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ASSISTIVE TECHNOLOGY USE BY KENTUCKY STUDENTS WITH VISUAL  
IMPAIRMENTS

By

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B.M.Ed., University of Louisville, 1977

M.C.M., Southern Baptist Theological Seminary, 1980

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A Dissertation

Submitted to the Faculty of the  
Graduate School of the University of Louisville  
in Partial Fulfillment of the Requirements  
for the Degree of

Doctor of Philosophy

Department of Teaching and Learning  
University of Louisville  
Louisville, Kentucky  
May 2011

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A Dissertation Approved On

March 29, 2011

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## ABSTRACT

### ASSISTIVE TECHNOLOGY USE BY KENTUCKY STUDENTS WITH VISUAL IMPAIRMENTS

David A. Hume

March 29, 2011

Assistive technology (AT) helps make the curriculum accessible to students with visual impairments. Studies have shown that half of these students are using assistive technologies. The purpose of this study was to seek a better understanding of the various factors related to assistive technology use by students with visual impairments in the Commonwealth of Kentucky.

Through the use of the online survey provider, *Survey Monkey*<sup>™</sup>, an invitation to participate in the Assistive Technology Use by Students with Visual Impairments (ATSVI) survey was sent to a list of all TVIs teaching in Kentucky. Of 117 invited participants, 71% responded and 62% of the questionnaires met the criteria of inclusion. Demographic data were gathered on the TVIs, including years of experience, degrees obtained, caseload size, size and type of employing district (residential or non-residential) and the extent and areas of AT training. Teachers also provided data about their student AT use, including the extent of low and high-tech use according to the student's primary learning media. Additionally, TVIs provided AT funding source data.

Significant correlation was not found between the size of employing district, years of teaching experience, level of education, specific areas of AT training and the extent of assistive technology use. Significant negative correlation was found between TVI caseload size and the extent of AT use. Significant positive correlation was found between the amount of overall AT training and the extent of AT use.

Several conclusions were made from the study's results. To increase assistive technology use by students with visual impairments, 1) TVIs should be encouraged to seek more AT training and AT providers should consider developing more on-line training, 2) training should be developed in specific AT areas according to TVIs surveyed needs, 3) TVI caseload sizes need to be smaller, and 4) TVIs need to be familiar with the large array of funding sources available for AT.

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## CHAPTER I

Assistive technology (AT) is comprised of devices and services designed to help individuals with disabilities function within their environments (King, 1999). These individuals can use AT to “a) assist them in learning, b) make the environment more accessible, c) enable them to compete in the workplace, d) enhance their independence and e) otherwise improve their quality of life” (Blackhurst & Lahm, 2000, p. 7). These functions of AT are as important to children with disabilities as they are to adults with disabilities for accessing play and learning and in increasing independence and quality of life. “With the assistance of technology, young children with disabilities can experience more success in exploring the world around them; in communicating their needs, desires and discoveries to other; and in making choices about their world” (Judge, 1998, p. 2). Many students who struggle with accessing the curricula require assistive technology for learning. In fact, the use of assistive technology for learning is so important that Congress addressed its need by requiring all Individual Educational Plan (IEP) committees to consider assistive technology devices and services for each student that requires a specially designed program (Individuals with Disabilities Education Act Reauthorization of 1997, 1997).

Assistive technology (AT) is defined as any “product, device, or equipment, whether acquired commercially, modified or customized, that is used to maintain,

increase, or improve the functional capabilities of individuals with disabilities (P.L 100-407, 1997) This definition includes all types of devices.

When asked to give an example of assistive technology, a typical answer might be that it is a computer or sophisticated electronic device. However, it is important to realize that assistive technology applications can be viewed as a continuum that ranges from “high-tech” to “no-tech” (Blackhurst, 2001). This continuum better articulates the types and complexity of devices that might be used for individuals with disabilities. High-tech devices are more complex, tend to be expensive and usually include electronic components. Some examples of high-tech AT include adapted computers, power wheelchairs, augmentative and alternative communication (AAC) devices. On the other hand, low-tech are items that usually cost under \$100. Low-tech AT usually does not usually use electronics and is less sophisticated such as Velcro, pencil grips, picture boards or crutches (Judge, 1998).

### **Assistive Technology for Students with Visual Impairments**

Visual impairments (VI) affect a student’s ability to access the curriculum and span from low vision to no vision, and often include additional exceptionalities (Ferrell, 2000, p.313). In *Foundations of Education*, Holbrook and Koenig (2000a) state, “the appropriate adaptation of instructional materials and teaching methods is essential to ensure that students with visual impairments have full and equal access to educational opportunities” (p. 175). Assistive technologies are available to help students with visual impairments access reading, writing, math, science, social science, the arts, daily living, and orientation and mobility. For students with low functional vision, low-tech assistive technology can be as simple as large print books for reading and wide lined paper with

bold markers for writing (Kapperman & Koenig, 1996). Electronic magnifiers and computer screen-enlargement software are examples of high-tech solutions of access technology for students with low functional vision (Leventhal & Jacinto, 2008).

For students with blindness, low-tech accessibility solutions include canes for mobility, plastic tactile stickers and braille for reading (Duffy, 1989; Willoughby & Duffy, 1989). Electronic braille note-takers and text-to-speech computer screen readers are examples of high-tech access solutions for students with blindness (Leventhal & Jacinto, 2008). As noted from the above examples, there are many options for individuals with visual impairments that can be used to accommodate one's needs. Those needs determine the level of sophistication or complexity of the level of technology. These options are also afforded to all students in need of assistive technology through specially designed instruction.

### **Learning Media Assessment for Students with Visual Impairments**

A functional vision learning media assessment (FVLMA) determines the primary learning media of the student with a visual impairment, which in turn is used to determine appropriate assistive technologies. "The learning media assessment documents the student's efficiency in using sensory channels (that is vision, touch, and hearing)" (Koenig & Holbrook, 1995). In the case of a student with low functional vision, for example, it might be determined that large print is the best option as his or her primary learning medium. A tactile medium such as braille or an audible medium such as a live reader might be determined to be the primary learning medium for a student with blindness. These adaptations and assistive technologies allow better access to the curriculum.

The objective of the FVLMA, usually conducted by a teacher of the visually impaired or a low vision specialist, is to determine which sensory channels the student uses to interact with the world. In addition to vision acuity tests, students are observed in their normal environments. Data are gathered from the student's family, teachers and others who share the student's environment.

### **Access to the Curriculum**

Schools are responsible for providing a broad and balanced curriculum for all pupils. In fact, the Individuals with Disabilities Education Act Amendments of 1997 (P.L. 105-17) ) mandate this broad and balanced curriculum. This curriculum requirement constitutes a shift in attitudes and beliefs by parents, schoolteachers and administrators and teacher training institutions.

Because of the Individuals with Disabilities Education Act (IDEA) there has been a push for greater access to the curriculum for students with disabilities. One of the ways for access has been through the concept of universal design. The Center for Applied Special Technology (CAST) has been in the forefront of developing the concept of Universal Design for Learning (UDL) (Hitchcock, Meyer, Rose, & Jackson, 2002). UDL is an approach to education that promotes greater access to the curriculum and represents a fundamental shift in the way to think about learning and instruction. UDL provides a flexible curriculum that considers individual differences in learning styles between students (Meyer & Rose, 2000). For example, a teacher might design a social studies lesson that requires some reading. Some students would learn best from visually reading the text, but others with reading disabilities or visual acuity issues would not realize the same benefits. In a UDL lesson, the teacher would have built in options for all students

to access the same information in other media, depending upon the student's best learning medium. For example, the teacher would provide visual media such as pictures or video for those students who learn best visually, or talking digital text and recordings for those who learn best audibly. In the case of a student with blindness, a teacher could provide access tactually with braille media. To implement UDL, teachers must plan their curriculum prior to instruction, and not provide accommodations as an afterthought regarding student access to the content.

Unfortunately, public schools and institutions nationally may not be providing access to the curriculum required for students with visual impairments to be successful. One national study including one hundred-twenty-eight teachers of the visually impaired and sixty-four administrators in 20 regions concluded that "most children are not receiving the access mandated by law, despite several national efforts" (A. J. Smith, Gerschlag, & Huebner, 2004, p. 624). Teachers' and administrators' lack of knowledge and training in both the law and the use of assistive technology were cited as possible reasons for the lack of access to the curriculum.

Both sighted and visually impaired students share a core curriculum, which include areas of study deemed important by the school. In the state of Kentucky, the core curriculum mandated by the Kentucky Department of Education is comprised of the areas of reading, writing, math, science, social studies, practical living and arts and humanities (Kentucky Department of Education: *Kentucky core content for assessment version 4.1*, 2006). In addition to these core curriculum areas, students with visual impairments require expanded training in areas specific to visual impairments. These additional areas of study for the student with visual impairments have come to be known as the expanded

core curriculum. This model was adopted by many educators of the visually impaired to meet additional needs of VI students (Corn, DePreist, & Erin, 2000). The expanded core curriculum for students with visual impairments include the additional areas of orientation and mobility, independent living skills, recreation and leisure skills, social interaction skills, career education skills, compensatory academic skills, visual efficiency skills, and the use of assistive technology (Hatlen, 1996). Therefore, this expanded version addresses the need for access to the curriculum through the use of AT. However, what is unknown is to what extent this access is provided to student with visual impairments in Kentucky.

### **Problem Statement**

Several studies have indicated insufficient use of assistive technology by students with visual impairments (Abner & Lahm, 2002; Corn & Wall, 2002; Edwards & Lewis, 1998; Kapperman, Sticken, & Heinze, 2002; Kelly, 2008; Land, 1998; Livingston-White, Utter, & Woodard, 1985; Parker, Buckley, & Truesdell, 1990; A. J. Smith, et al., 2004; Thurlow, Johnstone, Timmons, & Altman, 2007; Uslan, 1992). These studies were mostly concerned with counting numbers of students using assistive technology and looked at only a few factors related to the low use of assistive technologies by students. For example, according to studies in Illinois (Kapperman, et al., 2002) and Kentucky (Abner & Lahm, 2002), only half of Kindergarten through 12 grade (K-12) students with visual impairments received assistive technology services. Abner and Lahm suggested a lack of teacher training as a factor influencing student use of assistive technology. This was reflected the findings of a 1999 study which indicated that Kentucky's special

education teachers felt inadequately trained in the area of assistive technology (Bauder, 1999).

An Illinois survey of teachers (Kapperman, et al., 2002) of the visually impaired teaching in various environments, including regular classrooms, resource rooms and residential schools, suggested that student placement was the largest predictor of assistive technology. Kapperman, Sticken and Heinze found that Illinois students with visual impairments placed in a residential setting were more likely to use assistive technologies than their counterparts were in public schools (2002).

In an examination of national data collected by the Special Education Elementary Longitudinal Study (SEELS), Kelly found similar low uses of assistive technology (Kelly, 2008). The results of Kelly's study specified that well over half of students with visual impairments used no assistive technology. Though the sample was small, Kelly also found that students placed in residential schools were almost six times more likely to be using assistive technology than students placed in regular public school classrooms.

