via the Internet

On the first day of conducting research via the Internet in the computer lab, all students in Mrs. Warner’s classroom were instructed to open the bookmarked Web sites pertaining to their explorer, read for information, and record relevant facts on the provided fact sheets. Sarah opened many of the Web sites and skim-read each site, one at a time. She went to Mendon Center Elementary School’s library homepage to utilize bookmarked search engines and conduct searches on her explorer, Sally Ride. While Sarah’s peers were conducting research on the six North American explorers, she was utilizing the Internet to learn more information about a women who explored space two times on the STS-7 Challenger rocket.

Conducting research on Sally Ride was initially puzzling to me because I didn’t understand the relevance of the differentiated project. Since the curriculum being taught in the classroom was North American explorers, a unit that was leading into the Revolutionary War, I questioned how learning about Sally Ride would teach or reinforce the curriculum. I reiterated the interview I had with the Project Challenge teacher who stated that the purpose of the differentiated project was to learn about other explorers who impacted the world, that exploration
was not specific to trading, ships, and voyages, and to engage in higher-level thinking skills. I began to see some relevance in the project but remained puzzled the remainder of the class period, wondering if the unit could have been differentiated in another way, possibly by a process rather than by a person.

Sarah did not record notes on the provided fact sheets and appeared to be looking for new information while opening bookmarked Web sites and conducting searches. Towards the end of the class I asked her why she didn’t record information on her explorer. She replied that she was looking for new graphics and information on Sally Ride for the differentiated project of creating a scrapbook. She stated that she had recorded Internet-based notes while working with the Project Challenge teacher and this was her classmates’ first time doing research on the Internet.

During the two other days that I observed Sarah conducting research via the Internet, she displayed some more advance skills than her peers. While other fourth-grade students were strictly utilizing bookmarked hyperlinks to conduct research, Sarah also opened hyperlinks within main links, which took her to new and different information. She recorded notes on the provided fact sheets and completed the four sections. She also copied and pasted graphics pertaining to her explorer into AppleWorks Word Processing and then saved the graphics as a document into her server folder.

Sarah experienced some technical difficulties that required the assistance of the classroom teacher, the computer paraprofessional, and I. During one class period, she received unwanted advertising messages and Web sites, such as “Who 2 Classmates,” when clicking on hyperlinks that were not directly bookmarked. During another class period, the alias or shortcut for AppleWorks broke so she couldn’t get into the Web page that contained the hyperlinks on Sally Ride. I opened the harddrive and remade the AppleWorks alias. While reviewing the fact
sheets, she discovered a discrepancy in her researched information on whether Sally Ride did not become a pro tennis player because of her "forehand" or "forehead." Sarah was frustrated because she could not remember which Web site had the correct information. Her experience is an example of how students commonly get "lost" on the Internet because they cannot remember where they just were or which links contained which type of information.

I reviewed Sarah’s Project Challenge folder. Her fact sheets were complete, seven graphics copied from the Internet were printed, and four Web sites containing information on Sally Ride were printed and placed in the folder. She stated that the printed graphics and Web pages were for the scrapbook she would later present in her classroom. In contrast, the graphics saved to her server folder would be utilized in the multimedia slideshow presentation.

While conducting research and importing graphics from the Internet, Sarah remained focused and an independent worker. In the beginning of each class period, she immediately began working and remained working until the end of the class period. She communicated with one student in her class, a girl who was also in the differentiated group. Periodically, Sarah checked on the girl’s progress and the two students compared notes and graphics. Neither girl communicated with peers outside of the differentiated group.

Creating the Multimedia Slideshow Presentation

Each of the six fourth-grade teachers requested that I lead the first day of creating the multimedia slideshow presentation in KidPix. Since new skills were going to be learned by students, such as importing graphics from one application into another application, the teachers wanted “an expert” to lead their students and troubleshoot technical problems and challenges that would occur. In this situation, the teacher became a support for his or her students while
listening and learning from my instructions and following the lesson plans I had developed and modified.

On the first day of creating a slide in KidPix, I explained the importance of following directions in order to practice and learn new skills, since students would be encouraged to create the following three slides independently. The television located in the front of the computer lab was utilized as a visual for students who needed additional support to my instruction. All skills and examples were projected to the television from one of the computers in the lab.

Sarah displayed advance skills and, again, worked independently in a focused manner. While I was giving directions on how to create a slide in KidPix and how to import graphics saved on the server, she went ahead of my instruction and imported a graphic of her explorer which she had saved into her server folder. She typed and formatted text, imported stamps, and made a simple background. Her peers, on the other hand, chose to stay on task with my instruction. They did not work independently until all graphics were imported, resized, and moved to the proper location.

During the other class periods of creating slides two through four, Sarah worked independently and required minimal guidance. She properly logged onto the server, opened saved graphic files, launched KidPix, and created the slides independently. She utilized the stamp set and toolbars to create a background and utilized the typewriter and formatting tools to edit text. She successfully saved all four slides into her server folder and closed out of applications and the server properly (see Figure 1 for completed slideshow).

When all criteria was met, she chose to play Reader Rabbit, a software program that reinforces ELA skills, and create pictures in KidPix for the remainder of the class period. She did not choose to create graphics pertaining to her explorer, such as utilizing the drawing tools in
KidPix to draw a graphic of Sally Ride in space. Rather, she chose external anchor activities that were not relevant to the exploration project. The classroom teacher utilized the lesson plans to assist students with specific technological skills and questions.

Figure 1

Case Study 1: Sarah’s Completed Multimedia Slideshow Presentation

Slide 1

Sally Ride
May 26, 1951 - 7 she is still alive today in 2002

Sally Ride was born on May 26, 1951 in Encino, California. She is still alive today. She married Steven Allen and they had no children.

Slide 2

Sally Ride explored space two times during her space career. The name of her rocket was the STS-7 Challenger.

Slide 3

As a result of her exploration Sally wrote many books called, The Mystery of Mars, To Space and Back, The Third Planet, and Voyager. She almost became a pro tennis player but had a bad forehand.

Slide 4

The End

Sally has a dog named, Segan. Also today she is working as professor at Stanford University.

