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**A teacher case study: Examination of the benefits and barriers of using assistive
technology with a special needs student**

by

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A thesis submitted to the graduate faculty
in partial fulfillment of the requirements for the degree of
MASTER OF SCIENCE

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This is to certify that the master's thesis of
Lisa Kathryn (Sadler) Dolan
has met the thesis requirements of Iowa State University

Signatures have been redacted for privacy

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CHAPTER 1. INTRODUCTION

This case study is designed to examine the benefits and barriers a teacher encounters when working a student with special needs who uses assistive technology devices for daily instructional tasks. Specifically, it will provide insight into how a teacher serves a student with special needs who uses high technology systems such as computerized devices, as defined by Lewis (1998), for learning tasks.

This chapter provides general background information about assistive technology, including how assistive technology services are acquired for students. Student uses of assistive technology devices will be discussed, as well as the benefits and barriers of using these devices. These sections will be followed by the statement of the problem, research questions, limitations of the study, and finally, the definition of the terms related to the study.

Background

Assistive technology is an indirect result of the Education for All Handicapped Children Act of 1975 (PL 94-142) which required “that the state provide a free appropriate public education (FAPE) to students with disabilities between the ages of 3 and 21 residing within the United States, except when its application to those people would be inconsistent with state law or practice” (Wehmeyer, Sands, Knowlton, & Kozleski, 2002, p. 48). This act allows all students who attend school, a Free Appropriate Public Education (FAPE) in the least restrictive environment (LRE). The law is designed to assist students with special needs, so they too, can experience academic success in a classroom setting. Occasionally, special needs students require assistive technology devices to experience success in a classroom setting.

According to Wehmeyer (1999) an assistive technology device is “any piece of equipment or product system, whether acquired commercially, off the shelf, modified or customized, that is used to increase, maintain, or improve the functional capabilities of children with disabilities” (p. 48). Specifically, it is a tool designed to help students overcome a disability in the general classroom or in the least restrictive environment. These assistive technology tools, including the computerized devices as defined by Lewis, allow teachers to modify and adapt the student’s instructional program whether the goal is targeted at academic or social success.

Sweeny (2003) categorizes the assistive technology tools which students use into three categories: low, mid and high. The first assistive technology category involves the use of low-end technology. An example of a low-end technology device that could be used in a classroom would be a poster board with three pictures on it. The student points to one of the three pictures to communicate a choice to the teacher or another individual. The mid category of technology would include a small electronic device such as a tape recorder, switch, or electronic organizers. For example, a tape recorder could be used by a student to hear a story read aloud. A student could use a switch to make a request in the classroom, allowing an increase in communication and social activities. High-end assistive technology tools a student might use include a voice- activated computer, word prediction programs, and alternative computer keyboards. Ultimately, the specific type of assistive technology required by a student is determined during an Individual Educational Plan (IEP) meeting.

During the annual IEP meeting, the IEP team must address academic, behavioral and instructional areas, as well as the student’s integration needs. To write an IEP, a team works together to develop the best workable plan that fits into the student’s present level of

educational performance and sets goals for the student to reach in a year. Quarterly milestones are set for the student to meet in the upcoming school year. A special education teacher usually monitors these milestones. Typically, the decision making team at an IEP meeting includes; the parents, the special education teacher, the general education teacher, the principal, and a member of the Area Education Agency (AEA) assigned to a particular school district. Assistive technology team members are employed by the AEAs. These assistive technology team members become part of the IEP team after the decision is made that the student needs assistive technology services.

Skill areas addressed at this meeting include math, reading, writing, speech, behavior, and social. In addition, a section of the IEP requires that the team discuss if the student might require the use of any type of assistive technology.

Assistive technology became something educators could not ignore, with the passing of the Individuals with Disabilities Education Act (IDEA) and the reauthorization of PL 94-142. Amendments to the IDEA in 1997 include legislation that made it a requirement to consider assistive technology for all schools. As stated in Section 614(d), the IEP team must “consider whether [a] child needs assistive technology devices and services” (Wehmeyer, 1999, p. 49). If a student qualifies, the team then considers what services and screenings will take place and identifies which assistive technology devices are necessary to improve the student’s learning environment.

The assistive technology team determines the potential services and screenings needed for the student, at which time an individual from the team is usually assigned to the student. First the members of the assistive technology team interview and collect data from classroom teachers, parents, and other individuals who might work with the student during

their school day. After those initial interviews and observations are done, the assistive technology team's next job is to observe what adaptations and modifications are currently being done as part of the student's program needs. Once these observations are complete the assistive technology team makes recommendations to the IEP team. The team works through this process to find an appropriate assistive technology device.

Another option that an assistive technology team has is for the student to be brought on site and explore an array of assistive technology tools. The goal of the on site experience is to help determine what type of assistive technology tools would be the most beneficial to the student in reaching their IEP goals or long range plans.

Previous research has investigated what advances have been made in the area of assistive technology which will allow students with disabilities to realize benefits in the classroom. (Derer, Polsgrove, & Rieth, 1996; Lewis, 1998; Todis, 1996; Wehmeyer, 1999) The three main benefits of assistive technology are: 1) access to the learning environment, 2) increased independence, 3) communication and social gains made through assistive technology adaptations.

Improving access to the learning environment for a student means that by using the assistive technology device, a student is better able to interact with others and their environment in general. For example, a student might use an assistive technology device that supplies them with a voice to communicate with a teacher or peer.

Assistive technology can also help students become more independent in the classroom. They have to rely less on the teacher or peers because the assistive technology provides them with the tools they need to perform a task independently. Students may use a word processing program to assist them with independent writing.

Finally, a student can make communication and social gains with assistive technology adaptations. Adaptations that can be made within the classroom might range from the type of pencil a student uses to high tech computerized devices, all of which can allow student success. This adapted equipment allows students a way to communicate basic needs in a way that teachers and peers can understand what they are asking. Other assistive technology adaptations a student with a disability might use include a specialized positioning device such as a modified chair, allowing the student to sit at a table with classmates making the classroom environment comparable to peers without a disability. In the best case, these adaptations make things easier for students. Despite the benefits and successes brought to a student through the use of assistive technology, there are barriers that also exist, preventing these assistive technologies from allowing students to reach their full potential.

Several barriers exist that impede assistive technology use by students. Three common barriers found in the literature include: 1) expense or cost, 2) time (training and programming), and 3) lack of information.

Wehmeyer (1999) found that the expense or cost of assistive technology was the number one barrier cited by respondents in a survey of 500 teachers from mid-western states. Because of the high cost associated with assistive technology devices, schools struggle to find the funds to purchase the equipment for students.

The topic of time is repeatedly cited as a barrier in research studies (Derer, Polsgrove, & Rieth, 1996; Huntinger, Johanson, & Stoneburner, 1996; McGregor & Pachuski, 1996). Both teachers and parents reported they lacked the time to teach children how to use the devices, to train themselves to use the devices and, to prepare the device for student instruction, and they were frustrated with the time it took to obtain a device.

The lack of information about assistive technology available to educators and the general public is also documented as a common barrier. Wehmeyer (2000) also suggests there is a lack of information available to parents as to which devices are appropriate for their child to use.

Assistive technology seems to hold great promise for students with special needs in the classroom. However, its use in classrooms is still not without challenges. A better understanding on the impact of this use and how teachers and students interact with assistive technology on a daily basis is needed.

Statement of the Problem

Much of the research that exists about assistive technology documents large-scale, descriptive studies that involve survey data analysis (Huntinger, 1996). Limited research exists that describes in-depth how a teacher serving students with special needs works with and encounters barriers and benefits when using assistive technology in a learning environment. In addition, benefits and barriers that exist while using assistive technology devices have not been explored for elementary (K-6) students using high-end assistive technology (as defined by Sweeny, 2003).

Purpose of the Study

The purpose of this study was to conduct an in-depth case study of the benefits and barriers encountered by a teacher serving students with special needs using high-end assistive technology in various learning tasks.

Research Questions

1. What instructional tasks will a student complete as a result of using assistive technology during the school day?
2. What benefits are realized when high-end assistive technology devices are integrated into a student's learning environment?
3. What barriers exist when high-end assistive technology devices are integrated into a student's learning environment?

Limitations

The following limitations will be considered during this study. Since the study examines the practice of one student/teacher pair, findings cannot be generalized to other situations. The study also concentrates on a student who uses only one type of high-end assistive technology device. This assistive technology may limit the types of instructional tasks that actually can be realized as a result of using such a device.

Definition of Terms

Assistive Technology - The Technology Related Assistance for Individuals with Disabilities Act of 1988, (The Tech Act of 1988) defined assistive technology devices as:

Any item, piece of equipment or product system, whether acquired commercially off the shelf, modified or customized, that is used to increase, maintain, or improve the functional capabilities of individuals with disabilities (Smith & Jones, 1999, p 249).

Assistive Technology Services – The Technology Act of 1988 defined assistive technology services to include:

Any service that directly assists an individual with a disability in the selection, acquisition, or use of an assistive technology device (Smith & Jones 1999, p 249).

Summary

Many students use assistive technology tools to help bridge the gap between disabilities and classroom success. Three common benefits typically experienced when using assistive technology include access to the environment, independence, and communication and social gains made through assistive technology adaptations. Many of these benefits cannot be realized without overcoming barriers. Expense, time, and lack of information are barriers to using assistive technology in classrooms. Information is still needed on how teachers serving students with special needs, work with assistive technology devices, specifically high-end assistive technology devices, in educational settings and various learning tasks. The next chapter will discuss the literature related to assistive technology use in schools.