These studies indicate that both teacher training and student placement could influence the number of visually impaired students using assistive technology. The purpose of this study examined these and other factors related to AT use by students with visual impairments.

### **What Has Not Been Answered in Previous Research**

Recently published work in the field of visual impairments and blindness do not show if the percentage of AT use by Kentucky students with visually impairments has changed since 2002. Additionally, published studies have not examined factors, other than teacher training, related to the use of assistive technology by students with visual

impairments in Kentucky. For example, identifying factors that may affect the number of students using AT may help get more assistive technology into the hands of these students, thus helping make the curriculum more accessible. Other factors may also influence assistive technology use by students with visual impairments including lack of funding, size of teacher caseload, the student's educational placement in residential, self-contained or inclusive environment or the student's degree of visual loss.

Based on the information about assistive technology and the use by students with visual disabilities, there appeared to be a need to gather more information about these factors. Therefore, an investigation that surveyed teachers of visually impaired students in the state of Kentucky was conducted to provide such information. There are approximately 120 teachers of the visually impaired (TVIs) working with an estimated 1,100 k-12 students with visual impairments in Kentucky. These teachers were asked to provide demographic, caseload size, student placement and perceived funding data. Teachers were also asked to provide data on the number of students using low-tech and high-tech assistive technology by the students' primary learning media. The number and percentage of students using low-tech assistive technology as well as high-tech assistive technology was calculated for each teacher. Correlates between the use of assistive technology and factors such as teacher caseload size, district size, educational level, AT training, perceived AT funding, student educational placement, and student primary reading media were examined.

Unlike previous studies, this study examined factors other than teacher training and student placement that relate to assistive technology use. In addition, the

questionnaire was sent to the entire population of teachers of the visually impaired in Kentucky and its method procedure produced a completed return rate of 62%.

### **Purpose Statement**

The purpose of this study was to seek a better understanding of the various factors related to assistive technology use by students with visual impairments in the Commonwealth of Kentucky. Because the use of assistive technology by students with visually impairments is reported to be low and access to the curriculum is important to these students, research that identifies factors that correlate with the use of assistive technology could be used to increase the use of assistive technology by these students. Based on the above factors, the following questions were addressed in the study.

### **Research Questions**

**Research question 1.** To what extent are Kentucky students with visual impairments using low and high tech assistive technology devices?

**Research question 2.** How have Kentucky teachers of visually impaired students received training in the area of assistive technology, and which methods of AT training do they prefer?

**Research question 3.** In what areas of assistive technology, and to what extent in those areas have Kentucky teachers of the visually impaired received training?

**Research question 4.** What is the correlation between high-tech assistive technologies used by students with visual impairments and the extent of high-tech assistive technologies training received by their teachers?

**Research question 5.** What is the correlation between the size of the district in which the teacher is employed, the teacher's years of experience, caseload size, level of education and the extent of their students' assistive technology use?

**Research question 6.** What funding sources are used to provide assistive technology to Kentucky students with visual impairments?

**Research question 7.** Are there differences in the extent of low and high-tech AT use as determined by the student's primary learning media or educational placement?

### **Definitions**

For the purpose of this investigation, the following terms have been operationally defined:

**Assistive technology device (AT).** Any item, piece of equipment, or product system, whether acquired commercially, modified, or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities (P.L. 105-17)

**Assistive technology service.** Any service that directly assists a child with a disability in the selection, acquisition, or use of an assistive technology device (P.L. 105-17)

**Blindness.** The inability to see; the absence or severe reduction of vision (Holbrook & Koenig, 2000b, p. 313)

**Visual impairment (VI).** Any degree of vision loss that affects an individual's ability to perform the tasks of daily life, caused by a visual system that is not working properly or not formed correctly (Holbrook & Koenig, 2000b, p.321)

**Low vision.** Vision impairment after correction, but with the potential for use of available vision, with or without optical or non-optical compensatory visual strategies,

devices and environmental modifications, to plan and perform daily tasks (Holbrook & Koenig, 2000b)

**High-tech AT.** Electronic assistive technology device characterized by the use of an integrated circuit or “chip”, such as an electronic magnifier, talking calculator or adapted computer

**Low-tech AT.** Non-electronic assistive technology device, such as an optical magnifier, bold marker or mechanical braillewriter

**Teacher of the visually impaired (TVI).** A teacher trained and certified to work with students with visual impairments

**Primary learning media.** The medium, whether print, braille or auditory, that will be used by and individual for gaining basic academic skills (Corn & Koenig, 2000, p.449).

**Educational placement.** The least restrictive environment as determined by a student’s Individual Educational Plan committee

**Universal design for learning (UDL).** An educational framework based on research in the learning sciences, including cognitive neuroscience, that guides the development of flexible learning environments that can accommodate individual learning differences (Rose & Meyer, 2002).

## **CHAPTER II**

### **Review of the Literature**

This chapter is a review of pertinent literature related to this study, included the importance of assistive technology, federal and Kentucky law concerning assistive technology, current assistive technology available to students with visual impairments for access to both the Kentucky core content and the expanded core curriculum. Additionally this chapter reviews literature related to assistive technology training for teachers of the visually impaired, teachers' years of experience and caseload size, students' educational placement and primary reading media as related to the extent of assistive technology, and funding sources for assistive technology.

#### **Importance of Assistive Technology for Students with Visual Impairments**

An assistive technology device is any piece of equipment or product system, whether acquired commercially, modified, or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities (P.L.105-17). An assistive technology service includes any service that directly assists a child with a disability in the selection, acquisition, or use of an assistive technology device (P.L.105-17).

According to the Texas School for the Blind, there are five basic principles of assistive technology for students with visual impairments (Principles of Assistive Technology for Students with Visual Impairments, 2006). The first principle is that assistive technologies should be used to enhance basic skills, not replace them. Second,

that assistive technologies should be considered more than just educational tools – they are the work tools of students with visual impairments, similar to paper and pencil to the visually impaired (VI) students' sighted peers. The third principle involves the use of the electronic learning environments. VI students should have the same access to electronic learning (e.g. computers and the internet) as their sighted peers. The fourth principle is that assistive technology by itself may not always make software and electronic tools fully accessible. The last principle of assistive technology states that the correct technology should be used at the correct time in the student's developmental process.

More general VI education principles were articulated in the national agenda for the education of children and youths with visual impairments, including those with multiple disabilities which grew out of a presentation given by Anne Corn at the 1993 Annual Conference at the American Printing House for the Blind (Corn & Hatlen, 1996). Discussions following the presentation eventually led to eight goal statements presented to the annual international meeting of the Association for the Education and Rehabilitation of the Blind and Visually Impaired (AER) in Dallas, Texas in July 1994. The final version of the National Agenda was presented at the 1994 Annual Conference at the American Printing House for the Blind (Corn & Hatlen, 1996).

Phil Hatlen, a participant in the development of the national agenda for the education of children with visual impairments, stressed the importance of assisted technology as part of the expanded core curricula for students with visual impairments, stating,

Technology enables blind people to store and retrieve information and brings a library under the fingertips of the visually impaired person. It enhances

communication and learning and expands the world of blind and visually impaired persons in many significant ways (Hatlen, 1996, p. 31).

Furthermore, Presley and D'Andrea, in their book, *Assistive Technology for Students Who Are Blind or Visually Impaired* indicate the importance of assistive technology by stating, "In effect, technological devices used by someone who is visually impaired become extensions of that person and channels that support the flow of fundamental information that he or she cannot derive easily by sight" (2008, p. 5).

Therefore, the importance of assistive technology is not lost on teachers of the visually impaired and their students. In a nation wide survey, 42% of teachers of the visually impaired (TVIs) listed "becoming proficient users of assistive technology" as the primary goal for their students (Thurlow, et al., 2007). In 2005, for example, every student at the Kentucky School for the Blind (KSB) had assistive technology listed as an adaptation, accommodation, or modification on their individual educational plan (IEP). This demonstrated the importance given to assistive technology by students, parents, and professionals who make up the IEP committees at KSB (Hume, 2006).

### **Access to the Workplace**

Mirroring the importance of assistive technology for students is the importance of assistive technologies for working adults with disabilities. Like students facing barriers to education, adults with disabilities face barriers to the workplace. The lack of in-depth research of assistive technology use by students is reflected by the lack of in-depth research of assistive technology use by adults with disabilities. One meta-study showed that the research available on work place accommodations have mostly been case studies (Butterfield & Ramseur, 2004). Among these case studies of adult workers with visual

impairments, accommodations listed included: painted lines on stairs, lighting adjustments, braille signs, low glare computer monitors, computer screen readers, refreshable braille displays, and braille notetakers. Many of these accommodations and technologies are similar to ones used by students with visual impairments.

Some factors that impede the use of AT by students also seem to affect the use of AT by working adult with disabilities. For example, adults with disabilities report a lack of adequate training and support similar to the lack of training and support reported by K-12 special education teachers (Driscoll, Rodger, & de Jonge, 2001). Funding issues are also cited as a barrier for some adults with disabilities (Kaye, Yeager, & Reed, 2009).

Employers also have cited insufficient knowledge a factor affected the employment of adults with disabilities. Employers wanted to know more about job accommodations, assistive technology, best practices, legal and financial issues, funding resources and ADA requirements (Purdin, Liese, & Lehmann, 2003). In the field of educating students with visual impairments, knowledge in many of these same areas are just as important, including knowledge of the law as it relates to assistive technology for students with disabilities.

### **Curriculum Access for Students with Visual Impairments**

Federal law is clear about the role of assistive technology in the education of students with disabilities. According to IDEA, “The IEP team shall... consider whether the child requires assistive technology devices and services” (P.L.105-17).

Both low and high tech assistive technologies help students with visual impairments access the curricula. Technologies are available to help students access all curricula areas. The state of Kentucky has developed curriculum guidelines for all students in public K-12 schools, combining the Program of Studies and the Academic

Standards into a document called the Core Content Guide 4.1 (Kentucky Department of Education, 2006). This document has been widely used by teachers, schools, and districts as a curriculum guide to prepare students for Kentucky Accountability Testing, a yearly test given to students in Kentucky. In 2009, the Kentucky Legislature passed a bill extending testing based on the Kentucky Core Content for Assessment version 4.1 through the year 2011 (i.e. Kentucky Senate Bill 1, 2009). These tests, along with writing portfolios, are graded and combined with other factors such as dropout rates and student post-graduation transitional success to calculate an accountability index for each school.

The areas of study listed in the Core Content Guide 4.1 are reading, writing, math, science, social studies, arts and humanities and practical living. The Expanded Core Curriculum, adopted by many teachers of the visually impaired, integrates compensatory skills with the Core Content (Lohmeier, 2005, 2007). Hatlen grouped these compensatory skills in nine areas: 1) compensatory academic skills, 2) social development, 3) recreation and leisure, 4) orientation and mobility, 5) independent living skills, 6) technology, 7) career development, 8) visual efficiency skills, and 9) self-determination (Hatlen, 1996). The technology component helps students with visual impairments not only access the expanded core curriculum, but also all general education curricular areas.