Sarah and the other student in the differentiated group experienced the same technical difficulties while creating the four slides of the slideshow. The computers kept displaying memory overflow messages when importing graphics taken directly from the internet and from
graphics saved into their server folders. Mrs. Warner, the computer paraprofessional, and I restarted the computers because of memory and freezing problems. I asked the students to show me how they were importing graphics. I immediately realized the problem: they were importing a larger image of each graphic, instead of a smaller image. I taught them to import smaller images and then resize them in KidPix. This resolved the problem and they learned a new skill.

**Creating other Computer-Based Activities**

During the exploration computer-based activities, Sarah and her peers completed two other lessons: a "Winter Is..." poem and a "How To Be a Good Student" essay. These projects were created by the fourth-grade classroom teachers in order to reinforce ELA writing skills, objectives, and standards. As mentioned in the Method section, ELA is an ongoing and critical curriculum of fourth-grade students. Although the poem and essay were not part of the exploration unit, I printed and reviewed them in order to evaluate their significance in the learning process and to evaluate if the Exploration Rubric could be utilized to measure student-achievement. This part of the study was significant, as it proved that different computer-based projects require different performance indicators and criteria in order to measure student learning. Hence, different assessments tools would need to be created for each lesson, even for lessons which utilize the same application.

**Applying the Exploration Rubric**

The "Winter Is..." poem focused on students creative writing skills and sentence structure. Students were encouraged to use descriptive adjectives and complete sentences to describe the winter season. Mrs. Warner gave them verbal technological criteria to: center their title, format text in a chosen font and style, change the page orientation from portrait to
During the following two days that I observed Alyson conducting research via the Internet, she began to skim through paragraphs and then immediately scroll to the bottom, middle, or top of each Web page. I asked her why she was scrolling so much. She stated that she was skimming through the Web sites to find text in bold type. She would then go back and read in-depth information pertaining to the bold text, since she felt that bolded text contained important information. Throughout conducting research, Alyson worked very conscientiously. She remained focused and diligently conducted research and recorded pertinent information on the fact sheets. Periodically, she looked to the peer sitting to her left but never got out of her seat to interact with other peers.

Similar to students in Mrs. Warner's classroom, students in Mr. Boyer's classroom also experienced some technical difficulties while conducting research via the Internet. In one class, the Internet preferences on eight computers went into the trash can and the Internet stopped working. To date, I'm not sure how this happened but I had to re-send the preferences, utilizing communication software called Network Assistant, and restart the computers. The students had to wait patiently while I resolved the problem and lost approximately 10 minutes of computer class time. On the morning of another class, two of the six resource pages that contained hyperlinks on each explorer became corrupted on the server. The district network technician was called in to restore the files from backup tapes. Since he couldn't arrive until later that day, students in Mr. Boyer's classroom could not conduct research and practiced UltraKeys for that class period.

When given free time after completing each slide, Alyson chose to play Hot Dog Stand and How the West Was, two mathematical software applications that reinforce elementary mathematics skills. During the pre-assessment interviews, Alyson stated that math was one of
her favorite subjects. Her classroom teacher also stated that math and building on skills and concepts were her academic strengths. Hence, when given a choice of an anchor activity, she chose activities of interest and talent.

Creating the Multimedia Slideshow Presentation

Per the teacher's request, I led the first day of creating the slideshow presentation and explained the importance of following directions. Again, the television was utilized as a resource by students and the classroom teacher utilized the KidPix lesson plans as a guide while supporting students. On the first day of creating a slide in KidPix, Alyson was attentive, followed directions, and stayed on task with my instructions. She successfully logged onto her server folder, opened the resource pages that contained graphics, launched KidPix, and imported graphics. She then independently typed and formatted text and created a background with the toolbar and stampset. She worked independently and assisted a student sitting directly next to her who had difficulties copying and pasting graphics. At the end of the class period, she successfully saved slide one into her server folder and logged off of the server independently.

Some of her peers needed assistance.

While completing slides two through four, Alyson demonstrated that she had learned new skills. Whereas on the first day of class she followed my instructions, on the second, third, and fourth day of class she successfully created and saved the slides without assistance. She chose to not only color a background using the toolbars and stamp sets, but also created graphics pertaining to her explorer utilizing a combination of stamps and the drawing tools (see Figure 2). Mr. Boyer continually utilized the KidPix lesson plans to assist students with specific technological skills and questions.
Case Study 2: Alyson’s Completed Multimedia Slideshow Presentation

Slide 1

Henry Hudson was born in 1607 and died in 1683. Not much is known about Hudson’s early life. His father worked for the Mercery Company, and Henry was hired in 1631. Hudson was a captain of one of the famous German Colonists from the colony of Spa in Cohor. Hudson was also a Calvinist.

Slide 2

Henry Hudson had three voyages. He explored Virginia, North Carolina and Hudson River. The Half Moon was given to him by the “Mercery Company.” Hudson explored for Holland or England. On September 4th Hudson was attacked by Indians.

In 1609 Hudson sailed into New York Bay.

Slide 3

Hudson met some nice Indians and some difficult Indians. Henry Hudson found the Hudson river, Hudson Bay and Hudson Strait. He sailed up one of the most important rivers: the “Hudson River.” On September 20, 1609 the “Half Moon” reached a point where the river became shallow. That was near Present Day Albany.

Slide 4

As in Mrs. Warner’s classroom, students in Mr. Boyer’s classroom also experienced technical difficulties while creating the multimedia slideshow presentations. During the beginning of the second class, I was out of the computer lab assisting another teacher. Hence, I did not have the opportunity to observe how the students began class. When students tried to save their slide at the end of class, they received error messages. I immediately realized that they
did not log onto their server folders prior to opening the resources, which is critical in this project. Initially, the students, Mr. Boyer, and computer paraprofessional were in a panic, believing all students would lose their work. I instructed them to save to the desktop. Everyone followed my directions. After class, the computer paraprofessional and I transferred the files from the desktop into each student’s server folder.