CHAPTER II. REVIEW OF THE LITERATURE

Assistive technology can be a useful tool for some students with special needs in a classroom setting to help them compensate for their disabilities. Assistive technology may help teachers make the accommodations and modifications required by some students to compensate for their disabilities. According to Lahm (2003), without assistive technology usage, service providers would have difficulty meeting current legislation mandating that assistive technology be considered for each student receiving special education services. Derer, Polsgrove, and Rieth (1996) explored assistive technology to gain a deeper understanding to the “severe limit in information on current practices in field applications of assistive technology” (p. 62).

The purpose of this chapter is to present a review of literature that summarizes various aspects of using assistive technology with K-12 students. First, assistive technology is defined and categories of assistive technology as identified by Sweeney (2003) are presented. The next section describes how students use assistive technology in educational settings. Finally the benefits and barriers that exist while working with assistive technology are discussed.

Assistive Technology: Background Information

As stated in chapter one, assistive technology can be defined as any piece of equipment used to improve student functions that peers would be able to accomplish without a device. The goal of using assistive technology with students is to ensure their success in the classroom while making adaptations and modifications when needed. McGregor and

Pachuski (1996) note,

... in regular class settings, teachers are not able or willing to modify their instructional strategies or modify the curriculum to accommodate individual students with disabilities (p. 4).

Some students with disabilities need adaptations and modifications to the way teachers teach the curriculum or changes to the environment to allow students to experience success in the classroom. The inclusion of assistive technology includes the use of high and low technologies (Lewis, 1998). Although computers are most often thought of as the exclusive form of assistive technology, Lewis (1998) stated,

Long before the arrival of computers in the classrooms, teachers used simple, low-tech devices such as rulers to help students with learning disabilities keep their place while reading (p. 16).

These tools fit with Wehmeyer's definition of assistive technology as being any piece of equipment or product used to improve student function. The most commonly used assistive technology devices were wheelchairs and hearing aids both of which are considered "low to mid" technology. Other forms of assistive technology include computerized keyboards, which can enable a student to type answers in the same amount of time it takes peers to write the response. All of these assistive technology devices used in an educational setting can be divided into common assistive technology categories.

Assistive Technology Categories

Assistive technology encompasses a large field of products and tools developed for the purpose of allowing student success in educational environments. For example, audio tape recorders can become an assistive technology tool when they are used to compensate for

memory difficulties. Assistive technology tools can also be categorized further to help define these assistive technology tools and their purpose. According to Sweeney (2003), assistive technology can be categorized from low technology to high technology tools (see Table 1).

Sweeney stated:

The poster board with three photos that we use to allow our kids to make a choice is just as much assistive technology as a \$7,000 voice activated computer, a powered wheelchair, a specialized van, lowered counters in the kitchen, or a jointed feeding spoon (Sweeney, 2003, p. 223).

<i>Low Technology</i>	<i>Mid Technology</i>	<i>High Technology</i>
-Specialized pens, pencils, crayons, etc.	-Tape recorders, digital cameras	-Alternative keyboards
-Raised line paper	-Calculators	-Word processing programs
-Color coding	-Audio books	-Graphic organizer -Web software
-Magnetic letters/numbers	-Electronic organizer	-Spell checker/ Grammar checker
-Rubber stamps	-Switch operated toys and appliances	-On-screen programs, in math reading, etc. such as Clicker 4 -Individual computerized devices

Table 1. Assistive technology categories defined by Sweeney

Morse (2001) described assistive technology services, as “the myriad tasks school personnel must perform to ensure that an appropriate assistive technology device is selected for, and used by a special education student” (p. 16). This process is what assistive technology team members, teachers, and parents use to identify and provide the best assistive technology devices for all students in need. Still, a major step is making assistive technology available for students in the classroom.

How Students Use Assistive Technology in Classrooms

Many students with special needs have fallen behind without the help of assistive technology in the classroom. Having access to assistive technology would allow a student with special needs to complete instructional tasks that other students can easily finish without using assistive technology. Lewis (1993) lists two major purposes why students should use assistive technology in classrooms: 1) it augments an individual's strengths, so that his or her abilities counterbalance the effects of any disabilities, and 2) it provides an alternate mode of performing a task, so that his or her abilities are compensated or bypassed entirely.

Students use assistive technology devices from all the low, mid, and high categories as defined by Sweeny (2003). Todis and Walker (1993) reported that "Rose" used adapted pencils, eating utensils, scissors, and other tools for completing classroom tasks similar to her peers. Lewis (1998) mentioned that mid level assistive technologies help individuals with disabilities "cope with the demands of everyday life" (p. 23). The mid level technologies Lewis referred to include handheld calculators and audio books. Huntinger, Johanson, and Stoneburner (1996) describe how "Gary" used high-level assistive technology, such as memory building software and an augmentative communication device. These technologies students used have enhanced their daily functions in the classroom and home settings increasing the benefits experienced in educational settings.

Benefits for Using Assistive Technology

Assistive technology can provide alternatives for individuals with disabilities to compensate for, or overcome an existing difficulty (Lewis, 1998). This assistive technology leads students with disabilities to experience new successes in the classroom that would otherwise be impossible for them to attain.

A synthesis of findings from research studies focused on the use of assistive technology devices and revealed three major benefits for students: 1) access to the learning environment (Day & Huefner 2003; Derer, Polsgrove & Rieth, 1996), 2) independence in the classroom setting (Todis & Walker, 1993), and 3) communication and social gains with assistive technology adaptations (Huntinger, Johnson, & Stoneburner, 1996). Each benefit will be discussed in detail in the following sections.

Access to the Learning Environment

The Education for All Handicapped Children Act of 1975 and the update to IDEA, described the importance of providing students equal access to all learning environments (Wehmeyer et al., 2002). Equal access to learning environments can be facilitated through the use of assistive technology (Derer, Polsgrove & Rieth, 1996). For example, students using communication devices that enhance their interactions with peers provide those students with access to a learning environment that would otherwise be difficult for them to participate. Day and Huefner (2003) state:

Congress intended the benefits of providing AT (assistive technology) devices and services to include increased access to FAPE (free appropriate public education) in the general education setting and improved outcomes for students with disabilities (p.25).

Increased access to a free appropriate public education (FAPE) as a result of using assistive technology is a direct benefit to students. Inclusion has become possible because students are using assistive technology in all educational settings. Having access to assistive technology allows students to “overcome environmental or social barriers, thus allowing them to participate in school activities and interact with peers to a greater extent” (Derer,

Polsgrove, & Rieth 1996, p.73). Students using assistive technology devices can interact with peers and teachers making it a more conducive environment for learning.

Independence in the Classroom Setting

Another benefit of using assistive technology is that it promotes student independence in a classroom setting. Todis and Walker (1993) completed a case study that illustrated how a student who used a specific software program could realize independence in the classroom. This student, who had a physical disability, experienced success using a word prediction software program, which worked by typing and selecting words for a sentence using one finger on a keyboard. The student, who had limited functioning in her hands, now had greater success with writing and communicating in the classroom setting. By providing this student with an assistive technology device, it gave her independence and an alternative in order to complete a basic writing assignment. Without the assistive technology, the student probably could not have finished the assignment.

Ultimately, the goal is for students who use assistive technology to become more independent in the classroom so they can experience greater success. Assistive technology has allowed student's independence, as well as other attributes that will lead to more successes in the classroom. This independence in classrooms environments can be gained by students with fine motor coordination problems using a personal computer and word processing program to write (Todis & Walker, 1993). According to Morse (2001), independence is the "primary reason special-education students use these (assistive technology) devices" (p. 20).

Communication and Social Gains with Assistive Technology Adaptations

The third benefit for using assistive technology is the communication and social gains students experience as a result of the adaptations and modifications made within the learning environment. (Derer, Polsgrove & Rieth, 1996). Huntinger, Johnson, and Stoneburner (1996) concluded that one of the greatest student benefits of assistive technology is related to the development of social and emotional behaviors. According to Ashton (2000), “Assistive technology allows students to communicate basic needs so that others can understand them” (p. 35).

Communication gains can be realized using several types of adapted equipment. Lewis (1998) illustrated this using the following example,

Take for example the pencil I’m holding. It allows ideas in my brain to be recorded on paper. But millions and millions of people cannot use this pencil; generally they’re in the first grade. So what do we do? We make larger pencils for them so they can hold it. We give them a piece of adapted equipment (p.16).

There are many adapted or modified assistive technologies that are used to enhance communication and social interaction. Positioning devices, including chairs, allow students with physical disabilities to join classmates at tables, on the floor, or in a standing position (Hulme, Poor, Schulein, & Pezzino, 1983). These adaptations modify the environment in a way that enhances student ability to communicate and interact with others.

In sum, assistive technology can be beneficial to students in classrooms. These benefits include: providing greater access to learning environments, promoting independence within a school setting, and using adapted equipment for communication and social gains. Despite the benefits realized by most students using assistive technology in classroom settings, barriers still exist.

Barriers for Using Assistive Technology

Several barriers have been identified for using assistive technology in classrooms. Three major barriers were identified in the literature. First, the expense or cost associated with the technology device is commonly mentioned as a barrier. Time was frequently noted as a barrier; this barrier included the time necessary for training to use and the time needed for programming the assistive technology device. Another barrier impacting assistive technology use in the classroom was the lack of information available about the device (e.g. cost, function).