Table 1 lists low-tech and high-tech assistive technologies appropriate for students with low vision, and which technologies help students access different areas of the Kentucky core content curriculum and the expanded core content.

Table 1

*Assistive Technologies for Students with Low Vision*

Subject	Low Tech	High Tech
Reading	<ul style="list-style-type: none"> <li>• Adjustable lighting</li> <li>• Acetate overlay</li> <li>• Light box</li> <li>• Large Print</li> <li>• Adjustable copy holder/slant-board</li> <li>• Optical Magnifier</li> </ul>	<ul style="list-style-type: none"> <li>• Video Magnifier (CCTV)</li> <li>• Photo-copy enlargement</li> <li>• Scanner with OCR and computer screen magnification</li> <li>• Electronic Audio (files, tapes, CDs)</li> </ul>
Writing	<ul style="list-style-type: none"> <li>• Bold marker with bold lined paper</li> </ul>	<ul style="list-style-type: none"> <li>• Video Magnifier (CCTV)</li> <li>• Computer/Laptop/portable word processor</li> </ul>
Math	<ul style="list-style-type: none"> <li>• White board w/erasable marker</li> <li>• Large print ruler/protractor</li> <li>• Large print grid paper</li> </ul>	<ul style="list-style-type: none"> <li>• Large display calculator</li> <li>• Talking calculator</li> <li>• Video Magnifier (CCTV)</li> </ul>
Science	<ul style="list-style-type: none"> <li>• Enlarged diagrams, graphs and charts</li> </ul>	<ul style="list-style-type: none"> <li>• Video Microscope</li> <li>• Video Magnifier (CCTV)</li> </ul>
Arts & Humanities	<ul style="list-style-type: none"> <li>• Large lined staff paper and bold markers</li> <li>• Optical device (hand-held telescope)</li> </ul>	<ul style="list-style-type: none"> <li>• Video Magnifier (CCTV)</li> <li>• Magnification Visor</li> </ul>
Computer Access	<ul style="list-style-type: none"> <li>• Large print keyboard stickers</li> </ul>	<ul style="list-style-type: none"> <li>• Screen enlargement software</li> </ul>
Classroom Board Access	<ul style="list-style-type: none"> <li>• Optical device (hand-held telescope)</li> </ul>	<ul style="list-style-type: none"> <li>• VIDEO devices</li> <li>• Whiteboard to computer technologies</li> </ul>
Recreation	<ul style="list-style-type: none"> <li>• Large print games</li> </ul>	<ul style="list-style-type: none"> <li>• Video Magnifier (CCTV)</li> </ul>
Practical Living	<ul style="list-style-type: none"> <li>• Large print checkbook</li> <li>• Large labeled kitchen tools and household appliances</li> </ul>	<ul style="list-style-type: none"> <li>• Talking appliances</li> <li>• Magnified cell phone screens</li> </ul>
Mobility/Travel	<ul style="list-style-type: none"> <li>• Optical device (hand-held telescope)</li> </ul>	<ul style="list-style-type: none"> <li>• Video Magnifier (CCTV)</li> <li>• GPS w/magnified screen</li> </ul>

*Note.* From *Assistive Technology Guide for Students with Low Vision and Blindness*. D. Hume. Handout presented at Gateways 2008, Kentucky School for the Blind, Louisville, KY.

Table 2 shows both low-tech and high-tech assistive technologies appropriate for students with blindness, and which technologies help them access different areas of the Kentucky Core Content curriculum and the expanded core content.

Table 2

*Assistive Technologies for Students with Blindness*

Subject	Low Tech	High Tech
Reading	<ul style="list-style-type: none"> <li>• Braille materials</li> </ul>	<ul style="list-style-type: none"> <li>• Refreshable Braille PDA</li> <li>• Electronic Audio, Braille NoteTakers</li> <li>• Computer w/scanner and OCR</li> </ul>
Writing	<ul style="list-style-type: none"> <li>• Braille writer</li> <li>• Slate and stylus</li> <li>• Signature guide</li> </ul>	<ul style="list-style-type: none"> <li>• Mountbatten Brailier</li> <li>• PDAs (Braille notetakers)</li> <li>• Computer/Laptop</li> </ul>
Math	<ul style="list-style-type: none"> <li>• Manipulatives</li> <li>• Tactile ruler</li> <li>• Tactile protractor</li> </ul>	<ul style="list-style-type: none"> <li>• Talking calculator</li> <li>• PDA (notetaker) w/ scientific calculator</li> <li>• Talking ruler, talking measuring tape</li> <li>• Refreshable Braille notetaker</li> <li>• Accessible graphing software</li> </ul>
Science	<ul style="list-style-type: none"> <li>• Tactile diagrams, graphs and charts</li> </ul>	<ul style="list-style-type: none"> <li>• Talking tactile diagrams, graphs, charts</li> <li>• Talking scales</li> <li>• Talking color identifiers</li> </ul>
Arts & Humanities	<ul style="list-style-type: none"> <li>• Braille music</li> <li>• Tactile art</li> </ul>	<ul style="list-style-type: none"> <li>• Recorded music and music players</li> <li>• Audio descriptors</li> </ul>
Computer Access	<ul style="list-style-type: none"> <li>• Braille keyboard stickers</li> </ul>	<ul style="list-style-type: none"> <li>• Screen reader software</li> <li>• Refreshable Braille output device</li> </ul>
Recreation	<ul style="list-style-type: none"> <li>• Brailled games</li> <li>• Jingle balls</li> </ul>	<ul style="list-style-type: none"> <li>• Beeper balls</li> <li>• Audible game software</li> </ul>

Table 2 *Assistive Technologies for Students with Blindness* Continued

Practical Living	<ul style="list-style-type: none"> <li>• Braille labels/labeler</li> <li>• Tactile appliances</li> <li>• Slicing guide</li> <li>• Long oven mitts</li> </ul>	<ul style="list-style-type: none"> <li>• Talking check book software</li> <li>• Talking clock</li> <li>• Talking color identifier, money reader</li> <li>• Talking medical equipment/scales</li> <li>• Talking caller ID</li> <li>• Liquid level indicator</li> <li>• Talking Thermometer/thermostat</li> <li>• Talking cell phone screen</li> </ul>
Mobility/Travel	<ul style="list-style-type: none"> <li>• Long cane</li> </ul>	<ul style="list-style-type: none"> <li>• Talking GPS</li> </ul>

*Note.* From *Assistive Technology Guide for Students with Low Vision and Blindness*. D. Hume. Handout presented at Gateways 2008, Kentucky School for the Blind, Louisville, KY.

### Factors of Assistive Technology Use

**Extent of assistive technology use.** Several studies have examined the number of students with visual impairments using assistive technologies. A 1990 Massachusetts survey of teachers of the visually impaired showed “most did not use technological aids” with their students (Parker, et al., 1990). Teachers reported common problems in the areas of student technology assessments, training in the use of assistive technology and available personnel to repair and maintain the technologies.

A survey of Florida teachers of the visually impaired suggested that the Braille embosser was the most used high-tech device (Edwards & Lewis, 1998). Fifty-four and a half percent of the respondents indicated that they and their students benefited from the use of a braille embosser. This study reported the next most used devices, in order, as hardware/software enlargement tools, speech access devices, note taking devices and optical character resolution technology. At a reported use rate of 3.6%, the refreshable braille display was the least used high-tech device.

In a 2002 statewide survey of teachers of the visually impaired in Illinois showed

that only 40% of students requiring alternative reading formats used assistive technology. The authors of this study concluded that, “a significant number of visually impaired students in Illinois who could benefit from assistive technology are not receiving instruction in that area” (Kapperman, et al., 2002, pp. 107-108).

A 2002 survey of Kentucky teachers of the visually impaired showed that 31.9% of their students used screen enlargement technologies (Abner & Lahm, 2002). This was followed by no accommodations at all (27.7%) and screen reading technologies (19.5%). In this study, teachers of the visually impaired reported that only two percent of all their students were using refreshable Braille devices.

In an examination of data from the nation-wide Special Education Elementary Longitudinal Study (SEELS), it was found that 18% of students with visual impairments in the school years 2000 – 2001 and 2001-2002 used high tech assistive technology (Kelly, 2008). When counting only students with visual impairments considered to be “academically oriented,” this study found that 41% in the year 2000-2001 and 39% in the year 2001-2002 used high tech assistive technology.

Research suggests there may be factors that affect the extent of assistive technology use by students with visual impairments. These factors include teacher training, teacher years of experience student’s primary learning media, student’s educational placement and technology funding.

**Teacher training as factor of assistive technology use.** A 1996 survey of general special education teachers in Tennessee, Kentucky and Indiana showed that 41% of special educators lack adequate skills to use assistive technology in the classroom (Derer, Polsgrove, & Rieth, 1996). A survey of special education teachers in Kentucky

indicated that few teachers feel prepared to provide AT services to students (Bauder, 1999).

In a survey of teachers of the visually impaired in Illinois, 72% of the teachers interviewed were unable to respond to the survey because of their lack of knowledge about the assistive technologies that were discussed (Kapperman, et al., 2002). In a Brazilian study, the top reason for not using assistive technology given by teachers of the visually impaired was the lack of training (Alves, Montiero, Rabello, Gasparetto, & Carvalho, 2009).

Other studies have reported a lack of assistive technology training for teachers of the visually impaired and other special educators, but none statistically connected the perceived lack of training with the number of students not using assistive technology (Candela, 2003; Corn, 2002; Edwards, 1998; Eggett, 2002; Marston, 2000; Parker, 1990; Smith, 2007; Wahl, 2004). In fact, the one study that compared the extent of student assistive technology use directly with teacher pre-service training in assistive technology found no statistical significance (Kapperman, 2002).

**Training models.** There are various delivery models of assistive technology training. Many teachers of the visually impaired receive assistive technology as part of their college training. Smith and Kelly found that out of 30 programs in US and Canada, only “half the universities have a specific assistive technology course that offers instruction in [assistive technologies for students with visual impairments]” (D. W. Smith & Kelley, 2007, p. 431). Maushak found a “continued need to include assistive technology under the broader umbrella of technology in teacher preparation programs” (Maushak, Kelley, & Blodgett, 2001, p. 419).

Online training, through a university or other providers, is a growing source of assistive technology training. However, it appears that there is no clear preference regarding online training. For example, in one survey, fifty-nine percent of respondents indicated a preference for online training (Wahl, 2004). However, a previous study concerning assistive technology use by special education teachers in Kentucky indicated that the least favorite type of training indicated in the study was long distance training (Bauder, 1999). In a sample of teachers of the visually impaired, Maston found that VI teachers received meaningful training via online courses (2000).

In-service training is another common source of assistive technology training. Derer reported that forty-four percent of special education teachers who received assistive technology training did so through in-service (1996). The type of trainer providing inservice training ranged from 23% of assistive technology trainers who were school personnel, 15.6% who were technology consultants and 15.3% who were university or college faculty members (Bauder, 1999).