Alyson had an individual problem of the map of Henry Hudson’s voyages becoming embedded in KidPix. She raised her hand for assistance and I observed her moving and resizing the graphic. I realized that she was dragging the map too far to the top right corner, causing it to become embedded even though she had not clicked off of it. I instructed her to first resize the graphic and then drag to the desired location. She followed my directions and was able to resize and move the map accordingly.

Creating other Computer-Based Activities and Applying the Exploration Rubric

Similar to Sarah, Alyson also completed a “Winter Is...” poem and “How To Be a Good Student” essay in the computer lab in order to reinforce ELA standards and objectives and integrate technology into the curriculum. I printed and reviewed the poem and essay and compared them to Sarah’s work. They both included the same technological skills and ELA criteria. It became even clearer that separate rubrics would need to be created for each project since different performance indicators would need to be developed and, hence the learning experiences would vary.

Case Study 3: Lisa

Conducting Research via the Internet

On the first day of conducting research via the Internet in the computer lab, students in Ms. Hastings’ classroom were given clear and concise directions. Ms. Hastings asked students
to stay on task as she taught them how to open the resources that contained bookmarked hyperlinks, open links, and then conduct research on the Internet. As a class, students opened the first link of their explorer and learned as a group how to use the scroll bar and read information. The entire class was actively engaged and listened attentively to their teacher's directions.

After learning how to conduct research utilizing the bookmarked links, Lisa opened each and every link on her explorer and skimmed through each page. Whereas Alyson read each page individually and took notes, Lisa skim-read every Web page first and then went back to the first page to take notes pertaining to her explorer, Giovanni da Verranzo. She continually looked to the peer sitting next to her. She observed the peer while she was following Ms. Hastings' directions, opening hyperlinks, recording notes on fact sheets, exiting out of the resources page, and logging off of the server. Initially, her behavior got my attention, as it appeared she was looking for either guidance or reassurance while performing each and every technological skill. I began to think that she was not confident in using the computer or had low technological skills that would need additional support and guidance from a teacher.

During the second and third class of conducting research via the Internet, Lisa immediately appeared to be more confident. Not only did she go ahead of Ms. Hastings' instructions on how to open the hyperlinked Web sites, she utilized the search engine Yahoo to conduct searches on her explorer. This was a skill that was not taught or reinforced in the classroom or computer lab. She recorded brief key word notes on the fact sheets and did not write complete sentences. Although she looked to her peer periodically, she clearly conducted research independently. She did, however, experience some technological challenges with the Internet.
During the second day of conducting research, I observed Lisa erasing a large portion of the information written on the provided fact sheets. This concerned me so I asked her why she was erasing her researched information. She responded that the Internet had inconsistent information and Giovanni da Verranzo’s exploration dates did not match. There was confusion as to which Web site contained the corrected information. This is another disadvantage of the Internet: inconsistent and unreliable information. I encouraged her to record all of the dates that she found and compare them to information taken from classroom and library textbooks. She then went back to each link to look for consistencies and chose the most common dates. By the end of the second class period, she had approximately one-half of the fact sheets complete. The sheets were complete by the end of class three.

Creating the Multimedia Slideshow Presentation

Per Ms. Hastings’ request, I, again, was the lead teacher for creating slide one of the multimedia slideshow. The television was available as an aid. The entire class respectfully followed my instructions on how to log onto the server, open the resources, launch KidPix, and copy and paste graphics. With her classmates, Lisa stayed on task with my instructions and looked to her peer continually throughout the 45-minute class period. She listened and followed directions but clearly could not perform the technological skills independently. Not only did she wait for my instruction, she followed her peer’s actions and would not perform a technological skill until she had seen her peer complete it. Initially, I thought she would need additional guidance and support for the slideshow but, as seen in the Internet project, she proved me wrong.

By slide two, not only did Lisa properly log onto the server, launch the resources and applications, and import two graphics, she helped her peer do them as well. Clearly, she had mastered new technological skills within one class period. I felt proud of her because of the
amount of progress she displayed in such a short period of time. It became clear to me that once she has the confidence and knowledge to perform skills, she can do them independently and assist others in the process. Going back to the teacher pre-assessment interview, I also observed that she is a hard-worker who is internally motivated and simply does not give up, for, once she understands a concept, she is confident to perform it independently. While completing the slides, she utilized the stamp sets and toolbars to format the backgrounds and formatted text with different styles and color (see Figure 3 for completed slides). She saved independently but forgot her password two times.

Figure 3

Case Study 3: Lisa's Completed Multimedia Slideshow Presentation

Slide 1

Slide 2

Slide 3

Slide 4
During free time, Lisa worked in KidPix, Math Blaster, and primarily JumpStart typing. She stated in her pre-assessment interview that she likes JumpStart typing the best. However, her typing skills are below average. In Ultrakeys, for example, she is on Level V, whereas 90% of her peers are on Level IX or higher. I was pleased to see her working on a software program that would help her in an area of weakness.

Creating other Computer-Based Activities

As in Sarah and Alyson's experiences, Lisa also completed a "Winter Is..." poem and "How To Be a Good Student" essay in the computer lab. I printed and reviewed the poem and essay and compared them to Sarah and Alyson's work. They included the same technological skills and ELA criteria. However, Lisa had also completed a graph in the computer lab utilizing AppleWorks Spreadsheets. Immediately following the exploration unit, students in Ms. Hastings' classroom began learning about the Boston Tea Party. The teacher asked me to develop an integrated activity that would incorporate spreadsheet and graphing skills, in order to also reinforce mathematical learning goals. We agreed to have students take a survey of their favorite tea in their classrooms and then create a table, bar graph, and two comparison statements of the results on the computer. Additional lesson plans were developed for the teacher to follow as a guide.

Applying the Exploration Rubric

The tea graphing lesson plans contained technological skills that were different from the poem and essay projects. Students were expected to perform such skills as creating tables with borders, inserting and formatting graphs, labeling axes, interpreting graphs, and typing comparison statements. Clearly, this activity would require an assessment tool that contained different performance indicators than the Exploration Rubric. This project reinforced my belief
that each and every computer-based project would require its own assessment tool that contained both content and technological criteria, for, each computer-based activity has its own standards, objectives, and educational learning goals.