Assistive Technology Cost

Although several barriers were cited throughout the research on assistive technology, the one mentioned most frequently was the expense or cost associated with the purchase of a device as well as its upkeep. The upkeep includes the cost to purchase upgrades and to fund repairs (Derer, Polsgrove, & Rieth 1996; Lewis, 1998; Parker, et al., 1990; Todis, 1996; Todis & Walker, 1993; Wehmeyer, 1999). According to Todis (1998), upkeep was listed as a major reason why assistive technology devices have been abandoned. Ludlow (2001) noted, “assistive [technology] devices can too easily become expensive status symbols that sit unused on the shelf” (p.146).

Funding for such devices is always an issue for school districts. Schools simply have had a difficult time acquiring assistive technology for students due to the initial cost. Obtaining financial resources to purchase assistive technology is often very difficult (Huntinger, Johanson, & Stoneburner, 1996). In other cases, assistive technology devices were purchased, but the cost for repair and upkeep was too prohibitive for schools to maintain (Parker et. al., 1990; Todis & Walker, 1993; Wehmeyer, 1999).

Cost plays a significant role in the acquisition of assistive technology that would best meet student needs. That includes both the initial cost as well as the cost of maintaining the device. The financial obligations associated with assistive technology may be a contributing factor to the amount of time a student is with or without these devices.

Time

Time is another barrier associated with assistive technology use in classrooms. Issues related to time are twofold. First, it can take a considerable amount of time for teachers and the student to learn how to use the assistive technology device. Second, much time can be spent by the teacher programming the device for instructional tasks (Derer, Polsgrove, & Rieth, 1996).

In a study by McGregor and Pachuski (1996), teachers noted the lack of time needed to program the equipment as a barrier to assistive technology implementation in the classroom. To overcome the barrier of time, teachers felt the basic requirement of additional support is needed to help them find the time to program assistive technology devices used by their students.

Huntinger, Johanson and Stoneburner (1996) suggested that time must be spent providing staff development for teachers in this area. These authors remarked,

... a massive awareness and training effort which will reach both the organizational level and the classroom level is essential. Administrative emphasis on and support of effective ongoing staff development as well as providing adequate funding for equipment and materials are necessary if children are to benefit (p. 33).

Lack of Information About Assistive Technology

Before assistive technology can be a useful instructional tool for students, teachers, parents, and staff, they all need to have an understanding about what type of assistive technologies are available and the purpose of each device. Wehmeyer (1999) discussed the importance of knowing what technologies are available to help students. He sees the lack of information available to the teacher as a significant barrier to student success. Derer et al. (1996) stated,

The lack of research-driven recommendations, combined with multiple, and perhaps conflicting, perspectives increases the difficulty teachers face in acquiring useful and valid information on appropriate assistive technology selection and application (p. 77).

Parker, Buckley, Truesdell, Riggio, Collins, and Boardman (1990) identified several teachers who reported very little information was even given to them about assistive technology. These information gaps caused teachers to struggle with using assistive technologies in successful ways with students.

Barriers existing in educational environments with assistive technology can inhibit student successes if they cannot be overcome. The barriers existing in research affecting the student success involve: cost, time, and lack of information.

Summary

Assistive technology used effectively in the classroom may contribute to student success in a classroom setting. Benefits included better access to the learning environment, more independence in the educational setting, and communication and social gains realized as a result of assistive technology adaptation. These successes demonstrated the value in using low, middle and high technology devices in the classrooms. However, barriers still exist. Barriers such as cost, time and lack of information make it difficult to use assistive technology with students.

There is a need to examine how assistive technology is being used by students for instructional tasks and what specific benefits and barriers teachers encounter during this use. The next chapter will describe this study's research methodology that examined the benefits and barriers a teacher encounters when working with a special needs student using assistive technology devices for daily instructional tasks in an educational setting.

CHAPTER III. METHODOLOGY

This chapter outlines the research methodology and procedures used in this case study. The first section describes the research design. Next the sample selection will be described, followed by the research procedures. After that, the data sources will be described including formal interviews, observations and the teacher logbook. Finally, the data analysis will be explained. The final section will summarize the research methodology.

Research Design

The foundation of this research study uses an interpretive qualitative approach as defined by Merriam (2002). It is an interpretive approach because it focuses on understanding the experience of one teacher's perspective. Second, the qualitative approach uses a specific, in-depth case study. Merriam (2002) describes a case study as using "an intensive description and analysis of a phenomenon or social unit such as an individual" (p. 8). This research approach was used because it provided a rich and better understanding of the benefits and barriers one teacher encountered while helping a student who used a high-end assistive technology device for instructional tasks during a school day. A rich description as defined by Merriam (2002) is using "data in the form of quotes from documents, field notes, and participant interviews" (p. 5).

Sample Selection

The teacher participant for this study was selected using purposeful sampling. Purposeful sampling is when the study is designed to discover and understand a specific purpose or situation (Merriam, 2002). The participant was specifically chosen for the following reasons. First, the teacher was serving a student with special needs using a high-

end assistive technology device. Second, there was a level of cooperation from the teachers, parents, staff, and school district that enabled the researcher to investigate this issue. More information about the site and the teacher participant will be shared in chapter four.

Research Procedures

This case study focused on one teacher working with a student with special needs who used a high-end technology device on a daily basis. To obtain permission to conduct this study, the school principal was initially contacted to gain permission to speak with the teacher about the possibility of her participation.

The teacher participant was a special education teacher who worked in an Iowa school, serving students in a K-5 grade setting. She was contacted first through e-mail and then later by phone to set up a time for the first formal interview. Most contacts were made through e-mail to allow the teacher to respond to them at times that were convenient for her.

A signed consent form was obtained from the special education teacher (the participant), the student's parents and the student. The student's permission was required to make sure that she was aware that she was being observed. The student was only observed to better understand the benefits and barriers described by the teacher participant throughout the study.

Observations and interviews were conducted on a time schedule that was conducive to the teacher participant and the school schedule. Three observations and three interviews were scheduled and conducted. Two of each occurred in the afternoon, and one in the morning. The interviews were used to gather background information, identify assistive technology learning tasks, as well as barriers and benefits encountered by the participant. Interviews lasted between thirty and forty five minutes. Observations were conducted in

segments lasting fifteen to thirty-five minutes, allowing the researcher to see the completion of the specific learning task. Observations were also used to see how the assistive technology, the Dynamyte, aided in student success. (The Dynamyte will be described in depth in Chapter 4.)

Data Sources & Collection

Prior to the start of this research study, and before any data collection procedures occurred, all required paperwork was submitted and approved by the Institutional Review Board (see Appendix A). Guidelines were followed to assure that the identity of all participants in this case study remained anonymous. The teacher participant was not at any time referred to by name. Other individuals are referred to by their job title. The student who used the assistive technology device is referred to only as “the student”. Any records that identified the participant were kept confidential to the extent permitted by applicable laws and regulations.

An initial phone call was placed to gather background information from the teacher who would serve as the participant. This information included the participant’s assistive technology experience and a description of the classroom setting. The call was also used to set up the first formal interview and classroom observation. The participant was encouraged to ask any questions throughout this case study. The following sections describe the observations and interviews that occurred with the participant. Throughout the study, the data collection was guided by theoretical sampling (Merriam, 2002). This method will be described more in depth as part of the data analysis section.

Formal Interviews

All interviews occurred at the school in the classroom setting with the special education teacher. The length of the interviews varied from 30-45 minutes. There were a total of three interviews conducted with the teacher participant. The interview questions were open-ended and descriptive, as described by Taylor and Bogdan (1998), “Descriptive questions allow people to tell you about things that are important to them and the meanings that they attach to these things” (p. 102). This type of questioning encouraged a free flow of conversation between the participant and the researcher. Each face-to-face interview was recorded on an audiotape and later transcribed for analysis.

The purpose of the initial interview was to gather in-depth background information that included a rich description of the assistive technology device used by one of her students in the classroom, as well as the experiences she encountered using this assistive technology device with the student (see Appendix B). The participant also commented on other teachers’ opinions in the building regarding the assistive technology device and provided in-depth information about how the assistive technology device was used in the classroom setting. During the initial interview the researcher gave the teacher a logbook with the purpose of recording detailed personal reactions and notes about using the high-technology device during the school day (see Appendix C).

The second interview, conducted two weeks later, was used to clarify information that came as a result of the first classroom observation and the teacher’s first interview. A list of questions generated for the second interview is found in Appendix D. The purpose of this interview was to take, a closer look into this teacher’s perspectives about the barriers and benefits that existed as a result of having a student who used an assistive technology device.

The third and final interview was conducted to clarify all remaining questions related to this research project and to gather additional information about the school setting, the student's different classroom settings, and the student's day in relationship with the use of assistive technology.

The interviews were audio recorded and then transcribed in preparation for analysis. All audio recordings were erased upon the completion of the study.

Classroom Observations

Direct observations were used in the educational setting. Classroom observations were done as unobtrusively as possible to minimize the effect of observer presence both on the participant (special education teacher) and students. Observations were scheduled at various times across the school day to include classroom instruction in different settings. Observations occurred when the assistive technology was present and also when it was not. Detailed field notes were taken describing the type of instruction /activities the special education teacher was part of, the classroom teacher, the speech teacher, and the small group science teacher in their settings as well as staff and student behaviors when using the assistive technology device.