**Training competencies.** As part of training curriculum, the identification of what information would help teachers to better understand AT has been researched. For example, in an attempt to “standardize essential knowledge or skills Lahm & Nickels (1999) identified essential knowledge and skill competencies in assistive technology in eight categories. These competencies are identified in the categories of philosophical, legal, and historical foundations of special education; characteristics of learners; assessment, diagnosis, and evaluation; instructional content and practice; planning and managing the teaching and learning environment; managing the behavior and social interaction skills of exceptional students; communication and collaborative partnerships;

and professionalism and ethical practices (Lahm & Nickels, 1999). Smith (2009) conducted a Delphi study to identify which assistive technology competencies were important for teachers of the visually impaired. Smith identified 111 competencies required for VI teachers. The areas of competencies included foundations of assistive technology, disability-related assistive technology, use of assistive technology, assistive technology instructional strategies, learning environments, access to information, instructional planning, assessment, professional development, and collaboration. There appears to be many areas of overlap between the competencies that were developed by these researchers.

**Types of training.** Several studies have shown that teachers of the visually impaired want more training in the use of high-tech assistive technology. In a 2000 survey of Kentucky teachers of students with visual impairments, Abner and Lahm reported that 51% of the teachers who participated did not feel competent to teach their students to use assistive technologies. Although the study did not statistically link the perceived lack of teacher training with the extent of assistive technology use by the students, the survey showed that ninety-nine per cent of teachers of the visually impaired in Kentucky stated a desire for more training (Abner & Lahm, 2002).

Another study demonstrated that the teacher benefits of training in the area of science education for students with visual impairments. A pre-test and post-test was administered to 21 teachers who attended a one-week training session on teaching methods for students with visual impairments. The study reported a significant improvement in self-rated confidence by the teachers in the use of assistive technologies for teaching science (Penrod, Haley, & Matheson, 2005).

**Teacher years of experience as a factor of assistive technology use.** The literature has little to offer on the connection between teachers' years of experience and the extent of assistive technology use. There may be some indication that teachers with more experience tend to prefer the student to read tactually. "The more experienced the teachers were (in terms of years of teaching and knowledge of Braille), the less the students preferred to study aurally" (Argyropoulos, Sideridis, & Katsoulis, 2008, p. 229). In a Minnesota survey of assistive technology use it was found that students of teachers of the visually impaired with more experience are more likely to use a combination of tactile and auditory reading materials (Thurlow, et al., 2007).

It may be that more experienced teachers have learned the value of braille over time and recognize the potential of high tech tactile devices. Indeed, Farnsworth and Luckner found evidence that the refreshable braille notetaker enabled the braille student to have immediate access to curriculum materials (Farnsworth & Luckner, 2008). Therefore, immediate access to curriculum may be significant, especially in light of the fact that students prefer braille for reading, particularly for vocabulary, spelling and reading comprehension (Rao, 2006).

**Teacher caseload size as a factor of assistive technology use.** The research findings are mixed concerning the correlation between teacher caseload size and the extent of students' use of assistive technology. Edwards and Lewis found "no trends or patterns" concerning teacher caseload size and the types of assistive technologies being used by students with visual impairments in Florida (Edwards & Lewis, 1998). However, a 2007 national survey found a correlation between a teacher's caseload size and the amount of assistive technology used by their students. The study found a significant

inverse relationship between the size of the caseload and the percent of students using assistive technologies including the use of Braille technologies ( $p=.044$ ), audio technologies ( $p=.004$ ), electronic magnification ( $p=.030$ ), and computer screen readers ( $p=.003$ ) (Thurlow, et al., 2007). This suggests that teachers with smaller caseloads tend to use more assistive technologies with their students.

**Student's primary learning media as a factor of assistive technology use.** A learning media assessment helps determine which assistive technologies a student with visual impairment will use. This assessment examines which sensory channel – visual, tactual or auditory – the student uses most efficiently (Koenig & Holbrook, 1995). The primary learning media determines what types of assistive technology best suits the student. For example, a student whose primary learning media is tactual might use braille. A student who uses braille would then be a candidate to use a refreshable braille display. Students using “auditory” as their primary or secondary media would use a reader, audio books or computer speech to access the curricula.

In a national survey, Corn and Wall concluded that low vision students used computers more than blind students (2002). Several other studies identified overall percentages of specific types of assistive technologies used by students with visual impairments (Abner & Lahm, 2002; Edwards & Lewis, 1998; Kapperman, et al., 2002; Kelly, 2008; Livingston-White, et al., 1985; Parker, et al., 1990; Thurlow, et al., 2007). None of these studies, however, compared percentage of assistive technology use by students using different primary learning media.

**Student's educational placement as a factor of assistive technology use.**

Federal law is clear about the placement of students with disabilities in the least

restrictive environment among a continuum of available education placements (Hager & Smith, 2003; Huemann, 2000; Individuals with Disabilities Education Act Reauthorization of 1997, 1997; Lewis & Allman, 2000). Lewis and Allman (2000) describe four models along the continuum of placement options for students with visual impairments. The least restrictive is the “consultant model” in which the teacher for visually impaired (TVI) works minimally with the student, but serves as a consultant to the regular classroom teacher and school personnel. The “itinerant model” places the student in a regular classroom; served occasionally by a teacher of the visually impaired. A student placed in the “resource room model” spends most of the classroom day in a separate room; served by a specialist in the education of students with visual impairments. A residential school would be an example of a setting “designed specifically for students with visual impairments” model (Lewis & Allman, 2000). In the continuum of services, some consider this placement the most restrictive environment, but in the end it is an individual decision made by the IEP committee “recognizing that the regular classroom may not be the LRE placement for every disabled student” (Huemann, 2000, p. 777). According to IDEA, Section 612 (5) (a),

...removal of children with disabilities from the regular educational environment occurs only when the nature or severity of the disability of a child is such that education in regular classes with the use of supplementary aids and services cannot be achieved satisfactorily. (P.L. 105-17).

Some studies have shown a higher percentage of assistive technology use by students in residential school placements. One national survey showed that a relatively

high number of residential schools for the blind (87.5%) provided direct instruction in the area of assistive technology (Lohmeier, 2005). A Michigan survey compared use of instruction, aids and devices by students at the Michigan residential school for the blind with students placed in local school districts (Livingston-White, et al., 1985). The study found that students in both placements were using low-tech devices such as optical aids, slate and stylus and Braillewriters, though at a higher rate at the residential school. The study, conducted in 1985, did not include a number of high tech devices available today. Many students at the residential school were using some high tech devices including Opticons, Kurzweil Reading Machines, CCTVs and electronic mobility aids not being used by students in local districts. Students in both residential and local school settings used both audible books and talking calculators.

Edwards & Lewis found “no trends or patterns” in assistive technologies used in different educational settings in Florida (Edwards & Lewis, 1998), though an Illinois study found a significant relationship between placement and percentage of students using assistive technologies (Kapperman, et al., 2002). The finding of higher AT use by students in residential schools was reflected in the national Special Education Elementary Longitudinal study (SEELS) that showed “students attending residential schools were significantly more likely to use assistive technology than students not attending residential schools” (Kelly, 2008).

**Funding as a factor of assistive technology use.** It is up to the school to provide necessary assistive technology at no extra cost to the student with visual impairments (Hager & Smith, 2003). According to the Federal Code of Regulations, Title 24, Volume 2, Section 300.15, and as directed by IDEA, the public agency is responsible for “making

available” technology “if the child’s IEP Team determines that the child needs access to those devices in order to receive FAPE” (P.L. 105-17).

Despite the school’s legal requirement to provide assistive technology for students with disabilities, some teachers of the visually impaired rate funding as a concern. Parker, et al. reported that 19% of the teachers considered funding “sometimes” a problem, 23% “often” and 32% “always” a problem concerning the use of assistive technologies by their students with visual impairments (1990). In a survey of assistive technology use conducted by Derer, Polsgrove and Rieth, it was found that “by far the most frequently mentioned barrier involved monetary concerns” (1996, p.68).

Private, not-for-profit organization and foundation grant money is available for districts and schools with students with visual impairments in the state of Kentucky. For example in the years 2006-2009 the Kentucky School for the Blind used funds available from the WHAS Crusade for Children, the Honorable Order of the Kentucky Colonels, the Stevie Wonder House Full of Toys Foundation, the Kentucky School for the Blind Charitable Foundation, among others, to fund assistive technology needs required by the students’ individual education plans (Hume, 2006). According to the application form guidelines of the various grant-making organizations, most of these funding sources were also available for assistive technology purchases for districts throughout the state.

### **Literature Review Summary**

This review of the literature examined issues related to the extent of assistive technology use and the importance of assistive technology use by students with visual impairments. Assistive technology is an invaluable tool for students to access both the core curriculum and the expanded core curriculum (Hatlen, 1996; Presley & D’Andrea,

2008; Thurlow, et al., 2007). Many assistive technologies, both low and high-tech are available for students to access the curricula (Hume, 2006; Presley & D'Andrea, 2008).

Despite the availability of assistive technologies, many students with visual impairments are not using them to access the curricula (Abner & Lahm, 2002; Alves, et al., 2009; Corn & Wall, 2002; Edwards & Lewis, 1998; Kapperman, et al., 2002; Kelly, 2008; Thurlow, et al., 2007). The review found that factors statistically related to the extent assistive technology use by students with visual impairments have been discussed but not been thoroughly studied (Abner & Lahm, 2002; Alves, et al., 2009; Bauder, 1999; Derer, et al., 1996; Edwards & Lewis, 1998; Kapperman, et al., 2002; Kelly, 2008; Maushak, et al., 2001; Parker, et al., 1990; D. W. Smith & Kelley, 2007). Identifying these factors may help teachers, administrators, IEP committees, and leaders in the field of education of students with visual impairments remedy shortfalls in assistive technology use.

This purpose of this study is: (a) to determine: the extent of assistive technology use by students with visual impairments in Kentucky schools, (b) examine various factors that are statistically related to the extent of assistive technology use, including teacher's geographic location, years of experience, training, student educational placement and student primary learning media.

## **CHAPTER III**

### **Methodology**

The purpose of this chapter is to describe the methods that were used in this study. The major areas addressed include survey development, sampling, instrumentation, questionnaire validation, procedures, reliability and data analysis procedures.

The purpose of this study was to seek a better understanding of the various factors related to assistive technology (AT) use by students with visual impairments in the Commonwealth of Kentucky. Because the use of assistive technology by students with visually impairments is reported to be low (Corn & Wall, 2002; Edwards & Lewis, 1998; Kapperman, et al., 2002; Kelly, 2008; Land, 1998; Livingston-White, et al., 1985; Parker, et al., 1990; A. J. Smith, et al., 2004; Thurlow, et al., 2007; Uslan, 1992) and access to the curriculum is important to these students (A. J. Smith, et al., 2004), research that identifies factors that correlate with the use of assistive technology could be used to increase the use of AT by these students.