Discussion

Overview

The Exploration Rubric’s effectiveness of providing ongoing feedback and assessing student work, and utilizing and expanding upon a KWL Chart in different learning environments are discussed. The impact of integrating the Internet and the KidPix multimedia slideshow presentation into curriculum are evaluated, as well as their educational advantages and disadvantages on students’ learning experiences. The purpose and value of integrating technology into curriculum, applying acquired knowledge to new situations, meeting teacher and professional development needs, and the future of educational technology are reviewed, reflected upon, and analyzed.

Evaluating the Exploration Rubric

As mentioned in the Introduction, Method, and Results sections, the Exploration Rubric was developed to assess the learning of content and technological skills students acquired while completing computer-based activities that were integrated into classroom curriculum. A performance-based assessment was developed in order for students to demonstrate what they were learning and what they can do with their knowledge. The Exploration Rubric focused on how students accessed, interpreted, and synthesized information, not on rote memorization.

Recording field notes while observing students engaged in the computer-based activities would have been difficult without a clear understanding of what was to be learned. The Exploration Rubric provided clear criteria that enabled me to assess relevant content and
technological skills, how students followed directions, and whether they completed tasks with assistance or independently. In turn, the rubric served as a tool for providing ongoing feedback both for me as a teacher and for each participant as a student.

As stated in the Results section, students also engaged in three other computer-based activities during and immediately after the exploration project: the "Winter Is..." poem, the "How to be a Good Student" essay, and the Boston Tea Party graph. Each project would require a separate assessment since different skills, standards, objectives, and learning goals would be integrated. To develop these assessment tools, I would combine the content and technological categories as I had done on the Exploration Rubric, since they reinforce one another. The technological skills the students acquired helped them to learn the curriculum and the integrated curriculum helped them to acquire technological skills. Hence, students learning experiences of content and computer skills are interrelated, not separate.

Applying the KWL Chart

Without intentionally implementing it, I utilized the KWL chart of what do students know, what do students want to know, and what have students learned, throughout the assessment process. The teacher and student pre-assessment interviews enabled me to understand what students already knew and wanted to know, and reviewing my field notes and student work against the Exploration Rubric enabled me to understand what students learned. However, one question remained unanswered towards the end of the assessment process: How did students learn the content?

In order to assess technology's impact on student learning, I would take the KWL Chart one step further and make it into a KWLH Chart. In education, it is not only important to understand what students know, want to know, and have learned, it is important to understand how
they learned it. Understanding the "how" would influence our understanding of instructional technology's impact on student learning and achievement of curriculum. Hence, as educators, we would not only understand the content students have learned, we would understand whether the computer or other learning environments fostered each learning experience.

The Internet's Impact on Student Learning

While conducting research via the Internet, Sarah, Alyson, and Lisa displayed different research techniques. Sarah opened multiple Web sites and looked for specific information. She also conducted searches on the Internet utilizing search engines. Alyson read each Web site individually and focused on bold print to find important information. She recorded facts on her explorer from each Web site, one at a time. In contrast, Lisa reviewed each Web site and skipped from one site to another. She skim-read information on each Web site before engaging in note-taking. Hence, although the participants utilized different search techniques, all students were able to conduct research via the Internet successfully and record pertinent information pertaining to the curriculum of study. This fact proved that there does not exist "one way" of properly conducting research via the Internet.

Using Internet browsers and search engines, as students did in the exploration project, enabled students to access a wider variety of print and non-print resources. As students investigate multiple sources of information, they learn to analyze, synthesize, and evaluate the accuracy of data and compare written and visual images (ISTE, 2000). Although the Internet was utilized as a tool in this manner, participants, fellow peers, and I experienced challenges while integrating the Internet into curriculum. As outlined in Table 5, the Internet is not always a reliable tool for enhancing student learning.
Table 5

Internet Advantages and Disadvantages

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is a tool used to research information and gather facts</td>
<td>Internet sites are unreliable (e.g. hyperlinks randomly break and change)</td>
</tr>
<tr>
<td>Contains additional information since textbooks have limited information</td>
<td>Unwanted advertisements randomly appear</td>
</tr>
<tr>
<td>Contains graphics that students can import into computer-based projects</td>
<td>Difficult for students to go back to a Web site to find information. Students can’t remember which sites had which type of information.</td>
</tr>
<tr>
<td>Allows students to acquire research skills when conducting research via the Internet</td>
<td>Time Consuming: Students need to sort through lots of text to find important or relevant information</td>
</tr>
<tr>
<td>Incorporates NYS standards and objectives</td>
<td>Conducting searches launches 100’s or 1000’s of links, many which are invalid and unreliable</td>
</tr>
<tr>
<td></td>
<td>Contains inconsistent information</td>
</tr>
</tbody>
</table>

Originally, fourth-grade students were not encouraged to conduct searches on the Internet due to time restrictions and lack of Internet filters. According to the National Center for Education Statistics, 74 percent of the nation’s 15,000 public school districts have installed Internet filters, a tool that schools use because of concern for responsible computer use and student protection.

As of July, 2002 schools will be required to utilize Internet filters (Borja, 2002). In the meantime, other measures, such as providing bookmarked resources, monitoring student use, and an “acceptable use” policy are being utilized in my school district. Such resources and supervision are typical of elementary and middle schools nationwide (Borja, 2002).

The KidPix Multimedia Slideshow’s Impact on Student Learning

According to the ISTE (2000), in social studies elementary students move to higher levels of technology use through the use of multimedia-authoring and presentation software to produce
their own presentations of information, illustrations, and maps of states and countries. Agreeing with ISTE, participants in my study were able to display their researched information and acquired knowledge in a unique and creative manner. Through the use of the KidPix toolbars, students were able to create backgrounds, import stamps and graphics, and type information relevant to the classroom curriculum. Since graphics had to explain and reinforce the text, as stated on the Exploration Rubric, students had to choose appropriate tools that enhanced the content.