The first classroom observation occurred during the afternoon for about twenty minutes total. The setting for the observation was in a fourth grade classroom with the fourth grade teacher, the student who used the assistive device, the student's associate, and 26 other classmates. This observation provided an opportunity to view how one particular student used her assistive technology device in a large classroom setting and how this corresponded to what the teacher participant shared as typical assistive technology usage in the classroom setting.

The second observation took place two weeks later and occurred in two parts during the afternoon. The first part of the observation lasted twenty minutes in the general fourth grade classroom with the student, her associate, and her 26 classmates. The second part of this classroom observation lasted 35 minutes and was a one-to-one session during speech class in which the student used her assistive technology device to initiate requests. The speech pathologist responded to the student only when a request was made using her assistive technology device.

Three days after the second interview/observation, the final interview and observation were conducted. The final interview asked all remaining questions needed to complete this study (see Appendix E). The observation was done in three parts. The first part of this observation occurred during the morning with the student using her device, in a one-to-one setting with the student's associate in the hallway. This observation lasted about fifteen minutes. They were using the device's calculator to complete math problems. The second part of the observation also occurred during the morning while the student was in a small group setting with five peers for a science lesson. The lesson lasted about thirty minutes. The student came to the session without her assistive technology device. Within a few minutes the student's associate brought in the device. The third and final part of this classroom observation occurred during the afternoon. The student was observed for twenty minutes with the teacher participant during a small group reading lesson with four peers. The student used the assistive technology device to answer questions about classroom rules. The teacher would ask a question and the student would raise her hand to answer. Frequently, the student pressed a blank button as a way of answering a question or she would page through the device looking at the buttons on each page. All of the buttons on the assistive technology

device have been pre-programmed by the teacher. For example, one page might have all the names of the peers in her class while another page would have key words programmed in it. Occasionally, the student has something to say, but either does not have the correct button on it, or can not find it.

After each interview the teacher participant had a chance to ask any questions, or request clarifications about the study procedures. She also had the opportunity to e-mail or call the researcher if she had any questions during the study.

Teacher Logbook

At the time of the first interview, the teacher participant was given a binder to use as a logbook to document learning tasks, positive outcomes, frustrations or problems, and questions or comments that occurred while using the assistive technology device in the classroom (see Appendix C). The special education teacher was asked to write down the date and any comments as described above that related to the student, classroom teacher, speech teacher, or any staff working with the student and her assistive technology device, the Dynamyte.

Data Analysis

A grounded theory approach, along with the constant comparative method and theoretical sampling strategies were used to collect and evaluate information. The data, including the interview transcripts and classroom observation notes, were entered into a computer and coded by topic area. Anecdotal information, problems that occurred using the device, and instructional tasks accomplished were given in the teacher logbook. Information from other teachers was also put into the logbook as appropriate.

A grounded theory approach based on qualitative principles outlined in Taylor and Bogdan (1998) was used to collect and evaluate information. According to Taylor and Bogdan, Grounded Theory is,

... a method for discovering theories, concepts, hypothesis, and propositions directly from the data rather than from a prior assumptions, other research, or existing theoretical frameworks (p.137).

Grounded Theory was used for analysis because it involves identifying themes based on the data and information gathered during the study as opposed to looking through an already determined theoretical lens.

Taylor and Bogdan 1998 cite two major strategies for developing grounded theory based upon Glaser and Strauss's work (1967). The two strategies are the constant comparative method and theoretical sampling. These two strategies were used to code data supported by the grounded theory approach used in this case study.

Data from each interview was first transcribed and then coded. Theoretical sampling helped to guide the data collection used in this study. Theoretical sampling as defined by Taylor and Bogdan (1998) is,

...a procedure whereby researchers consciously select additional cases to be studied according to the potential for developing new insights or expanding and refining those already gained (p. 27).

As themes developed, additional cases (individuals) were interviewed to gain a better insight about the case being studied. All data were collected, coded, and analyzed to help determine the questions for the next interviews and observations, as well as to help develop an emerging theory.

Data gathered from the interviews, classroom observations, and the teacher's logbook were continuously compared using the constant comparative method, "in order to derive conceptual elements of the theory" (Merriam, 2002, p. 8). For this study, discovering the developing elements of the benefits and barriers encountered as a result of using assistive technology was the focus.

In sum, multiple methods were used to collect data for this case study. According to Taylor and Bogdan (1998), using multiple methods permits triangulation and allows researchers to double check information. Data were collected using informal and formal interview procedures, classroom observations, and a daily logbook kept by the classroom teacher. Multiple methods were used with the grounded theory approach that included using the constant comparative method and theoretical sampling.

Summary

This chapter outlined the research methodology used for this case study. First the research design was described. Next the type of sample selection used was given. The research procedures were outlined regarding how the research was to be conducted in this particular educational setting. Then, the data sources and data collection were then explained using the interviews, observations, and the teacher logbook. Finally, the grounded theory strategies of the constant comparative methods with theoretical sampling were explained to analyze the data in this research.

The next chapter will describe the teacher participant, the research setting, and then will present the results related to the study's research questions. It will reveal the themes that emerged related to the barriers and benefits of using high-end assistive technology specific to this case study.

CHAPTER IV. RESULTS AND FINDINGS

This chapter presents the results of a case study that describes one teacher's experiences with a fourth grade student using a high-end assistive technology device. Specifically, it describes the types of instructional tasks the student used the device for, as well as the benefits and barriers encountered in a classroom setting. First, background information about the teacher participant, the student using the assistive technology device, and the school setting will be described. Next, assistive technology use is clarified including what the device is and the student's goal for the use of the device. The types of instructional tasks the student used the device for will be described, followed by the benefits and barriers the teacher participant encountered.

Research Setting, Teacher Participant, and Student

Research Setting

The school setting for this study was an urban Iowa school, serving 282 students in a K-5 environment. There are two classrooms per grade level with an average class size of 23 students per teacher. The classroom that was observed had 27 fourth grade students, fifteen boys and twelve girls. The school serves students from a wide range of ethnic backgrounds. Sixty percent of the students in this school received free or reduced lunch.

Teacher Participant

The teacher participant was a special education teacher in an urban community school district. She has taught for 26 years in special education. This teacher serves students in an inclusive setting, meaning she works with students with special needs in the classroom setting, as opposed to a pull-out program. She works with small groups of students for specific skill instruction and, at other times, works with all of the students in the classroom

teaching a group lesson. The participant does not have a strong technology background. She has been working with the Dynamyte, the assistive technology device, since August 2004.

Student (observation only)

The following information was gathered through observation. At no time during the study was the student interviewed. The student is a fourth grade girl who is eleven years old. There are two main reasons why she was using the Dynamyte. First, it is difficult for most people to understand her when she speaks. Individuals who have been around her for a long period of time are able to understand her, but most people have a difficult time. Second, she needs this device to communicate because her handwriting is very large, unlike that of her peers in fourth grade. You can read her signature, but other letters are not legible so it is difficult for her to communicate through written means.

The student had several IEP goals associated with using the Dynamyte. The goals included long-range goals for the future, as well as short-term goals for the current academic year. One of the short-term goals for this student was to initiate conversation or convey her needs to others independently. The other short-term goal was for the student to produce five word sentences. The long-range goal for the student was to express her needs to others using the Dynamyte. The needs might include classroom help, general help, or questions the student would have throughout the day. Although it is not a current goal, the teacher also wanted the student conversing with other students and adults.

The student used the high-end assistive technology device in a variety of settings throughout the day.

1. Large Group (29 students) for most subjects. In this setting the student sits and learns by listening. The assistive technology device was available, but was not

used much because the teacher predominately presented the information in a lecture format.

2. Small Group (4-6 students) for students with an alternative assessment goal in science and integrated reading. In the science class, the student was actively engaged in the teaching and learning that occurred. The student participated through hands-on activities. During reading instruction the student worked in small groups with the special education teacher and other peers in her classroom.
3. One-on-one class instruction for individual skill development with the speech pathologist.

The student had a variety of menus set up in the Dynamyte among that she could navigate. The student used the screens programmed with information to communicate her needs. Some buttons were set up to speak when the student pressed the on-screen button, and others would not speak until the student pressed a button to speak an entire sentence at once.

The Assistive Technology Device

The assistive technology device used by the student in this setting is a Dynamyte (see Appendix F). It is a small square device (8x7x2 inches) that students carry to help them communicate during their learning day as a result of a disability. It weighs 3.2 pounds and the display screen where the buttons appear is 6.5 inches. The device can speak pre-programmed letters, words, small phrases and sentences. The teachers or parents program the device to have pages relevant to the student's instructional day. The assistive technology device used for this case study was matched with the student and her IEP goal of initiating conversation, or expressing her needs to complete various instructional tasks throughout the day.

Results and Findings

The purpose of this case study was to determine the benefits and barriers encountered by a teacher serving a student with special needs who used an assistive technology device. It was also determined what instructional tasks the student completed while using the device in a classroom. The next three sections will report the findings as discovered through teacher interviews, classroom observations, and analysis of a daily log maintained by the teacher participating in this study.