#### **Survey Development**

To develop a survey questionnaire, Bourque and Fielder (2003) recommend adopting or adapting questions from other studies. "Surveyors should take advantage of the fact that others have developed and tested questions that they can use." (Bourque & Fielder, 2003, p. 45) According to Dillman, short concrete closed-end questions result in the highest questionnaire response rate (2000). These criteria were followed in the

selection and editing of questions for this study. Survey questions from questionnaires previously developed for the Kapperman et al. study (2002) and the Thurlow et al. study (2007) were combined and adapted to form the basis of this study's survey questionnaire. Questions were selected to align with this study's seven research questions. The questionnaire was adjusted according to content validation.

### **Content validity of questionnaire**

Litwin (1995) recommended an assessment of survey question items "by individuals with expertise in some aspect of the subject under study." The questionnaire in this study was distributed to a "blue ribbon panel" of experts in the field of assistive technology for content analysis. The members of this group wrote comments as to 1) whether each question was relevant to the field of assistive technology for students with visual impairments and 2) whether each question was relevant to this study's overall research questions. Survey questions were modified or deleted according to input from the panel.

The content validity method for the ATSVI questionnaire used an adaptation of Hambleton's procedure of index of item objective congruence (Hambleton, 1984; Turner, Mulvenon, Thomas, & Balkin, 2002). A panel of experts were given a copy of the questions and asked to rate each for relevance to the goal of the question. A number of -1 was given non-relevance, 0 for unclear and 1 for relevance. Questions with an average score below .75 were re-evaluated and either eliminated or reworded according to comments, for survey inclusion.

### **Instrument Reliability**

Test-retest reliability measures the “reproducibility” of a questionnaire’s results (Litwin, 2003, p. 6). A “stability coefficient” (Cureton, 1971, p. 45) results from using a measurement of correlation between data collected in more than one particular time. A correlation coefficient of at least 0.70 is “considered good” (Litwin, 2003, p. 8).

Ten teachers of the visually impaired from outside the state of Kentucky were sent an online pilot survey. Two weeks later, they received and completed the same survey. From this, an acceptable test-retest r-value coefficient of stability of was calculated. The resulting overall test-retest r-value was good ( $r = .780$ ). Caution must be taken, however, interpreting significance because of the small size of the pilot group.

### **Instrumentation**

This study examined factors related to the amount of assistive technology used by students with visual impairments in Kentucky. Data were gathered by a self-administered on-line survey using *Survey Monkey*<sup>TM</sup> (Finley, 1999). The survey was sent to teachers of the visually impaired throughout the state of Kentucky. The survey consisted of 30 questions. Table 3 provides a matrix how the survey questions aligned with each of the study’s research questions.

Table 3

*Research Questions – ATSVI Teacher Questionnaire Matrix*

<b>Research Question</b>	<b>ATSVI survey questionnaire number</b>
<p><b>Research Question 1</b>            To what extent are Kentucky students with visual impairments using low and high tech assistive technology devices?</p>	<p>6. How many students with visual impairments do you have on your caseload?  <b>10.</b> Of your <b>tactile/braille</b> media learners, how many use at least one <b>low-tech</b> assistive technology device as listed above?  <b>11.</b> Of your <b>tactile/braille</b> media learners, how many use a computer?  <b>13.</b> Of your <b>tactile/braille</b> media learners, how many use at least one high-tech assistive technology device as listed above?  <b>16.</b> Of your primarily <b>visual</b> or <b>large print</b> media learners, how many use at least one <b>low-tech</b> assistive technology device as listed above?  <b>17.</b> Of your primarily <b>visual</b> or <b>large print</b> media learners, how many use a computer?  <b>19.</b> Of your primarily <b>visual</b> or <b>large print</b> media learners, how many use at least one <b>high-tech</b> assistive technology device as listed above?  <b>22.</b> Of your primarily <b>listening/audio</b> media learners, how many use at least one <b>low-tech</b> assistive technology device as listed above?  <b>23.</b> Of your primarily <b>listening/audio</b> media learners, how many use a computer?  <b>25.</b> Of your primarily <b>listening/audio</b> media learners, how many use at least one <b>high-tech</b> assistive technology device as listed above?</p>
<p><b>Research Question 2</b>            How have Kentucky teachers of visually impaired students received training in the area of assistive technology, and which methods of AT training do they prefer?</p>	<p><b>26.</b> Where have you received knowledge of assistive technology?  <b>27.</b> On a scale of 1 being the most and 5 being the least, rank how you would most prefer to receive assistive technology training:</p>

Table 3 *Research Questions – ATSVI Teacher Questionnaire Matrix Continued*

**Research Question 3**

In what areas of assistive technology, and to what extent in those areas have Kentucky teachers of the visually impaired received training?

28. Of which devices have you received assistive technology training?

29. Of which devices would you like to receive assistive technology training?

**Research Question 4**

What is the correlation between specific high-tech assistive technologies used by students with visual impairments and the extent of specific high-tech assistive technologies training received by their teachers?

12. Which **high-tech** assistive technology devices do your **tactile/braille** media learners use?

18. Which **high-tech** assistive technology devices do your **visual** or **large print** media learners use?

24. Which **high-tech** assistive technology devices do your **listening/audio** media learners use?

28. Of which devices have you received assistive technology training?

**Research Question 5**

What is the correlation between a the size of the district in which the teacher is employed, the teacher's years of experience, caseload size, level of education, the service delivery model and the extent of their students' assistive technology use?

1. District size - less than 5,000, 5000 – 20,000 or 20,000 and above.

2. Number of years of experience teaching students with visual impairments:

3. What grade level do you teach?

4. What Kentucky Teaching Rank do you hold?

5. What college degrees do you have?

6. How many students with visual impairments do you have on your caseload?

7. Which service delivery model most closely describes how you teach your students with visual impairments?

10. Of your **tactile/braille** media learners, how many use at least one **low-tech** assistive technology device as listed above?

13. Of your **tactile/braille** media learners, how many use at least one high-tech assistive technology device as listed above?

16. Of your primarily **visual** or **large print** media learners, how many use at least one low-tech assistive technology device as listed above?

Table 3 *Research Questions – ATSVI Teacher Questionnaire Matrix* Continued

- Research Question 6**  
What funding sources are used to provide assistive technology to Kentucky students with visual impairments?
- Research Question 7**  
Are there differences in the extent of specific assistive technology use as determined by the student's primary learning media?
- 19.** Of your primarily **visual** or **large print** media learners, how many use at least one high-tech assistive technology device as listed above?
- 22.** Of your primarily **listening/audio** media learners, how many use at least one **low-tech** assistive technology device as listed above?
- 25.** Of your primarily **listening/audio** media learners, how many use at least one **high-tech** assistive technology device as listed above?
- 30.** From which sources have you received assistive technology funding?
- 6.** How many students with visual impairments do you have on your caseload?
- 8.** Of your caseload, how many students use **tactile** or **braille media** as their primary learning media? \_\_\_\_\_
- 10.** Of your **tactile/braille** media learners, how many use at least one **low-tech** assistive technology device as listed above? \_\_\_\_\_
- 13.** Of your **tactile/braille** media learners, how many use at least one high-tech assistive technology device as listed above?
- 14.** How many students in your caseload use **print** or **large print** as their primary learning media? \_\_\_\_\_
- 16.** Of your primarily **visual** or **large print** media learners, how many use at least one low-tech assistive technology device as listed above?
- 19.** Of your primarily **visual** or **large print** media learners, how many use at least one high-tech assistive technology device as listed above?

Table 3 *Research Questions – ATSVI Teacher Questionnaire Matrix Continued*

20. Of your caseload, how many students use **listening/audio** as their primary learning media? \_\_\_\_\_
22. Of your primarily **listening/audio** media learners, how many use at least one **low-tech** assistive technology device as listed above?
25. Of your primarily **listening/audio** media learners, how many use at least one **high-tech** assistive technology device as listed above?

Several past studies gathered data using surveys given to teachers of the visually impaired in order to answer these types of questions about assistive technology use by their students. This way, confidentiality of students was better preserved. In these surveys, teachers gave information on themselves and the number of their students using which kind of technologies (Abner & Lahm, 2002; Corn & Wall, 2002; Edwards & Lewis, 1998; Kapperman, et al., 2002; Thurlow, et al., 2007). The Assistive Technology for Students with Visual Impairment (ATSVI) teacher survey was developed by using these existing surveys as models. A copy of the ATSVI survey is found in Appendix A. This study utilized an electronic format to deliver the scale to the participants.

### **Participants**

Before the ATSVI survey was administered, permission was obtained from the University of Louisville Institutional Review Board (IRB). This involved the submission of the proposed study's purpose, choice of participants/subjects, and methodology to the IRB.

The population of this study included all teachers of the visually impaired in the state of Kentucky. The Professional Standards Board of Kentucky endorses teachers to teach students with visual impairments. After fulfilling educational, testing and practicum requirements in the field of educating students with visual impairments,

teachers receive endorsements on their previously earned, non-TVI teaching certificate (16 KAR 4:020 (2010),).

A list of teachers obtained from the Kentucky School for the Blind's Outreach Department included the names and email addresses of current active teachers of the visually impaired (TVIs) in Kentucky. The list represented a full range of VI education delivery models including residential, resource room (a room set aside for VI students to spend part or most of their day), itinerant and collaboration/consulting. Because the population of TVIs in the Commonwealth of Kentucky is relatively small (n=120) and contact information was available for all of these teachers, the study's sample comprised the entire population.

### **Procedures**

After content validity was addressed and the pilot study was completed, e-mails containing a link to the survey were sent to a list of teachers of the visually impaired in the Commonwealth of Kentucky obtained from the Kentucky School for the Blind outreach center (See Appendix B, Survey Cover Letter). Teachers were asked to click on the link and, after granting consent, complete the short questionnaire comprised of either number entry text boxes or multiple-choice check boxes. Some questions gave the opportunity for entering comments in addition to checking boxes. When the respondent completed the questionnaire, they were asked to click on the submit button which sent the resulting data online to the *Survey Monkey*<sup>™</sup> server. A list of teachers not responding was generated anonymously, and after a period a follow-up email was automatically sent by *Survey Monkey*<sup>™</sup> (Finley, 1999). Completed surveys were stored on the *Survey*

*Monkey*<sup>TM</sup> server. These data were tabulated and downloaded to a format readable by SPSS version 13 for analysis (Landau & Everitt, 2004).

### **Non-response**

Non-response introduces considerable error in survey research (Groves, Dillman, Eltinge, & Little, 2002). In order to increase survey response, Dillman recommends establishing trust with the survey recipient. Among the recommendations is to make the task appear important (Dillman, 2000). The email cover letter accompanying this study's AT on-line survey invitation attempted to stress the importance of the survey by emphasizing the role of understanding assistive technology use in improving education for students with visual impairments (See Appendix B, Survey Cover Letter).

For a higher response rate, Dillman also recommends linking social exchange elements to the survey (2000). The ATSVI survey invitation letter emphasized the low personal cost in time the survey would take. By explaining how important their work is to the students they care so much about, and emphasizing personal connections with this investigator and others in the small field of teaching visually impaired students, the contact letter attempted to use a sense of camaraderie to increase response rates.