According to the ISTE (2000), literate people today must be effective communicators, critical thinkers, creative problem solvers and lifelong learners. Students need to develop their abilities in ELA, including speaking, listening, reading, writing, viewing, and visual representation. Technology facilitates, enhances, and expands students' abilities in these areas (ISTE, 2000). The KidPix multimedia slideshow in my study was a platform for ELA representation.

Similar to the Internet, KidPix also had advantages and disadvantages while being integrated into classroom curriculum. As outlined in Table 6, the advantages greatly outweigh the disadvantages. As seen in Figures 1, 2, and 3, all participants were able to utilize KidPix as an organizational tool to display their newly acquired knowledge in an organized and meaningful fashion. I would continue to integrate computer-based technology into curriculum utilizing KidPix and other multimedia presentation tools.
Table 6

Kid Pix Multimedia Advantages and Disadvantages

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is a tool to organize information into a meaningful and creative presentation</td>
<td>More difficult to draw on the computer than by hand for some students</td>
</tr>
<tr>
<td>Incorporates computer skills needed for life</td>
<td>Graphics become embedded</td>
</tr>
<tr>
<td>Writing and typing activities include ELA and other standards</td>
<td>Time consuming for some students</td>
</tr>
<tr>
<td>Good platform for students to share acquired information and knowledge</td>
<td></td>
</tr>
<tr>
<td>Freedom to create, draw, and have fun</td>
<td></td>
</tr>
<tr>
<td>User-friendly and appropriate for elementary school children.</td>
<td></td>
</tr>
</tbody>
</table>

Integration: What Have I Learned is the Purpose of the Infusion of Technology

After reviewing the literature on instructional technology, two main arguments for technology use exist in American schools today: to enhance student learning experiences and to prepare students for a highly technological world. Through computer-based integration, participants in my study not only acquired technological skills that will help them succeed later in life, they also learned content that were linked to educational goals and objectives. Hence, I would argue that the purpose of the infusion of technology is not about learning content or acquiring technological skills; it is about both.

Secondly, as seen in the classroom, library, and computer-based exploration projects, integration of technology does not necessarily solely teach curriculum. Although the Internet was utilized to learn important and relevant facts about exploration and although the KidPix multimedia slideshow provided a platform for students to present their acquired information,
such activities reinforced the classroom curriculum; they did not solely teach it. In order to evaluate if the Internet or multimedia projects could solely teach curriculum, other collaborative learning environments, such as grade level classrooms and the library, could not have also integrated activities into the same curriculum.

**Application of Knowledge**

In order to prove that students retained knowledge, they would need to be given the opportunity to apply their acquired knowledge to a new or different situation. Further research would need to be conducted to see if students could conduct research via the Internet and create a multimedia presentation independently. As stated by ISTE (2000), “Effective integration of technology is achieved when students are able to select technology tools to help them obtain information in a timely manner, analyze and synthesize information, and present it professionally.” Until students have mastered Internet, multimedia, and other technological software such as spreadsheet, timeline, and word processing, students would not be able to select appropriate technology tools because they would not be aware of the applications and the potential skills within each application.

**Professional Development Needs**

Literature continually states that the number one reason teachers do not integrate technology into curriculum is lack of professional development, that teachers are not given the opportunity to be trained on and practice the technologies and software applications. I would argue that although professional develop is important, it is not the only means for effective integration to occur. As indicated in my research study, providing teachers with resources, such as lesson plans that specifically state how to perform the technological skills involved in a
computer-based activity, can greatly impact teachers ability to integrate technology effectively and, hence, support students.

Secondly, having accessible and competent technology personnel who can model computer-based activities and then encourage teachers to facilitate future lessons can also give teachers the confidence and ability to integrate, teach, and facilitate computer-based lessons. Hence, although professional development is important, it is not the only means of developing and maintaining technologically-literate educators.

Thirdly, having quality technical personnel whom can troubleshoot hardware, software, server, and network issues in order for teachers to focus on integration and support student work is essential. As detailed in the Results section, server folders became corrupted, computers froze and went on memory overflow, application aliases broke, graphics became embedded, and students had trouble saving their work because they did not follow the proper sequence of logging onto their server folder. Such problems required my personnel assistance, someone who is trained and responsible for technical troubleshooting. Without such support and assistance, the computer-based activities would not have gone as smoothly and some students would have lost 45 minutes worth of work. As stated by NCREL (2000), an important component of professional development is access to on-site technical support personnel who are responsible for troubleshooting and assistance after the technology and lessons are in place. I would argue that without such competent personnel, integration would falter and, hence, student learning experiences would be negatively affected.

The Future: Where Do We Go From Here

The government is going to conduct a three-year, $15 million dollar study on assessing the impact of technologies on student learning. On January 25, 2002, the Secretary of Education
addressed a group of educators and business leaders at a policy summit meeting of the National Coalition for Technology in Education and Training. He stated, "It's now time for the next step, to see how technology is applied to curriculum. It's pointless to integrate things into our curriculum if they don't add value to student performance." The study is coming at a time when nearly all classrooms are wired to the Internet and most schools have an adequate supply of computers (Trotter, 2002).

The purpose of the government’s study is to examine conditions and practices under which educational technology is effective in increasing student academic achievement, as well as the ability of teachers to integrate technology effectively into curricula and instruction. To date, the federal government has not designed the study or determined who will conduct it. However, the study will be longitudinal and track the progress of students over time. To assess student performance, the study will measure results using authentic assessments, as I had done in my study. A former education researcher at the Office of Technology assessment stated that the study will be a very difficult undertaking, but one that would be valuable when coupled with the knowledge base that already exists (Trotter, 2002).

The Future: Personal Reflections

After reviewing the literature and conducting my research study, I would like to pose the following question for the future of technology: Can computer-based technology be the sole means of teaching and learning content? With colleges developing on-line courses, simulations being conducted for students and professionals, the Internet and Internet 2 providing a means of learning new information, and on-line field trips available for individuals, what will happen to the future of American education? I recently accepted a position at a local college, who is a leader in on-line learning and promotes meeting educational goals and objectives through the use
of the Internet and e-mail. Doctors are performing surgeries and NASA is sending employees on space missions using computer-based simulations. Universities and researchers will be utilizing the Internet for learning content specific to their fields. Some schools throughout America are allowing students to retake courses on the Internet rather than attend summer school. Therefore, I ask, where do we as educators draw the line between utilizing technology as a tool for learning and utilizing technology as a sole means of teaching and learning?