Research Question One

Research question one was stated as follows: What instructional tasks will a student complete as a result of using assistive technology during the school day? The instructional tasks completed by the student using the assistive technology device occurred in a variety of settings: large group, small group, and one-to-one. Some of the instructional tasks completed by the student were observed directly by the researcher, while the teacher participant observed others. The teacher participant shared her direct observations of the student completing instructional tasks with the researcher during interviews and the daily logbook. This combined information documented the instructional tasks completed by the student using the Dynamyte.

First, the information collected from the teacher explained how the student accomplished instructional tasks throughout the school day. The Dynamyte was used as an instructional tool to spell out words during a spelling assessment (Teacher Interview, September 28, 2005). In this task, the Dynamyte was used as a voice to say each letter as it was spelled out, or the word as a whole once the letters were all selected. Second, the Dynamyte was used as a tool for student comprehension. To prepare the device for this

instructional task, the teacher needed to know the subject material being presented and the questions she was going to ask the student in order to create a Dynamyte page. The student then answered comprehension questions using the teacher-made Dynamyte page specific to the subject area and selected words or phrases that answered the teacher's questions (Teacher Interview, September 28, 2005). The teacher noted it was a very time consuming process and that it was much easier to answer questions using the white board. The white board allowed the teacher to quickly write information that the student could point to instead of using the specific device. The teacher reported that at times, she had to modify the instructional situation just to use the device (Teacher Interview, September 28, 2005).

The researcher also observed the students while she used the assistive technology device for instructional tasks in the classroom. First, the researcher observed the student in speech class. In this setting, the student used the Dynamyte to initiate conversations with the teacher and ask questions (Classroom Observation, October 18, 2005). The student wanted to use the speech teacher's machine to play a reading game on the Internet, so she used her own voice first and when there was not a response, she tapped the teacher's arm as a way of getting attention. The teacher turned away. Later the teacher responded to the student when the student used the assistive technology device to get her attention. Throughout the speech session, the student was required to use her assistive technology device to gain teacher attention when she wanted to show the teacher something. When the student did not use the device, the teacher simply turned her back or did not respond until the device was used.

The researcher also observed the student completing a math worksheet in the hallway with her associate. The student used the Dynamyte as a calculator to add two digit math problems (Classroom Observation, October 21, 2005; Teacher Logbook, October 5, 2005,

October 7, 2005, October 10, 2005). Along with the math sheet, there were several pre-determined answers on sticky notes the student used to show what she got for an answer. If the answer was not on one of the sheets the student knew she did not have the correct answer (Classroom Observation, October 21, 2005). The student needed many prompts from her associate to complete this task.

In the fourth grade classroom, the assistive technology device was not observed being used by the student (Classroom Observation, September 28, 2005; Classroom Observation, October 21, 2005). The teacher presented information primarily in a lecture format. The teacher participant stated that the students are expected to sit and listen to the information presented and learn (Teacher Interview, September 28, 2005).

In yet another instructional setting, the student did not bring the assistive technology device to a small group science class (Classroom Observation, October 21, 2005). The teacher did not remind the student to get it. Later, the student's associate brought it in so she could use it to communicate with others in the group. The students in the small group setting were learning about volcanoes. The small group also conducted an experiment about volcanoes. During this science class, the student did not use the assistive technology device. When the teacher asked questions, other students answered them (Classroom Observation, October 21, 2005).

The teacher participant experienced benefits and barriers as a result of the instructional tasks accomplished by the student. The next section discusses the benefits that existed.

Research Question Two

Research question two was stated as follows: What benefits are realized when high-end assistive technology devices are integrated into a student's learning environment? The teacher participant in this case study experienced several benefits as a result of her student using assistive technology during the school day. These benefits also emerged as a result of the data triangulation between teacher interviews, classroom observations, and the teacher's logbook. The three major benefits identified were: 1) communication, 2) instructional uses, and 3) social gains. Findings for each benefit are presented in the following three sections.

Communication

Communication can be defined in different ways when dealing with assistive technology devices. The first way communication was perceived by the teacher as a benefit was by serving as a mechanism for school and home communication. The teacher wrote notes to the parents on the device, and the parents also responded by writing a note on the device for the teacher (Teacher Interview, September 21, 2005). Occasionally, the student was given the responsibility for making sure messages were delivered as part of her goal of initiating conversations, and was instructed how to share the information with her parents (Teacher Interviews September 21, 2005, October 18, 2005; Teacher Logbook, October 3, 2005).

The device was also used to communicate student needs at school, at home, and in the community (Teacher Interview, October 18, 2005). Communication is part of the student's IEP goal. The student actually communicated things she needed using programmed pages on the Dynamyte. During speech, the student communicated to her teacher she needed help with

a game she was playing (Classroom Observation, October 21, 2005). She pressed the button and the device responded “I need help”, and the teacher turned to help (Classroom Observation, October 21, 2005).

The Dynamyte has the student’s identification on it in case she got lost or needed help (Teacher Interview, October 21, 2005). She can use the programmed pages to communicate to others, personal information, such as name, address, and telephone number.

Instructional uses

There were several instructional benefits realized by the teacher associate when using the assistive technology device. Some of these instructional benefits were short-term benefits while others were long-term. Several instructional benefits were discussed earlier in research question one as the instructional tasks the student accomplished.

The short-term successes accomplished by the student occurred with daily academic tasks in a variety of settings (Classroom Observations, October 18, 2005, October 21, 2005). In the large group setting the student worked with her associate to complete daily math sheets (Teacher Logbook, October 19, 2005). The student solved addition problems using the calculator located within the device to compute the answers. The student then chose the answer based upon a set of pre-written sticky notes (Classroom Observation, October 21, 2005). These types of instructional tasks gave the teacher immediate feedback on how the student was doing academically. Another instructional benefit occurred during spelling. The student spelled weekly spelling words using the Dynamyte “otherwise you wouldn’t even understand what she said,” according to the teacher (Teacher Interview, September 28, 2005, October 18, 2005).

Long-term benefits were seen during the one-to-one speech instruction. The speech teacher required the student to use the device for all conversations and questions (Classroom Observation, October 18, 2005). The teacher talked about the student long-term goals on the IEP, "The long range hope would be that she can express her needs" (Teacher Interview, September 28, 2005). The goal of the speech teacher is to teach the student to use her device for expressing her needs. When the student tried to get the speech teacher's attention without using her device, the teacher did not respond and simply waited for the student to use it (Classroom Observation, October 18, 2005). The instructional benefits realized by the teacher allowed the student to experience successes that were measurable for short-term outcomes. Although the long-term benefits are not as easily measurable, they are just as important. Social gains were the last benefit that emerged from the data.

Social gains

Social benefits were illustrated mostly in the large group settings with classmates. The special education teacher discussed different ways social gains were made as a direct result of the student using the assistive technology device (Teacher Interview, October 18, 2005). First, when the student was in the classroom, other students were curious about the device and initiated contact with the student. "I think there's a curiosity to it," "students want to know what it is," explains the teacher (Teacher Interview, September 28, 2005, October 18, 2005). This created social experiences for the student who is typically withdrawn around others. Classmates also helped the student use her Dynamyte. They pointed out buttons they thought she was looking for or tried to help her navigate through the pages when needed (Classroom Observation, October 21, 2005).

Another social benefit for the student was the ability to be a part of a whole group as the leader of a pledge (Teacher Logbook, September 28, 2005; Teacher Interview, September 28, 2005). The teacher participant has programmed certain routines, such as the Pledge of Allegiance and the Character Counts pledge into her Dynamyte. The teacher did this so “she can participate with the rest of the class, and even be the leader at that time,” according to the teacher (Teacher Interview, September 28, 2005). As a result of these experiences, the student socially interacted with her peers in the classroom.

Research Question Three

Research question three was stated as follows: What barriers exist when high-end assistive technology devices are integrated into a student’s learning environment? The teacher participant cited several barriers that affected student usage of the assistive technology device. These barriers emerged as a result of the triangulation of data between teacher interviews, classroom observations, and the teacher’s logbook. Using grounded theory, four conceptual elements or themes developed while analyzing the data. These four barriers were: 1) reliability, 2) consistency, 3) time, and 4) flexibility. Findings for each barrier are presented in the next four sections.

Reliability

One barrier identified was related to the reliability of the Dynamyte, the assistive technology device. Reliability is associated with being dependable and able to give the same results over time. In this case, the Dynamyte was expected to be charged and in workable condition for the student to use each day. Reliability for the Dynamyte included the reliability of the device being charged so that the school staff could depend on it for the day

and the reliability that the device would be working the way it was designed to in order to assist the user.

On occasion the Dynamyte came to school without the battery charged. According to the teacher logbook, this happened several times and the student had to go without a communication device until the Dynamyte was charged (Teacher Logbook, September 29, October 3, 2005). When this happened the teacher plugged in the device until it was charged for student use. The device could be used at times when it was plugged in and had enough charge, but then the assistive technology device would have to be near an electrical outlet. During a spelling task, the device was not charged, so the student could not use it. As a result the student used her voice to spell and the teacher had to interpret the student voice to determine if she was correct with her spelling task (Teacher Logbook, October 3, 2005).