According to Dillman, without follow-up contacts, "response rate will usually be 20-40 percentage points lower" (2000). Therefore, two weeks after the first survey was sent, a follow-up reminder email was sent with links to the online survey (See Appendix C, Follow up Letter). These emails were sent only to those whose surveys had not been received by using a *Survey Monkey*<sup>TM</sup> feature that keeps track of respondents anonymously and sends a reminder to those of the original mailing who have not responded.

Vehovar, Batagelj, Manfreda, and Zaletel (2002) have found a relatively lower rate of response to web surveys than traditional surveys, possibly due to low population penetration and inadequate technological support. For this study, dissemination to the subject population was achieved by sending emails to all teachers listed on the Kentucky School for the Blind Outreach Department’s directory of current TVIs. Since email addresses that were listed in the directory were the teachers’ preferred contacts, support for computer technology was assumed. However, despite publication in the directory, some emails were returned (bounced), indicating incorrect addresses.

**Data analysis**

The data were compiled and analyzed using the Statistics Package for Social Sciences (SPSS) version 13. Initially, tabulations of the number and percentage of responses to demographic questions were conducted. Second, analysis of the data for each research questions was conducted. Table 3 shows which specific ATSVI survey questions were used to gather data for each of this study’s research questions.

Additionally, the Table 4 shows how the data were analyzed.

Table 4

*Research Questions – Data Analysis Matrix*

<b>Research Question</b>	<b>Data Analysis</b>
<p><b>Research Question 1</b>            To what extent are Kentucky students with visual impairments using low and high tech assistive technology devices?</p>	<p>As reported by teachers, the sum of students using low-tech assistive technology was calculated. Additionally, the sum of students using high-tech assistive technology was calculated. Percentages of low and high tech use were then calculated by comparing these numbers with the total number of students with determined primary learning modes.</p>

Table 4 *Research Questions – Data Analysis Matrix* Continued

**Research Question 2**

How have Kentucky teachers of visually impaired students received training in the area of assistive technology, and which methods of AT training do they prefer?

The number of teachers responding to the survey will be the denominator in the ratio of teachers receiving training. The sum of numbers from all respondents to each training-type category listed in question twenty-six will be the nominator of the ratio of teachers that have received that type training. All ratios will be converted to percentages.

Respondents ranked their preferred method of receiving AT training on a Likert-type scale of 1 – 5. The mean for each training-type preference was calculated to determine its rank order.

**Research Question 3**

In what areas of assistive technology, and to what extent in those areas have Kentucky teachers of the visually impaired received training?

The ratio of the sum of each device teachers indicated they received training in to the total number of respondents was calculated to produce percentages. Likewise, the ratio of the sum of each device teachers indicated they would like to receive training in to the total number of respondents was calculated to produce percentages.

**Research Question 4**

What is the correlation between general and specific high-tech assistive technologies used by students with visual impairments and the extent of specific high-tech assistive technologies training received by their teachers?

The sum of specific devices reported to be used was tabulated. The sum of teachers reported to have received training in each device was tabulated. These numbers were examined for correlation.

Table 4 *Research Questions – Data Analysis Matrix* Continued

**Research Question 5**

What is the correlation between the size of the district in which the teacher is employed, the teacher's years of experience, caseload size, level of education and the extent of their students' assistive technology use?

Using data gathered from questions six, ten, thirteen, sixteen, nineteen, twenty-two and twenty-five, for each respondent a ratio was calculated, in percentage, of students using low-tech AT. Likewise, for each respondent a ratio was calculated, in percentage, of students using high-tech AT.

Data from question one were coded. The number one represented the smallest district category, two the middle sized districts and three the large district category. The correlation of the ratio of AT use by category will be examined.

Likewise, data from questions two, three, four and five was coded from the lowest to highest category indicated in each question. Then for each question, the correlation of the ratio of AT use by category was examined.

To determine significant difference in use of AT according to service delivery model (question seven), the percentage of students using AT for each teacher was considered a score represented by a corresponding interval number between zero and one-hundred. Group means between service delivery groups were then be compared through the use of factorial ANOVA analysis.

**Research Question 6**

What funding sources are used to provide assistive technology to Kentucky students with visual impairments?

Using data gathered from question thirty, percentages were calculated to determine the rank order of funding sources.

Table 4 *Research Questions – Data Analysis Matrix* Continued

**Research Question 7**

Are there differences in the extent of specific assistive technology use as determined by the student's educational placement or primary learning media?

For each respondent, the total number of VI students they serve was calculated from data gathered by question six. A record was generated for each student indicating primary learning media category (questions eight, fourteen and nineteen). Each record was scored one for low-tech use, or zero for low-tech non-use (questions ten, sixteen, and twenty-two). Likewise, each record was scored one for high-tech use, or zero for high-tech non-use. (For example, if a teacher indicates he/she has six students, six records were generated. If he/she indicated three students are visual learners, three of the records were placed in that category. If he/she indicated two of the visual learners were using high-tech AT, two of those records were marked with a score of one for high-tech AT use and one of the records were scored a zero.)

An ANOVA test for significant difference in group means was conducted to determine if there were differences in AT use between primary learning media categories of students. Additionally, an ANOVA test for significant difference in group means were conducted to determine if there were differences in AT use between placement categories of students.

## **CHAPTER IV**

### **Results**

The purpose of this chapter is to report results of the data collection. An overview of research components (the independent and dependent variables, and correlates) and validity and reliability of the survey instrument are first discussed. Next, the sample and demographic information are provided. The chapter concludes with an analysis of data aligned to each research question.

#### **Overview of Research Components**

The use of assistive technology (AT) is vital for students with visual impairments accessing the curriculum. Visual disabilities range from low-vision, which allows for some degree of functional vision, to total blindness. Assistive technologies vary accordingly. For some students with low-vision, special lighting, magnifiers or large print text serve as technologies that make the curriculum accessible. For students with blindness, tactile braille, audio books and computers with speech output are examples of AT that help make the curriculum accessible. Despite the availability of both low and high-tech assistive technologies, many students are not using AT.

A review of the literature suggested that nearly half of students with visual impairments were not using assistive technology (Abner & Lahm, 2002; Corn & Wall, 2002; Edwards & Lewis, 1998; Kapperman, Sticken, & Heinze, 2002; Kelly, 2008; Thurlow, Johnstone, Timmons, & Altman, 2007). The reasons for the apparent low use

of AT by students with visual impairments could vary. It was the purpose of this study to examine factors that may be related to the extent of AT use by these students.

Although law requires consideration of assistive technology by the student's individual planning committee (P.L. 105-17), a review of the literature reveals that other factors may be related to the extent of AT use. Some factors investigated included: teacher training (Abner & Lahm, 2002; Alves, Montiero, Rabello, Gasparetto, & Carvalho, 2009; Bauder, 1999; Derer, Polsgrove, & Rieth, 1996; Kapperman, et al., 2002; Maushak, Kelley, & Blodgett, 2001; Smith & Kelley, 2007), teacher years of experience (Argyropoulos, et al., 2008; Farnsworth & Luckner, 2008; Rao, 2006; Thurlow, et al., 2007), teacher caseload size (Edwards & Lewis, 1998; Thurlow, et al., 2007), student primary learning media (Abner & Lahm, 2002; Corn & Wall, 2002; Edwards & Lewis, 1998; Kapperman, et al., 2002; Kelly, 2008; Livingston-White, et al., 1985; Parker, et al., 1990; Thurlow, et al., 2007), student educational placement (Edwards & Lewis, 1998; Kapperman, et al., 2002; Kelly, 2008; Livingston-White, et al., 1985; Lohmeier, 2005), and assistive technology funding (Derer, et al., 1996; Parker, et al., 1990). It was the purpose of this investigation to examine these factors as they relate to the extent of assistive technology use by students with visual impairments.

### **Dependent Variable**

The primary dependent variable of this study was the extent of assistive technology use by students with visual impairments. With the ATSVI survey, teachers of the visually impaired (TVIs) provided caseload size numbers and numbers of students using assistive technologies. These numbers were used to create ratios (in percentages) of AT use per number of students taught.

This investigation examined three ratios of AT use. First, the extent of low-tech AT use was compared among independent variables. Next, the extent of high-tech use was compared among independent variables. Finally, the extent of all AT use was compared among independent variables.

### **Independent Variables**

The ATSVI survey also collected teacher and student attribute data. The review of the literature guided the selection of factors of AT use serving as independent variables for this study. Teacher attributes comprised the first group of independent variables examined against the dependent variable of the extent of AT use by students with visual impairments. These attributes included years of service, educational attainment level, size of caseload, size of district, type of AT training received, type of AT training desired and extent of AT training.

Student attributes comprised another group of independent variables related to the dependent variable of the extent of AT use. These attributes included student educational placement and student primary learning media.

Student educational placement variables included 1) residential placement (such as the Kentucky School for the Blind), 2) resource room placement (in regular school placement, but in mostly self-contained VI resource rooms) and 3) full inclusion setting groups. The primary learning media student variable comprised of 1) tactile/braille reader, 2) print/large print reader and 3) primarily auditory learner groups.

Sources of funding also served as independent variables in relation to the dependent variable of the extent of AT use. Funding sources reported by the teachers by

the ATSVI survey included state, federal, district, school, foundation, corporate and private sources.

### **Correlates**

This investigation also examined the relationship between factors of assistive technology use by checking correlations between all variables of data collected. These factors included teacher attribute variables, teacher training variables, student attribute variables, AT funding source variables, and the extent of AT use.

### **Specific Assistive Technology Device Use**

The ATSVI survey also gathered specific device use data. Percentages of use by device were calculated. Low-tech AT investigated included items such as optical aids, bold markers, wide-lined paper, braillewriters, the slate and stylus, and the long white cane. High-tech AT investigated included devices such as video magnifiers, electronic whiteboards, digital talking books, talking tools and appliances, computer adaptations, electronic scanners and refreshable braille notetakers.

Teachers listed the AT used by their students by different primary learning media groups. The popularity of device use was then determined by the rank order of percentage of use within those groups.

### **Validity and Reliability of the ATSVI Survey Instrument**

The content validity method for the ATSVI questionnaire used an adaptation of Hambleton's procedure of index of item objective congruence (Hambleton, 1984; Turner, et al., 2002). A panel of experts were given a copy of the questions and asked to rate each for relevance to the goal of the question. A number of -1 was given non-relevance, 0 for

unclear and 1 for relevance. Questions with an average score below .75 were re-evaluated and either eliminated or reworded according to comments, for survey inclusion.

A test-retest procedure was conducted to check the reliability of the ATSVI survey. Teachers of the visually impaired from outside the state of Kentucky were sent an online pilot survey. Later, they received and completed the same survey. From this, an acceptable test-retest r-value coefficient of stability of was calculated. The resulting overall test-retest value was  $r = .780$ .

### **Sample and Demographic Information**

In December of 2010, the investigator invited all current teachers of the visually impaired (TVIs) in Kentucky to participate in the Assistive Technology for Students with Visual Impairments (ATSVI) survey. One hundred and seventeen teachers were emailed a link to the ATSVI questionnaire using the on-line service, *Survey Monkey*™ (Finley, 1999). The email list, obtained from the Kentucky School for the Blind Outreach Department, included the entire population of practicing TVIs in Kentucky.