This Thesis has been about the past, present, and future of educational technology: what has been done, what needs to be done, and how do we get there. Regardless of the future of technology in education, one fact is clear: unless educators develop assessment tools with performance indicators tied into educational learning goals, the long-term impact of technology on student learning and achievement will continue to be unknown. My Thesis is a starting point of what needs to be done to effectively assess student learning of content and technological skills. Now it’s the government’s goal and responsibility to do the same....
References


Appendix A1

Introductory Letter

January 30, 2002

Dear Parents,

My name is Mary Hallett and I am the Instructional Technology Specialist at Mendon Center Elementary School. My four areas of responsibility include integrating computer technology into curriculum, maintaining the school's website, professional development, and technician work. This is my second year in this position and I'm thoroughly enjoying working with students, teachers and administrators. I am also a graduate student at St. John Fisher College where I'm pursuing my Master's degree in Mathematics, Science and Technology Education. I am in the process of writing my Thesis and will be graduating this May. However, in order to complete my Thesis, I need to conduct a research study and elaborate on my findings and conclusions. I am seeking three fourth grade students to participate in my study.

The purpose of my study is to assess the technological skills and curriculum which students are learning while completing computer-based activities. In other words, I will be assessing the processes involved in instructional technology, not students. Little research has been conducted to prove that technology enhances student learning and achievement. Yet, the main purpose of computer technology is to improve student learning and achievement, to teach and/or reinforce the curriculum being taught in the classroom. Through my literature review I've learned the importance of developing assessment criteria and tools that will measure student learning. Hence, the first part of my study is to work with classroom teachers to identify the criteria, using NYS and Pittsford Central School District's standards and objectives.

Once the assessment tool is created, I will work with three randomly selected students. I will interview the students before and after each computer activity to assess prior and new knowledge. I will observe the students while they're completing each computer activity and will record my findings in field notes. I will provide each student with a journal book to reflect on his/her learning experiences. All student work will be saved to the server, as usual. I will then review the assessment tool, interview notes, field notes, journals and student work to generate findings and conclusions relating to my study.

The research study will take place in February through early March. Attached is a permission form granting permission for students to participate in the study. If you are interested in having your child participate in the study, please review the form with your child, sign it, and return it to your child's classroom teacher. If you do not wish to participate in the study, please dispose of the permission form. Three students will then be randomly chosen to participate in the study. I will then contact the parents and meet with each participant to review the study. I want to emphasize the fact that student and teacher names will not be used or mentioned in the research project.

If you have any questions, please feel free to contact me at 218-1409. Thank you and I look forward to working with fellow students and assessing student learning and achievement.

Sincerely,

Mary Hallett, Instructional Technology Specialist
Appendix A2

Permission Form

I give my child, __________________________________, permission to participate in Mary Hallett's research study from February through early March, 2002. I understand that my child will participate in interviews and keep a journal book reflecting on his/her learning experiences. I understand that my child will be observed while engaging in computer-based activities and his/her work will be saved and later reviewed. I also understand that this study will not interfere with my child’s academics and student/teacher names will not be used or mentioned.

☐ I grant permission for my child to participate in the study.

_________________________________________  ___________________________________________
Parent’s Signature                      Student’s Signature

_________________________________________
Classroom Teacher’s Signature

_________________________________________
Instructional Technology Specialist

_________________________________________
Principal’s Signature

_________________________________________
Helping Teacher’s Signature

Please return to your child’s classroom teacher. Thank you!
February 5, 2002

Dear Parents of «FirstName» «LastName»,

Thank you for returning the permission form, granting permission for your child to participate in my Thesis research study from February through early March. Your willingness to have your child participate in the study is greatly appreciated.

On Friday, February 1st, I gathered all returned permission forms and randomly selected three students. Your child was selected to participate in the study. By default, the North American Explorers curriculum will be the focus of the study.

During lunch on Friday I met with the three participants. We introduced ourselves and got to know each other a little better. We also discussed the purpose of the study and writing journals. Yesterday, we met as a group at lunch to answer questions and complete a pre-assessment questionnaire. The purpose of the questionnaire is to assess prior knowledge of both the curriculum and technological skills. All participants have expressed excitement for their involvement in the research project and I look forward working with them.

If you have any questions, please feel free to contact me at 218-1409. Otherwise, I will communicate with you and «FirstName» on a regular basis.

Sincerely,

Mary Hallett
Instructional Technology Specialist
February 5, 2002

Dear Parents of «FirstName» «LastName»,

Thank you for returning the permission form, granting permission for your child to participate in my Thesis research study from February through early March. Your willingness to have your child participate in the study is greatly appreciated.

On Friday, February 1st, I gathered all returned permission forms and randomly selected three students. Your child was not randomly selected to participate in the study. However, your child will engage in the same computer projects as the students selected for the study.

Thank you, again, and I look forward to conducting my research and integrating computer technology into curriculum for each and every student.

Sincerely,

Mary Hallett
Instructional Technology Specialist
Appendix B1

Example of Resource Page

JOHN CABOT

Zoom Explorers Website
(scroll down list of explorers to find Cabot)
www.enchantedlearning.com/explorers/indexc.shtml

John and Sebastian Cabot
www.mariner.org/age/cabot.html

John Cabot
www.win.tue.nl/~engels/discovery/cabot.html

The Cabot Dilemma: John Cabot’s 1497 Voyage & the Limits of Historiography
http://etext.virginia.edu/journals/EH/EH33/croxtto33.html
### Slide/Key Questions

#### SLIDE 1
- Explorer's name
- Years of his life
- Facts of his early life:
  - Nationality
  - When/where he was born
  - Family
  - Parents
  - Interests/Talents/Experiences
  - Education

Include a PICTURE of explorer

#### SLIDE 2
- How many voyages were there?
- Where did he explore?
- Name of ships/vessels
- What country did he sail for and how did this country support the voyages?
- What were some of the problems and/or discoveries on the voyages?