There were other documented instances that questioned the reliability of the device. The teacher participant cited times when the Dynamyte would occasionally stay on, repeating itself during classroom instruction, and would not turn off. When the classroom is quietly working, the device got stuck on a word and repeated it continuously becoming a disruption for other students. The battery was taken out of the device to fix this problem (Teacher Interview, October 18, 2005). The teacher also mentioned occasions when the device would shut off for no apparent reason; “it (the assistive technology device) breaks down quite often” (Teacher Interview, September 21, 2005; Teacher Logbook, October 18, 2005). At times, the Dynamyte experienced problems that required it being sent to the company to be fixed. The teacher participant shared her frustrations saying, “one major thing I would change is that it breaks down quite often;” “one time last year it was gone for over a month” (Teacher Interview, September 21, 2005). There was not an alternative in place during the time the

device was sent away for repairs (Teacher Interview, September 21, 2005). Because the student used the device on a daily basis in the classroom, she relied on it to work everyday.

Consistency

Another barrier that emerged from the data sources was consistency, or the ability to constantly maintain the use of the assistive technology device for different situations during the student's day. Consistency includes both the consistency of use within the school settings as well as between teachers and the consistency of use between home and school.

In the school setting, the teachers working with the student have different expectations as to how the student should use the assistive technology device. During the school day, the student was often reminded to bring the device to class (Teacher Interview, September 21, 2005; Classroom Observation, October 21, 2005). If the student forgot the device one of the following occurred so the student would consistently bring it to class (Teacher Interview, October 21, 2005; Classroom Observation, October 21, 2005). Her associate brought it to the student, the teacher participant requested the student get the device, or the student would simply do without the assistive technology. According to the teacher participant, "There has to be a lot of reminding for her to bring it," "I'll have to say, you need to go get it and use it, because I'll make her" (Teacher Interview, October 21, 2005). When the student had the device in class, she chose to use it or not. If she did not use it, she used an alternate method to communicate her needs. She would try to talk, gesture, or simply sit there and have the adults "guess" her needs (Classroom Observation, September 28, 2005, October 18, 2005, October 21, 2005). The teachers want the student to use it, but may not always be consistent in their expectations.

During an interview, the teacher participant stressed the importance of consistency in support between home and school, so the student could experience maximum success (Teacher Interview, October 18, 2005). The consistency from home to school is not obvious to the teacher participant, “They aren’t using it at home, we have no continuity” (Teacher Interview, October 18, 2005; Teacher Logbook, October 12, 2005). Recently the IEP was changed, per the parent request, so that the expectations for assistive technology usage at home were not as great as previously expected (Teacher Interview, October 18, 2005; Teacher Logbook, October 12, 2005).

Time

A third barrier that impeded the teacher from successfully using assistive technology was time. The device came with some pre-made pages, but none relevant to the current curriculum (Teacher Interview, September 28, 2005). When asked what barriers were experienced, the teacher participant responded, “time to set it [the Dynamyte] with everything you need” (Teacher Interview, October 18, 2005). Time needed to program a page greatly depended upon the content area, number of buttons per page, and the buttons needed to link pages together.

The teachers have found two alternatives to using the device in order to save time. The teacher participant found it more time efficient to use a marker board and write choices for the student to select choices instead of creating a new page on the Dynamyte (Teacher Interview, October 18, 2005). The teacher participant shared that the speech pathologist had created pages on the device to assess the student’s comprehension, but “I just use the marker board because I don’t have time to do that” (Teacher Interview, October 18, 2005). Another way teachers have found to handle the issue of time is to only ask the student yes/no and

short answer questions. The teacher noted, “Most of the things we have her do are yes/no and really short answer” (Teacher Interview, October 18, 2005; Teacher Logbook, September 30, 2005; Classroom Observation, October 21, 2005). The adults and peers working with the student often asked these types of questions, simply to save time. The limitations of the device due to time, also limited the amount of flexibility the teacher and student had during the school day.

Flexibility

The last barrier identified was flexibility. Flexibility in this case study referred to the device and its ability to change or be changed according to current circumstances. The teacher participant often complained that the Dynamyte could not be used to engage the student in spontaneous classroom conversations with teachers and peers. “It’s just not spontaneous at all” (Teacher Interview, October 18, 2005). For example, if a conversation got slightly off topic, the student couldn’t participate because the information was not pre-programmed into her device (Teacher Interview, October 18, 2005; Classroom Observation, October 18, 2005). In this case, the student was limited in participating and contributing in the conversations using the Dynamyte.

Another way the Dynamyte lacked flexibility was when the device did not have enough information programmed onto it. The student raised her hand to provide a response, but then pressed a blank button on the Dynamyte (Classroom Observation, September 21, 2005, October 18, 2005; Teacher Logbook, October 11, 2005). The teacher noted that one day, the student communicated she was sad, but pointed to a blank button when asked why (Teacher Logbook, October 11, 2005). Later, she was part of a group creating classroom rules, and again raised her hand to provide a response, and pressed a blank button (Classroom

Observation, October 21, 2005). During her one-to-one speech class, she raised her hand and got the teacher's attention and then pressed a blank button (Classroom Observation, October 18, 2005). The assistive technology device did not provide the flexibility needed by the student that allowed her to say what she wanted.

The four barriers that emerged in this case study were reliability, consistency, time, and flexibility. These barriers along with the benefits help determine the degree to which this student was successful in these educational settings.

Summary

The special education teacher who participated in this case study worked with a fourth grade student using a Dynamyte, a high technology assistive technology device. The student used her assistive technology throughout the school day. The expectations for the student varied due to the setting, teacher, and the instructional purpose.

This chapter answered several questions. First, research question one found the student to accomplish academic work in spelling, math and comprehension as well as for initiating conversation by using the assistive technology in various classroom settings. Next, research question two found communication, instructional tasks, and social gains as benefits to the student. Finally, research question three found reliability, consistency, time, and flexibility to be the major barriers that emerged in this case study.

Collectively the three research questions helped gather data to better understand the benefits and barriers encountered by the teacher participant while serving a student who used an assistive technology device. The next chapter discusses those findings and provides several recommendations to assist those who have students using assistive technology.

CHAPTER V. OVERVIEW AND DISCUSSION

This chapter discusses the findings of this case study. First a brief overview of the study will be given and how the researcher as a participant will be used to enhance the richness of this study. Next the results and findings will be summarized briefly and include connections to the existing literature base. Finally, recommendations will be shared that offer suggestions to inform the use of assistive technology in classrooms.

Overview of the Study

The purpose of this study was to investigate the benefits and barriers encountered by a teacher serving a student with special needs who used an assistive technology device in various classroom settings. Specific information was gathered using classroom observations, interviews, and a daily teacher logbook. Themes that emerged from the data were coded and examined to best determine the existing benefits and barriers this special education teacher encountered when working with a student using high-end assistive technology.

The classroom observations occurred in different settings with the number of peers varying upon the type of situation. The goal of the observations was to see how the student used the Dynamyte in the educational setting. The large group setting showed the student with peers in a fourth grade classroom. The first small group setting observed was during a reading group conducted in the teacher participant's special education classroom, the other was in a science class located in a second special education teacher's classroom. The last setting was a small room with only the speech teacher and the student.

The interviews with the teacher participant helped to discover the benefits and barriers encountered in a typical school day working with a student using an assistive technology device, in this case the Dynamyte. The teacher shared what went well with the

Dynamyte, and what frustrations occurred when using this device. The detailed information from the interviews, observations and teacher information were coded into themes that led to the findings of the study.

Researcher as a Participant

Personal experiences encountered by the researcher were added into this study to help develop the findings, including the barriers and benefits. The experience came from six and a half years of special education experience serving students with special needs and working with various assistive technology devices. The vast assistive technology experience included a Dynamyte similar to the one used by the student in this study.

Results and Discussion

The overall findings in this study go beyond typical quantitative surveys listing specific barriers and benefits found by classroom teachers (Parker, Buckley, Truesdell, Rigglo, Collins & Boardman, 1990; Wehmeyer et al., 1999). The findings in this case study produced specific details from the teacher participant listing four barriers and three benefits that stood out. In addition this research study was able to determine reasons why specific benefits and barriers existed.

Research Question One

Research question one asked what instructional tasks were accomplished by the student using an assistive technology device during the school day. Instructional tasks as a benefit are discussed further as a part of research questions three, the benefits. The instructional tasks completed by using assistive technology are obvious benefits to the student including working towards her goal on her IEP to daily classroom work (Classroom Observation, October 21, 2005). In this case study, the instructional benefits identified as a

result of the assistive technology device, the Dynamyte, really depended on the teacher working with the student. For example, the instructional benefit identified during speech was initiating conversation. This was a goal on the student's IEP.

The teacher participant discovered other instructional tasks accomplished by the student including; answering comprehension questions, using the Dynamyte as a calculator for math, and spelling words during a spelling exam (Teacher Logbook, October 5, 2005, October 11, 2005, October 18, 2005, October 19, 2005).

Research Question Two

Research question two focused on the benefits gained as a result of using assistive technology for instructional tasks in an educational setting. The three benefits identified in this study were benefits also found in previous studies (Ashton, 2000; Derer, Polsgrove & Rieth, 1996). Communication, instructional uses, and social gains were the benefits cited by the teacher participant in this study.

Communication

Derer, Polsgrove and Rieth (1996) found that communication was a benefit identified through their data analysis. This supports the findings in this particular study where using assistive technology for communication was a benefit to the student. According to the Dynavox website (<http://www.dynavotech.com>) the maker of the Dynamyte, communication is one area the Dynamyte was shown to be used in an instructional setting. The student in this case used the Dynamyte to communicate basic needs in a voice that others can understand. This mirrors a study by Ashton (2000) where assistive technology was used for this exact reason.