Fink (1995) recommends setting “eligibility criteria” of sample inclusion . Not all responses were usable for this study according to the investigation’s criteria:

**Inclusion** - Completed surveys by currently teaching certified TVIs in Kentucky.

**Exclusion** - Incomplete surveys and surveys submitted by TVIs not teaching at the time of the survey (e.g. consultants, administrators, etc.).

Eighty-three contacts responded to the email invitations, resulting in a total response rate of 71%. Faulty email addresses accounted for 4 of the non-responses. One responder indicated they were no longer teaching; nine questionnaires were incomplete and unusable, leaving 73 eligible questionnaires from TVIs currently teaching in

Kentucky, resulting in a net response rate of 62%. The ATSVI survey response rates are depicted in Table 5.

Table 5

<i>ATSVI Survey Response</i>	<i>N</i>	<i>%</i>
Surveys sent	117	100
Survey responses	83	71
Completed questionnaires by TVIs Currently Teaching	73	62

The remainder of this chapter presents the results found in this investigation of assistive technology use by students with visual impairments in Kentucky. The results are presented in order, as pertinent to the study’s central research questions.

### **Research Question 1**

To what extent are Kentucky students with visual impairments using low and high tech assistive technology devices?

**Results.** In response to the ATSVI survey, the number of braille, print and auditory learners reported was 673. Teachers reported that 583 (86.6%) students were using low-tech AT and that 423 (62.9%) were using high-tech AT. Table 6 summarizes the overall percentage of low-tech and high-tech AT use by Kentucky students with visual impairments.

Table 6

*Overall Percentage of Low and High Tech AT Use*

	<i>N</i>	<u>Low Tech</u>		<u>High Tech</u>	
		<i>N</i>	%	<i>N</i>	%
VI Students	673	583	86.6	423	62.9

***Low-tech AT use by student using braille.*** Of the 73 complete surveys, 59 TVIs indicated that they worked with students using braille/tactile as their primary learning mode (80.2%). Breakdown by types of low-tech AT used by TVIs with these students showed that the braillewriter was the most used (93.2%). Other low-tech devices used by teachers with their braille/tactile students include non-electronic mobility devices – e.g. the long white cane (76.3%), tactually marked tools and rulers (74.6%), manipulatives (69.5%) and tactile graphics (61%). Least used included adapted daily living tools (25.4%), the slate and stylus (20.3%) and braille keyboard stickers (18.6%). The teachers listed no low-tech AT as “other” on the questionnaire. The percentage of specific low-tech AT use by braille students is shown in Table 7, listed in rank order.

Table 7

*Extent of specific low-tech AT use with braille students*

Technology	Frequency of use by TVI (N=59)	%
Braillewriters	55	93.2
Non-electronic mobility devices	45	76.3
Tactually marked rulers and tools	44	74.6
Manipulatives	41	69.5
Tactile graphics	36	61.0
Daily living adapted tools	15	25.4
Slate and styluses	12	20.3
Braille keyboard stickers	11	18.6
Other	0	0

***High-tech AT use by student using braille.*** Breakdown by types of high-tech AT used by TVIs with braille students showed that talking calculators were used most (71.2%). Other devices include computer screen readers (54.2%), digital file book readers (40.7%), accessible PDA with braille display – otherwise known as braille notetakers (33.9%), braille embossers (32.2%) and electronic brailers (23.7%). Less used high-tech AT included accessible PDAs with voice output only (13.6%), computer scanners with OCR (10.2%), audio description technology (10.2%), talking tactile tablets (8.5%), talking appliances and medical devices (6.8%), talking GPS (6.8%) and talking rulers, measuring tapes and protractors (5.2%). In the open response marked “other,” teachers listed no other high-tech devices for students using braille. The percentage of

specific high-tech AT use by braille students is shown in Table 8, and listed in rank order.

Table 8

*Extent of specific high-tech AT use with braille students*

Type of Technology	Frequency of use by TVI (N=59)	%
Talking calculators	42	71.2
Computer screen readers	32	54.2
Electronic/digital-file book readers	24	40.7
Accessible PDA with braille displays	20	33.9
Braille embossers	19	32.2
Electronic braille	14	23.7
Accessible PDAs with voice output only	8	13.6
Computer scanners with OCR	6	10.2
Audio description technologies	6	10.2
Talking tactile tablets	5	8.5
Talking appliances, kitchen and medical devices	4	6.8
Talking GPS technologies	4	6.8
Talking rulers, measuring tapes, protractors, scales, color identifiers	3	5.1
Electronic cane (sonar/laser canes)	0	0
Other	0	0

*Low-tech AT use by print/large- print students.* Of the 73 complete surveys, 69

TVIs indicated that they worked with students using print/large-print as their primary

learning medium (94.5%). The breakdown of types of low-tech AT used by TVIs with these students showed that large print (88.4%) and optical aids (87%) were used the most. Other low-tech devices used by teachers with print/large-print students included: wide lined paper (73.9%), bold markers (71%), keyboard stickers (40.6%), copy stands (39.1%), white boards with erasable markers (36.2%) and adjustable lighting (33.3%). Less used were large print or tactually marked kitchen appliances (13%) and other low-tech AT (1.4%). The percentages of specific low-tech AT use by print/large print students is shown in Table 9, and are listed in rank order.

Table 9

*Extent of specific low-tech AT use with print/large-print students*

Type of technology	Frequency of use by TVI (N=69)	%
Large print media	61	88.4
Optical aids (e.g. magnifier, monocular)	60	87.0
Wide lined paper	51	73.9
Bold markers	49	71.0
High contrast keyboard stickers	28	40.6
Copy stands	27	39.1
White board with erasable markers	25	36.2
Adjustable lighting	23	33.3
Large print or tactually marked kitchen tools and appliances	9	13.0
Other	1	1.4

*High-tech AT use by print/large-print students.* The high-tech AT used most by TVIs with their print/large-print students were the talking or large display calculator (72.5%). Other high-tech AT used by teachers with their print/large-print students included: computer screen enlargers (63.8%), electronic/digital-file book readers (60.9%) and electronic whiteboards (37.7%). Less used were scanning technologies (8.7%) and talking measuring device or tools (4.3%). The teachers listed no other high-tech low-vision devices used by print/large-print learners on the questionnaire. The percentage of specific high-tech AT use by print/large print students is shown in Table 10, and listed in rank order.

Table 10

*Extent of specific high-tech AT use with print/large-print students*

Type of technology	Frequency of use by TVI (N=69)	%
Talking or large display calculators	50	72.5
Computer screen enlargers	44	63.8
Electronic/digital-file book readers	42	60.9
Video magnifiers (e.g. CCTV)	41	59.4
Electronic white boards (e.g. Smart-board)	26	37.7
Hand held electronic magnifiers	13	18.8
Scanning technologies (e.g. Kurzweil 1000)	6	8.7
Talking measuring device or tools	3	4.3
Other	0	0%

*Low-tech AT use by auditory learners.* Thirty-one teachers indicated that they worked with students whose primary learning modes were auditory. With these students, the teachers reported manipulatives to be the most used low-tech assistive technology (90.3%). Also used were large print or tactually marked rulers, tools and appliances (38.7%), whiteboards (29.9%), adaptive living aids (19.4%), and optical aids (16.1%). Additionally, teachers indicated the use of tactile graphics (12.9%), non-electronic mobility device such as the long white cane (12.9%), keyboard stickers (9.7%) and large print media (6.5%). The teachers did not report other low-tech AT devices used by their auditory learners. The percentages of specific low-tech AT use by auditory-learning students are shown in Table 11, and are listed in rank order.

Table 11

*Extent of specific low-tech AT use with auditory learners*

Type of technology	Frequency of use by TVI (N=31)	%
Manipulatives	28	90.3
Large print or tactually marked rulers, tools and appliances	12	38.7
White board with erasable markers	9	29.9
Adaptive daily living aids	6	19.4
Optical aids	5	16.1
Tactile graphics	4	12.9
Non-electronic mobility devices (e.g. long white cane)	4	12.9
Keyboard stickers	3	9.7

Table 11 *Extent of specific low-tech AT use with auditory learners* Continued

Large print media	2	6.5
Other	0	0

***High-tech AT use by auditory learners.*** Teachers reported using electronic audio books with 32.3% of their auditory learners. Also used were talking or large display calculators (29%), screen magnification software (16.1%), alternate keyboards (12.9%), switches (12.9%), video magnifiers (9.7%) and computer screen readers (9.7%). Less used were hand-held electronic magnifiers (3.2%) and audio description technologies (3.2%). Six and four tenths percent of respondents listed “other” high-tech assistive technologies. The percentages of specific high-tech AT use by auditory-learning students are shown in Table 12, and are listed in rank order.

Table 12

*Extent of specific high-tech AT use with auditory learners*

Types of technology	Frequency of use by TVI (N=31)	%
Electronic audio books	10	32.3
Talking or large display calculators	9	29.0
Screen magnification software	5	16.1
Alternate keyboards	4	12.9
Electronic switch technologies	4	12.9
Video magnifiers (e.g. CCTV)	3	9.7
Computer screen readers	3	9.7

Table 12 *Extent of specific high-tech AT use with auditory learners* Continued

Hand held electronic magnifiers	1	3.2
Audio description technologies	1	3.2
Other	2	6.4

**Research Question 2**

How have Kentucky teachers of visually impaired students received training in the area of assistive technology, and which methods of AT training do they prefer?

**Results.** ATSVI respondents checked *AT workshops, professional development (PD) or vendor presentations* as the most common method of AT training (80.8%). Self-study was identified by 65.8% of teachers as a method of learning specific assistive technologies. Other modes of training included college/university classes (58.9%) and specialist support (43.8%). The least used method of receiving training was through on-line webinars (16.4%). Table 13 shows the frequency and percentage of methods used by TVIs for AT training.

Table 13

*Method of AT training received by TVIs*

Training Method	TVI (N=73) <i>frequency</i>	%
AT workshops, professional development or vendor presentations	59	80.8
Self study; use of manuals and tutorials	48	65.8
College/university classes	43	58.9
Individual support by specialist	32	43.8
Webinars	12	16.4

On a 5-point Likert-type scale, teachers ranked most to least preferred method of receiving AT training. The choice: *AT workshops, PD or vendor presentations* was ranked highest with a mean score of 3.98. Webinars ranked next ( $M=3.60$ ), followed by self-study ( $M=3.35$ ), specialist support ( $M=1.84$ ) and college/university classes ( $M=1.7$ ). The mean scores for TVIs' preferred method of training is shown in Table 14.

Table 14

*Method of AT training preferred*

Training Method	<i>Mean</i> (5-pt. scale)
AT workshops, professional development or vendor presentations	3.98
Webinars	3.60
Self study; use of manuals and tutorials	3.35
Individual support by specialist	1.84
College/University classes	1.70

**Research Question 3**

In what areas of assistive technology, and to what extent in those areas have Kentucky teachers of the visually impaired received training?