Include a NY STATE MAP
Include a FLAG of the country he sailed for
<table>
<thead>
<tr>
<th>Slide/Key Questions</th>
<th>Research</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SLIDE 3</strong></td>
<td></td>
</tr>
<tr>
<td>What were the results of his exploration?</td>
<td></td>
</tr>
<tr>
<td>Any tributes or legacy to him?</td>
<td></td>
</tr>
<tr>
<td>List any other interesting facts</td>
<td></td>
</tr>
</tbody>
</table>

| **SLIDE 4**         |          |
| Type the words "THE END" |          |
| This is your slide to design |          |
| Include any information or pictures you would like |          |
Appendix B3

Lesson Plans

Title: North American Explorers
Curriculum: Social Studies
Grade-Level Span: 4th Grade

PURPOSE:
Students will research explorers who had an impact on the continent of North America, in particular, on New York State. Students will gain an understanding of the causes and results of the exploration and how the exploration impacted the growth of New York State and the world. Students will integrate technology to research and present information in a meaningful and creative fashion using a combination of the Internet and multi-media software.

DESCRIPTION:
In their classroom and in the library, students will be introduced to the story of Marco Polo and make a spice poster. Using a variety of texts, students will learn about the Age of Exploration and how exploration led to colonization and to the American Revolution. Students will then use their library and Internet skills to conduct research and answer key questions about an assigned explorer. Students will practice "jot dot" note-taking using a graphic organizer (Fact Sheets). Students will utilize their notes and present their acquired knowledge in a four-picture slideshow presentation in KidPix Studio Deluxe.

COMPUTER-BASED ACTIVITIES:
- Conduct Research via the Internet
- Present acquired information in a four-picture slideshow multimedia presentation

OBJECTIVES:
Students will be able to...
- launch Internet Explorer and open bookmarked hyperlinks saved on the server.
- use correct keyboarding techniques to access information on the Internet.
- record factual, pertinent and interesting information pertaining to an explorer on provided Fact Sheets.
- create a four-picture slideshow that demonstrates knowledge of an explorer's early life, their voyages, results of exploration, and tributes or legacies.
- import and create graphics, format text and backgrounds, paste stamps, and utilize other KidPix Studio Deluxe tools when creating a slideshow.
- use proper mechanics, including correct punctuation, capitalization, grammar, spelling and complete sentences.
- respectfully follow the directions of teachers when learning research, note-taking and multi-media skills.
- interact appropriately with peers when sharing slideshow presentation.
STANDARDS:

**NYS Learning Standards for Mathematics, Science, and Technology**

*Standard #2*: Students will access, generate, process, and transfer information using appropriate technologies.

**NYS Learning Standards for Social Studies**

*Standard #1*: History of the United States and New York

Students will use a variety of intellectual skills to demonstrate their understanding of major ideas, eras, themes, developments and turning points in the history of the United States and New York.

*Standard #2*: World History

Students will use a variety of intellectual skills to demonstrate their understanding of major ideas, eras, themes, developments and turning points in history and examine the broad sweep of history from a variety of perspectives.

*Standard #3*: Geography

Students will use a variety of intellectual skills to demonstrate their understanding of the geography of the interdependent worlds in which we live – local, national, global – including the spatial distribution of people, places and environments over the Earth’s surface.

*Standard #4*: Economics

Students will use a variety of intellectual skills to demonstrate their understanding of how the United States and other societies develop economic systems and associated institutions to allocate scarce resources, how major decision-making units function in the US and other national economies, and how an economy solves the scarcity problem through market and non-market mechanisms.

**NYS Learning Standards for English Language Arts**

*Standard #1*: Students will read, write, listen and speak for information and understanding.

*Standard #3*: Students will read, write, listen and speak for critical analysis and evaluation.

**ISTE NETS Standards**

1. **Basic operations and concepts**

   Students demonstrate a sound understanding of the nature and operation of technology systems. Students are proficient in the use of technology.

2. **Social, ethical and human issues**

   Students practice responsible use of technology systems, information, and software. Students develop positive attitudes toward technology users that support lifelong learning, collaboration, personal pursuits, and productivity.
3. **Technology productivity tools**  
   Students use technology tools to enhance learning, increase productivity, and promote creativity.

4. **Technology communication tools**  
   Students use a variety of media and formats to communicate information and ideas effectively to multiple audiences.

5. **Technology research tools**  
   Students use technology to locate, evaluate, and collect information from a variety of sources.

**TOOLS AND RESOURCES:**

**Classroom and Library**
- Social studies textbooks
- Encyclopedias
- Resource books and materials
- Blank slideshow worksheets
- Writing utensils

**Instructional Technology**
- Computers
- Internet browser: Internet Explorer
- Kid Pix Studio Deluxe
- AppleWorks Word Processing
- Internet links of valid explorer websites (accessible on the server)
- Fact Sheets for Internet note-taking
- Writing utensils
- Graphics for students to import into their projects (accessible on the server)
- Server folders for students to save their work
- Lesson Plans
- Rubric

**ASSESSMENT:** Rubric

**CREDITS:**
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Appendix B4

KidPix Slideshow Lesson Plans

A) Making Slides

I. MAKE A STORY BOARD IN YOUR CLASSROOMS
   Use the "Blank slides" worksheets to plan what researched information and graphics will
   be included on each slide.