In addition, the Dynamyte enhanced communication between the student's home and school. Specifically, the communication device was used as a communication channel between the teacher and the parents, and between the student and the parents, as directed by the teacher. For example, the teacher typed in a message for the parents to listen to when the student got home. This purpose encouraged using the assistive technology device at home. One drawback occurred as a result of the student not being motivated to show a message to her parents. The teacher participant cited an example of when this happened during a classroom project. The special education teacher wrote a note in the assistive technology device for the student to share with her parents about a teepee project constructed on the playground. The parents later shared at conferences that they did not know it was on there. Although an assistive technology device can facilitate communication between home and school, there is still a human factor that is needed to make these interactions successful.

Instructional uses

The instructional benefits to the student who used the assistive technology device, was observed during speech class. Initiating conversation is a specific goal listed on the student's IEP. The speech teacher required all student communications to be done using the device. This forced the student to initiate conversation when she wanted attention. The teacher participant also shared that the student used her Dynamyte to answer comprehension questions from a story with pages previously created.

From observations, interviews and the teacher logbook, instructional benefits realized in the fourth grade general classroom included using the assistive technology device as a calculator or leading the class in the Pledge of Allegiance or the Character Counts Pledge. Derer, Polsgrove, and Rieth (1996) discussed students using assistive technology to be part

of classroom experiences that would be difficult without the use of assistive technology. The student does not have a voice that others could understand, so the assistive technology device provided her with an opportunity to participate. The student could also use her device to verbally spell her weekly spelling words in the classroom, making her part of the learning environment.

Instructional benefit to the special education teacher occurred when she had time to set up a specific lesson with predetermined questions and/or answers programmed on the Dynamyte, so that the student could fully participate in classroom instruction. When the student participated during classroom instruction it helped the student to socialize with her peers.

Social gains

One specific type of social benefit for the student was realized and was not expected by the researcher or found in past research. Social gains cited in past literature were due mostly to adaptations made within the environments. Hulme, Poor, Schulein, and Pezzino (1983) found through the use of different positioning devices, students were given access to classroom situations that provided them social opportunities. This device, the Dynamyte, actually elicited conversation between the student and her peers out of curiosity. Classmates came up to the student and initiated conversations with her, because of their curiosity towards the device, asking what it was, and what it did (Teacher Interview, September 28, 2005, October 18, 2005).

Another social benefit identified was similar to one cited in past research. Huntinger et al. (1996) report an increase in students learning social behaviors while using an assistive technology device. Although it was not entirely successful in the study at all times, the

student learned to ask questions and initiated conversations with other students and teachers. With this student, using the assistive technology device was not always a preferred option. It was evident that the student had formed a group of friends or some teachers that communicated with her, and many of those conversations did not require her to use the Dynamyte. Many times, using her voice had become a preferred method of communication between her and others (Classroom Observations, September 28, 2005, October 18, 2005, October 21, 2005; Teacher Interview, September 28, 2005, October 18, 2005; Teacher Logbook, September 30, 2005, October 7, 2005, October 17, 2005). While this worked in some situations, as discussed in Chapter Four, not everyone understood the student's voice. This keeps the option of using the student voice from being an effective long-term solution.

Research Question Three

Research question three determined the barriers that existed when high-end assistive technology devices are integrated into a student's learning environment. Barriers for the teacher participant have existed and still exist, preventing the student from reaching the long-term goal of initiating conversation. The three primary barriers identified in this study were time, consistency, and reliability, similar to those found in other studies (Huntinger, Johanson & Stoneburner, 1996; McGregor & Pachuski, 1996). Another barrier, flexibility was not found in previous studies in this area.

Time

Time is a barrier associated with using assistive technology that was frequently mentioned in the published research (Derer, Polsgrove & Rieth, 1996; Huntinger, et al., 1996; McGregor & Pachuski, 1996). Time covers many areas including: time to program and set up the device for student use, as well as wait time if the device was broken or not

charged. Time to prepare the device for student use, was found to be a barrier in surveys conducted by Wehmeyer (1999), Derer, Polsgrove, and Reith (1996), McGregor and Pachuski (1996) and Huntinger, Johanson, and Stoneburner (1996). According to Huntinger et al., one teacher even refused to learn an assistive technology device because it took too much of her time.

In this study, the student was not observed using the assistive technology device in the large group fourth grade classroom setting, the small group science class, or parts of the reading class. The teachers simply did not have the time to program pages into the Dynamyte that related to all the content being taught. Derer et al. (1996) also noted the lack of time as a barrier, both in the time for training as well as the time to prepare the equipment for use. These findings help confirm that time is a huge barrier for teachers who are working with students using an assistive technology device. Personally, as a special education teacher myself, the majority of the programming occurred at my home to overcome the time barrier at school. Although that helped overcome the time barrier at school, it created another barrier related to access. If the device was with me, then the student was not able to use it at home.

There is another issue related to wait time. This occurred when the student and staff had to wait on the company to repair the assistive technology device when it does not work. When the device was being repaired, the teachers, student, and parent had to wait for the device to be returned before the student could use it. As the teacher participant indicated, “it takes a lot of time to wait for the device to be sent in, repaired, and returned” (Teacher Interview, September 28, 2005).

Consistency

Consistency, defined in chapter four as the ability to maintain assistive technology usage throughout different situations during the student day, was the second major barrier identified in this study. McGregor and Pachuski (1996) identified consistency as a barrier when they discussed the problem with teachers unable to modify instruction to meet student needs while using an assistive technology device. This finding was observed in this study in the large classroom setting. The format of this setting was largely lecture and whole group questioning. It would be difficult for any student to participate in this type of setting if they could not talk and even more so when the device made to assist them cannot accurately reflect the lesson's content. Hence, the student was unable to participate and the device was not used.

Huntinger, Johnson, and Stoneburner (1996) discussed another aspect of consistency in the difference among attitudes towards assistive technology and how that can affect the usage. In their study, the student's teacher refused to learn to program an assistive technology device "because it would take too much of her time" (p. 23). When this occurs, the student lacked the consistency needed to be successful with the assistive technology device on a daily basis.

Lack of consistency between home and school can be a frequently cited problem. Todis and Walker (1993) noted the lack of parental support was a significant barrier to student success using assistive technology. The teacher participant in this study stressed the importance of consistency between home and school and confirmed the need for parental support from home. The teachers supported and used the Dynamyte at school when possible, but the parents in this study did not use it as consistently as the teachers would have liked.

According to the teacher participant, that was a barrier for successfully using assistive technology (Teacher Interview, October 18, 2005).

In my own observations, I noted additional consistency barriers associated with the student in the four different instructional settings observed. Much of the difference may be accounted for by the number of students in a given setting. In the small group, one-to-one setting, the student was expected to communicate only using her device. But as other students were added into the settings the teachers lacked the individual time needed to ensure that the student was using her assistive technology device consistently at all times.

Reliability

For the student to experience success, the device must be reliable and work when it is needed. The teacher and student often encountered times when the device was not working. During this study, the Dynamyte came to school once or twice a week with the battery needing charged. The device also experienced reliability issues when it would not turn off or it constantly repeated words. The device was also sent into the company to be repaired, and the student was forced to function during the day without any communication device other than her voice. Even when the device was reliable and being used on a consistent basis, it still might lack the flexibility.

Flexibility

The student required the same flexibility from an assistive technology device that a peer might have with their voice. Unfortunately, with this assistive technology device, the complexity of the machine along with the student's limitations did not allow for flexibility throughout the school day. For example, when the student wanted to communicate and the button she needed was not programmed on her device, she pressed a blank button. This

indicated to the staff that she had something to say, but was unable to communicate those thoughts using the device. The device had the capabilities to freely type a message for peers, but in this case, the student's limitations did not allow her to do this to communicate. When programming the device it was almost impossible to plan for every possible variable that could arise in student-to-student conversations and student-teacher conversations. If this barrier of flexibility could be overcome, the student and teachers would experience more successes while using the assistive technology device in the classroom setting.

Recommendations

This case study explored and presented the benefits and barriers encountered by a special education teacher serving a student with special needs using an high-end assistive technology device. Some changes in assistive technology usage are needed for it to be effective for the teacher, parents and students. Barriers common to the teacher in this study included: reliability, consistency, time, and flexibility.

Major improvements to these barriers, as explained previously, are needed for the student and teacher to maximize successes both in the school setting and for the future. Hence, the following five recommendations are suggested to help overcome the current existing barriers: provide alternatives, consistent expectations, share a common goal, make it beneficial to the student, and assistive technology support

Provide Alternatives

Since assistive technology devices are not always reliable, alternative solutions must be available and provided. Some barriers cannot be avoided, such as when a device quits working or needs the battery charged. To eliminate this issue of the battery not being charged, a schedule could be put into place that documents when the charging will occur.

Overnight charging at home may be an ideal time to do it. Another possible alternative would be to have a back-up battery at school that always remains charged.

Other alternatives must be put in place for when the assistive technology device is not present. These alternatives will probably not be as effective or convenient as using the assistive technology device, but can still provide the student and teachers with options other than the student's voice. In this case, an alternative tool for the student might be a notebook with pictures. The teacher participant actually suggested such an option (Teacher Interview October 18, 2005). This would allow the student an alternative to initiate conversation as stated in the student's IEP.