II. CREATE A SEPARATE FOLDER TO HOLD THE SLIDE SHOW
   1. Log onto the server
   2. Open Special Projects folder – do not click anywhere!
   3. File, New Folder
   4. Name the folder “Explorer Slide Show” (w/initials) close windows

III. OPEN APPLEWORKS (keep open in Finder)
   1. Go to Launcher, Applications, and open AppleWorks
      close Starting Points window

IV. OPEN EXPLORER FOLDER
   1. Go to Launcher, Resources, Resources-4, and open “Explorers” folder
   2. Open student’s explorer folder (e.g. “Cabot”)
   3. Open AppleWorks file that contains the graphics to be copied into Kidpix
      (e.g. “Cabot – Pictures, Flags, Maps”) [OK] Open a Copy keep opened

V. CREATE A SLIDE FOR THE SLIDE SHOW
   1. Go to Launcher, Applications, and open KidPix
   2. Use the Typewriter to type the researched information
   3. Import Pictures
      Go to FINDER
      Open AppleWorks from the FINDER
      Click on the picture or map to be copied
      Go to Edit on menu bar and click “Copy”
      Go to FINDER and open KidPix
      Go to Edit on menu bar in KidPix and click “Paste”
      Immediately resize and move the picture to its proper location
      Repeat, as needed.
   4. Format the Background (e.g. stamps, color, draw)

VI. SAVE THE SLIDE
   1. File, Save A Picture
   2. Open Grade 4
   3. Open student folder
   4. Open Special Projects folder
   5. Open folder named “Explorer Slide Show”
   6. Save picture as “Slide 1” SAVE
VII. Repeat Steps V and VI for each slide
**Remember to name each slide in the order you want them (e.g. slide 1 as "Slide 1", slide 2 as "Slide 2" and so forth)**

B) Make a Slide Show
*Start making the Slide Show AFTER all four slides are complete and saved to the same folder*

I. Log onto the server

II. Open "Slide Show" in Kidpix
   1. Go to Launcher, Applications, Kidpix
   2. Choose "SlideShow" (12 trucks will appear)

III. Import the four saved slides into Trucks 1, 2, 3 & 4
   1. Click on Truck 1
   2. Click on the bottom left corner button - "Pick a Picture"
   3. Open the saved Slide (e.g. Slide 1)
      - Click on Grade 4
      - Open student's folder
      - Open Special Projects folder
      - Open "Explorer Slide Show" folder
      - Open "Slide 1"
   4. Repeat steps 1, 2 & 3 for remaining slides

IV. Pick a sound for each slide
   1. Click on Truck 1
   2. Click on the middle button with the music note - "Pick a Sound"
   3. Choose the sound you like and click Select (click the preview button to preview it)
   4. Repeat steps 1, 2 & 3 for remaining slides

V. Pick a transition for each slide
   1. Click on Truck 1
   2. Click on the bottom right corner button - "Pick a Transition"
   3. Choose the transition you like and click Select (click the preview button to preview it)
   4. Repeat steps 1, 2 & 3 for remaining slides

VI. Save the slide show
   1. File, Save a SlideShow
   2. Open Grade 4
   3. Open student folder
   4. Open Special Projects folder
   5. Open "Explorer Slide Show" folder
   6. Save slide show as "Slide Show"

VII. Play the slide show
   1. Click on Goodies on menu bar
   2. Click on "Play once"
Teacher Pre-Assessment Interview Form

Teacher’s Name_________________________ Student’s Name_________________________

A) Student Information

1. Is your student a low, medium or high achiever? Low  Medium  High
   Why? ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________

2. What are your student’s strengths academically? ____________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________

3. What are your student’s weaknesses academically? ____________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________

B) Content Knowledge

1. Have you been studying the North American Explorers in your classrooms? Yes  No
   If yes, what have you taught? ____________________________________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________

   If yes, what activities have your students engaged in?_____________________
   ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________
2. What is your student's current knowledge about the North American Explorers?

C) Technological Skills
1. Has your student conducted research via the Internet this year? Yes No
   If yes, what project(s) did he/she do?

2. Has your student done activities using KidPix Studio Deluxe this year? Yes No
   If yes, what project(s) did he/she do and what computer skills were involved?

3. Has your student completed a multi-media presentation this year? Yes No
   If yes, what project(s) did he/she do and what computer skills were involved?

4. How would you rate your student's technological skills? Low Average High
   Why?
D) Miscellaneous Comments

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

Completed by ___________________________ Date ______________
Appendix C2

Student Pre-Assessment Interview Form

Teacher’s Name __________________________ Student’s Name __________________________

A) Student Information

1. What are your favorite subjects? _________________________________________________
   Why? ________________________________________________________________________

B) Content Knowledge

1. Have you been studying the North American Explorers in your classrooms? Yes No
   If yes, what have you done? _________________________________________________

2. What have you learned about the North American Explorers? _______________________

3. What would you like to learn about the North American Explorers? _________________
C) Technological Skills

1. Have you ever conducted research via the Internet? Yes No
   If yes, what project(s) did you do? ______________________________________
   _________________________________________________________________
   _________________________________________________________________

   What do you think is the purpose of the Internet in education? ____________
   _________________________________________________________________
   _________________________________________________________________
   _________________________________________________________________

   Are you able to research the Internet independently or do you need assistance?
   _________________________________________________________________
   _________________________________________________________________
   _________________________________________________________________

2. Have you done activities using KidPix Studio Deluxe this year? Yes No
   If yes, what project(s) did you do and what computer skills were involved?
   _________________________________________________________________
   _________________________________________________________________
   _________________________________________________________________

   What can you do in KidPix independently (e.g. paintbrush, pencil, typewriter)?
   _________________________________________________________________
   _________________________________________________________________
   _________________________________________________________________

   Do you like doing computer projects in KidPix? Why or why not? ______________
   _________________________________________________________________
   _________________________________________________________________
   _________________________________________________________________
3. Have you ever completed a multi-media presentation?  
   Yes  No  
   If yes, what project(s) did you do and what computer skills were involved? 
   ___________________________________________________________  
   ___________________________________________________________  
   ___________________________________________________________  

4. What new computer skills would you like to learn this year?  
   ___________________________________________________________  
   ___________________________________________________________  
   ___________________________________________________________  

5. What do you like about computer class? Concerns? Improvements?  
   ___________________________________________________________  
   ___________________________________________________________  
   ___________________________________________________________  
   ___________________________________________________________  
   ___________________________________________________________  

D) Miscellaneous Comments  
   ___________________________________________________________  
   ___________________________________________________________  
   ___________________________________________________________  
   ___________________________________________________________  
   ___________________________________________________________  

Completed by ___________________________  Date ___________________________