Consistent Expectations

The expectations between home and school regarding the assistive technology device should be the same, according to the teacher participant (Teacher Interview, October 18, 2005). The expectations between teachers in the school setting must be the same as well. According to the teacher participant, the long-range goal for the student using the assistive technology device, the Dynamyte, "would be that she could express her needs... answer questions, when somebody asks her a question" (Teacher Interview, September 28, 2005). The teacher also noted it would be really nice if (the student) could converse with others, but currently didn't see that happening. If the long-range plan for this student was to express her needs using the assistive technology device, then the teachers must be consistent with the device throughout their day. When the student moves from room to room, a policy must be in place so that the device moves with her and is always available for student use. The teachers must share and participate in this common goal.

Share a Common Goal

The teachers and parents should meet and determine the common goal for the student using the assistive technology device. Once the goal is set, the teachers must put forth equal effort to help the student meet this goal. If the goal is for the student to initiate conversation using her assistive technology device, then all teachers need to expect that the student will only initiate conversations by using her device and not give her attention when she initiates conversation with touch or her voice, similar to the method the speech teacher currently uses. The student will then begin to see the benefits of using her assistive technology device and hopefully will begin to use it more.

Make it Beneficial to the Student

If the student sees the purpose behind using the device and is consistently encouraged to use assistive technology device, it will begin to become part of what she does during the school day. The student must experience success using the device before it will become important for her each day. Teachers need to find a motivating factor for the student such as lunch, recess or a preferred activity and only allow the student to participate when she has initiated a question through the use of her device. Once she has mastered the use of her assistive technology in these areas, then gradually expand it to other areas until you have the student using the assistive technology device consistently during the school day. Also, if there is the consistency between school and home, it will be made even more apparent of the benefits this assistive technology device can hold.

Assistive Technology Support

Assistive technology support is an area greatly needed to maximize the potential that assistive technology could have in an educational setting. If there is a problem with the

device, the teacher needs to find the support to fix the assistive technology device. Currently there are no alternatives in place for when the device isn't working (Teacher Interview, September 28, 2005). This could be accomplished in one of two ways. First, provide additional teacher training so the teacher can address more technical issues. Second, additional support could be given by having an "on-call" representative from the school/district technology personnel to provide assistance when the device isn't working during the school day. By eliminating the amount of time an assistive technology device is gone for repair there is more time for learning through instructional tasks, which is the ultimate goal for this student.

Conclusion

Ultimately if a student is to benefit from assistive technology, teachers must feel supported and the student should be encouraged to reach her full potential while using the device. Teachers must treat the device as the student's voice and expect to hear it in the same way they would hear a student's voice without a disability. When using high-end technology assistive devices teachers must be given the time to prepare and organize lessons and time to then program many of these devices. Solutions are required that will assist teachers who are desperately trying to connect curriculum with the functions of these high technology devices.

Assistive technology can be a valuable tool for a student with special needs. It can provide many benefits including communication, instructional, and social as shown in this study. However, before these successes can be realized, many existing barriers must be overcome. The barriers identified in this study were reliability, consistency, time, and flexibility.

McGregor and Pachuski (1996) conducted a study entitled, “Assistive Technology in Schools: Are Teachers Ready, Able and Supported?” (p. 4). Teachers must be prepared to work with students who will use assistive technologies in their classrooms. Assistive technologies are present in schools and teachers must be trained on how to use and program these devices. When an assistive technology device fails, the teachers should be supported and have a plan in place for a possible alternative for the student. Finally, the goal is for all students to have the opportunity for an education. If assistive technologies are the means for some students to experience ultimate success in classrooms, then steps must be taken to guarantee that the benefits will outweigh the barriers associated with their use.

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- <http://www.dynavotech.com>: Dynavox Technologies
- <http://www.onionmountaintech.com/assistive.php>: Onion Mountain Technology.
Assistive Technology Info (Sweeney)
- <http://www.state.ia.us/educate/aea/index.html>: Iowa Department of Education Area
Education Agencies. Overview

APPENDIX A

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Institutional Review Board
Office of Research Compliance
Vice Provost for Research
1138 Pearson Hall
Ames, Iowa 50011-2207
515 294-4566
FAX 515 294-4267

TO: Lisa Dolan

FROM: Human Subject Research Compliance Office

PROJECT TITLE: A teacher case study: Examination of the benefits and barriers of using assistive technology with a special needs student

RE: IRB ID No.: 05-275

APPROVAL DATE: June 7, 2005

REVIEW DATE: May 29, 2005

LENGTH OF APPROVAL: One year

CONTINUING REVIEW DATE: June 6, 2006

TYPE OF APPLICATION: New Project Continuing Review

Your human subjects research project application, as indicated above, has been approved by the Iowa State University IRB #1 for recruitment of subjects not to exceed the number indicated on the application form. All research for this study must be conducted according to the proposal that was approved by the IRB. If written informed consent is required, the IRB-stamped and dated Informed Consent Document(s), approved by the IRB for this project only are attached. Please make copies from the attached "masters" for subjects to sign upon agreeing to participate. The original signed Informed Consent Document should be placed in your study files. A copy of the Informed Consent Document should be given to the subject.

The IRB must conduct **continuing review** of research at intervals appropriate to the degree of risk, but not less than once per year. Renewal is the PI's responsibility, but as a reminder, you will receive notices at least 60 days and 30 days prior to the next review. **Please note the continuing review date for your study.**

Any **modification** of this research project must be submitted to the IRB for review and approval, prior to implementation. Modifications include but are not limited to: changing the protocol or study procedures, changing investigators or sponsors (funding sources), including additional key personnel, changing the Informed Consent Document, an increase in the total number of subjects anticipated, or adding new materials (e.g., letters, advertisements, questionnaires). Any future correspondence should include the IRB identification number provided and the study title.

APPENDIX A (cont.)

Approval letter
Page 2
Dolan

You must promptly report any of the following to the IRB: (1) **all serious and/or unexpected adverse experiences** involving risks to subjects or others; and (2) **any other unanticipated problems involving risks** to subjects or others.

Your research records may be audited at any time during or after the implementation of your study. Federal and University policy require that all research records be maintained for a period of three (3) years following the close of the research protocol. If the principal investigator terminates association with the University before that time, the signed informed consent documents should be given to the Departmental Executive Officer to be maintained.

Research investigators are expected to comply with the University's Federal Wide Assurance, the Belmont Report, 45 CFR 46 and other applicable regulations prior to conducting the research. These documents are on the Human Subjects Research Office website or are available by calling (515) 294-4566.

Upon completion of the project, a Project Closure Form will need to be submitted to the Human Subjects Research Office to officially close the project.

C: C&I
Denise Schmidt

APPENDIX B: Teacher Interview Questions
Obtaining Background Information

1. How long have you worked with the student?
2. What type of device does this student use?
3. Why was the student selected to receive assistive technology services?
4. What outcomes are expected as a result of the assistive technology device?
5. How successful do you feel the student has been in the classroom as a result of the addition of her assistive technology device?
6. What things would you change with the device? Why would you change them?

APPENDIX C
Sample Page from Daily Teacher Logbook

Teacher Daily Journal

Date	Learning Task	Positive Outcome	Frustrations or Problems	Other Questions or Comments
10/5	Math + using calculator	Herbie # punched in a score 14		
10/7	same as.			She really enjoys using the calculator on her Dynavox.
10/11	Explaining why she was upset	pointed to I'm sad	Couldn't or wouldn't explain why	
10/11	asked to use the computer (prompted her to use Dynavox)	I understood her.		
10/11	Math test w/calculator	Enjoys using it		
10/17	Science Class	Used voice to comment or answer		Chose to use voice rather than Dynavox

APPENDIX D: Teacher Interview Questions
Teacher Questions and Assistive Technology Information

Questions

Teacher interview questions will be open-ended to encourage a free flow of conversation and to discourage short yes/no responses. The questions may include but are not limited to the following:

1. What is your definition of assistive technology?
2. Describe the types of assistive technology devices students have used in the classroom for instructional tasks.
3. How are assistive technology services acquired for students? For students who use “High Technology” devices?
4. Describe ways that the assistive devices(s) are used by the student for instructional tasks during the school day.
5. What does the student gain (how does he/she benefit academically) as a result of using the assistive technology device in the classroom?
6. How would the student’s instructional education plan be altered if he/she did not have access to the assistive device on a daily basis?
7. What alternatives are in place in the absence of the assistive technology?
8. What specific barriers have you or the student encountered when using the assistive technology device for daily instructional tasks?
9. Are any steps in place to overcome the current barriers? What are the next steps?
10. What barriers are difficult to overcome and why?
11. Tell about what success the student has seen as a result of the assistive technology.

APPENDIX E: Teacher Interview Questions
Follow Up Questions

1. Describe this school. Urban or a Rural Setting?
2. What is the average class size in this school?
3. Describe the student's day?
4. How would you describe the type of programming. Full Inclusion/Pull Out
5. How reliable is the device you work with?
6. How satisfied are you with the device?

APPENDIX F

Dynamyte by Dynavox

www.dynavoxsys.com

(This Dynamyte system has now become an outdated assistive technology because of the new technologies created by the Dynavox company.)

**Specifications**

Weight: 3.2 pounds

Size: 8" x 7" x 2"

Display: 6.5" diagonal with 640 x 480 resolution

Access and Selection Methods: Touch Screen with adjustable release times, touch enter mode, and audio touch.

Speech Output

Memory: 16mb memory card

Cost: \$6,395 (device is no longer available to purchase from Dynavox. New technologies have replaced created by Dynavox have replaced it)

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