**Results.** Teachers indicated the top three areas of training received were video magnifiers (68.5%), computer screen readers (67.1%) and electronic/digital-file book readers (61.6%). The least three areas indicated by teachers included audio description (15.1%), electronic mobility devices (15.1%) and talking measuring devices, kitchen tools, appliances or medical devices (13.7%).

The highest areas of training needs indicated by TVIs included electronic/digital-file book readers (43.8%), accessible PDA with a braille display (41.1%) and electronic

whiteboard technologies such as the Smartboard (39.7%). Least indicated training needs were in the areas of video magnifiers (15.1%), talking measuring devices, kitchen tools, appliances or medical devices (9.6%) and talking or large display calculators (9.6%).

Table 15 shows the frequency and percentage of AT training areas received and AT training areas desired.

Table 15

*Areas of AT training received and desired by TVIs*

Training Area	<u>Training received</u>		<u>Training desired</u>	
	TVI <i>frequency</i>	%	TVI <i>frequency</i>	%
Electronic/digital-file book reader	45	61.6	32	43.8
Accessible PDA with a braille display	35	47.9	30	41.1
Electronic whiteboard technologies (e.g. Smartboard)	30	41.1	29	39.7
Computer screen reader	49	67.1	24	32.9
Computer screen reader w/magnification	37	50.7	22	30.1
Accessible PDA with speech only	33	45.2	21	28.8
Braille/tactile media production	30	41.1	21	28.8
Talking tactile tablet for diagrams, graphs, etc.	17	23.3	20	27.4
Scanning with optical character recognition	31	42.5	18	24.7
Electronic mobility device (e.g. GPS device)	11	15.1	18	24.7
Electronic braille	27	37.0	13	17.8

Table 15 *Areas of AT training received and desired by TVIs* Continued

Audio description	11	15.1	12	16.4
Video magnifier	50	68.5	11	15.1
Talking or large display calculator	38	52.1	7	9.6
Talking measuring devices, kitchen tools, appliances or medical devices	10	13.7	7	9.6
Other (Apple products accessibility)	1	1.4	n/a	n/a

*Note.*  $N = 75$

Table 16 shows the difference/gap of percentages between AT training areas received and AT areas desired.

Table 16

*Gap between training received and training desired*

Training Area	Percent desired	Percent received	Percent difference
Electronic/digital-file book reader	43.8	61.6	-17.8
Accessible PDA with a braille display	41.1	47.9	-6.8
Electronic whiteboard technologies	39.7	41.1	-1.4
Computer screen reader	32.9	67.1	-34.2
Computer screen reader w/magnification	30.1	50.7	-20.6
Accessible PDA with speech only	28.8	45.2	-16.4
Braille/tactile media production	28.8	41.1	-12.3
Talking tactile tablet for diagrams, graphs, etc.	27.4	23.3	4.1
Scanning with optical character recognition	24.7	42.5	-17.8
Electronic mobility device (e.g. GPS device)	24.7	15.1	9.6
Electronic brailler	17.8	37.0	-19.2

Table 16 *Gap between training received and training desired* Continued

Audio description (e.g. audio described movies)	16.4	15.1	1.3
Video magnifier	15.1	68.5	-53.4
Talking measuring devices, kitchen tools, appliances or medical devices	9.6	52.1	-42.5
Talking or large display calculator	9.6	13.7	-4.1

#### **Research Question 4**

What is the correlation between high-tech assistive technologies used by students with visual impairments and the extent of high-tech assistive technologies training received by their teachers?

**Results.** The percentage of high-tech use by TVIs was compared to the number of training areas as indicated by the TVIs. Using SPSS (Landau & Everitt, 2004), a two-tailed Pearson correlation test was conducted (Shavelson, 1996). Overall, training in more areas of assistive technology by teachers of the visually impaired was significantly correlated with high-tech AT use [ $r(73) = .237, p = .04$ ]. There were no significant correlations between specific assistive technology trainings and the use of those specific technologies. Table 17 presents the correlation and significance between specific areas of TVI training and the use of those assistive technologies by their students.

Table 17

*Correlation between specific areas of TVI training and the extent of their use*

Specific AT Training and Use	<i>r</i>	<i>p</i>
Video magnifier	.193	.102
Computer screen reader	.186	.116
Electronic/digital-file book reader	.168	.156
Talking or large display calculator	.018	.878
Computer screen reader w/magnification*	.207	.079*
Accessible PDA with a braille display	.148	.211
Accessible PDA with speech only	-.142	.229
Scanning with optical character recognition*	.217	.065*
Braille/tactile media production	-.090	.448
Electronic whiteboard technologies (e.g. Smartboard)	.167	.157
Electronic braille	-.134	.258
Talking tactile tablet for diagrams, graphs, etc.	-.090	.451
Audio description (e.g. audio described movies)	-.007	.952
Electronic mobility device (e.g. GPS device)	-.101	.939
Talking measuring devices, kitchen tools, appliances or medical devices	.006	.963

*Note. N = 73*

\*  $p < .10$

## Research Question 5

What is the correlation between the size of the district in which the teacher is employed, the teacher's years of experience, caseload size, level of education and the extent of their students' assistive technology use?

**Results.** Using SPSS version 13, the measures of the teacher attributes were tested for Pearson correlations checking for significance set at the .05 level (Landau & Everitt, 2004). The mean percentage of teacher's students using high-tech AT was 67.87. Table 18 shows descriptive statistics of teacher's attributes.

Table 18

### *Descriptive statistics of teacher attributes*

Teacher Attributes	Mean	SD	N
Percent of students using high-tech AT	67.87	30.50	73
District size	1.88	1.12	73
Experience	3.01	.95	73
Number of braille, print and auditory learners	9.22	5.56	73
College degree	2.05	.37	73
Rank	1.34	.61	73

*Note.* District sizes: 1 = less than 5000 students, 2 = 5000 to 20,000 students, 3 = greater than 20,000 students. Experience: 1 = less than 3 years, 2 = 4 to 7 years, 3 = 8 to 15 years, 4 = more than 15 years. College degree: 1 = bachelors 2 = masters 3 = specialist or doctorate.

Fifty-one percent of the teachers surveyed worked in districts with less than 5,000 students. Twenty-nine percent worked in districts with between 5,000 and 20,000 students. Twenty percent worked in districts with more than 20,000 students. Using less

than 5,000 students in a district as band one, 5,000 – 20,000 students as band two, and over 20,000 students as band three, the mean teacher’s district size was 1.88. This indicated that the average district size in which TVIs in Kentucky teach was less than 5,000 students. Table 19 shows the frequency and percentage of TVIs’ district sizes. The extent of AT use by teachers with their students showed no significant correlation with the size of the teachers’ district at the .05 level [ $r(73) = -.110, p = .35$ ].

Table 19

*District sizes of Kentucky TVIs*

District Size	TVI(N=73)	
	Frequency	%
< 5,000 students	37	50.7
5,000 – 20,000 students	21	28.8
> 20,000 students	15	20.5

On average, the highest degree obtained by Kentucky TVIs was a masters level degree. Using teacher’s rankings (1-3), the average ranking of TVIs was high at 1.34. Table 20 shows the frequency and percentage of TVIs’ highest degree obtained.

Table 20

*TVI Highest degree obtained*

Degree	TVI(N=73)	
	Frequency	%
Bachelors	3	4.1
Masters	63	86.3
Specialist or Doctorate	7	9.6

Table 21 shows the frequency and percentage of TVIs' certification rank. The data indicate that the majority of teachers earned a Rank 1.

Table 21

*Teacher ranking of Kentucky TVIs*

Rank	TVI (N=73)	
	<i>Frequency</i>	<i>%</i>
Rank 1	44	60.3
Rank 2	24	32.9
Rank 3	5	6.8

The years of experience reported by TVIs in Kentucky are shown in Table 22. Teachers' years of experience and the extent of high-tech AT use with their students were not significantly correlated. Neither were the district size of the teachers and the extent of high-tech AT use with their students. Additionally teachers' rank or college degree obtained and the extent of their students' high-tech AT use were not significantly correlated.

Table 22

*Years of experience of Kentucky TVIs*

Years of Experience	TVI (N=73)	
	<i>Frequency</i>	<i>%</i>
Less than 3 years	5	6.8
4 to 7 years	17	23.3
8 to 15 years	23	31.5
More than 15 years	28	38.4

However, a significant correlation was found between the teacher rank and level of college degree obtained [ $r(73) = -.46, p = .00$ ]. Additionally, the size of the district and

years of experience was also significantly correlated [ $r(73) = .26, p = .02$ ], indicating the presence of more experienced teachers in larger districts. The correlations of high-tech use, rank, degree obtained, district size and years of experience are shown in Table 23.

The teacher's number of students and the percentage of that teacher's students using high-tech AT was significantly correlated [ $r(72) = -.26, p = .02$ ]. Teachers who were responsible for smaller numbers of students used significantly more high-tech AT with those students.

Table 23

*Teacher attributes and percentage of student high-tech use correlation*

Measure	1.	2.	3.	4.	5.	6.
1. High-tech use %	1					
2. District size	-.110	1				
3. Years of experience	-.071	2.63*	1			
4. Number of students	-.264*	.108	.150	1		
5. College degree	.183	.017	.117	.028	1	
6. Rank	-.150	-.142	-.129	-.043	-.458**	1

*Note.* \*Correlation is significant at the .05 level. \*\* Correlation is significant at the .01 level

**Research Question 6**

What funding sources are used to provide assistive technology to Kentucky students with visual impairments?

**Results.** The respondents were asked to provide an approximate percentage of funding sources used for their students' AT. They were given the options of 1)

local/district 2) state/federal 3) foundations 4) corporate/business donations 5) private donations and 6) other. Of the 72 TVIs responding to the ATSVI survey, 36 knew the source of AT funding for their district(s). Of those 36 respondents, local/district received the highest mean percentage as a source of AT funding ( $M = 59.39$ ,  $SD=38.39$ ). State and federal funding received the next highest mean percentage ( $M = 21.25$ ,  $SD = 27.91$ ). Foundations received the third highest mean percentage ( $M = 11.72$ ,  $SD = 27.78$ ) while corporate/business donations ( $M = 3.06$ ,  $SD = 11.60$ ) and private donations ( $M = 3.19$ ,  $SD = 13.10$ ) both received similar means as marked by the TVIs. The least mean percentage of sources marked was other ( $M = 1.39$ ,  $SD = 5.56$ ). Table 24 shows maximum and mean percentages of AT funding and standard deviation by sources.

Table 24

*Descriptive statistics of percentage of AT funding sources reported by TVIs*

Funding Source	<i>N</i>	<i>Maximum Percentage</i>	<i>Percentage Mean</i>	<i>Standard Deviation</i>
Local school/district	35	100	59.39	38.389
State and federal funding	35	100	21.25	27.912
Foundation grants	35	90	11.72	27.778
Corporate/business grants	35	50	3.06	11.605
Private donations	35	75	3.19	13.101
Other	35	30	1.39	5.556

Using SPSS version 13 (Landau & Everitt, 2004), one-way ANOVA tests were conducted to examine differences in the means of percentages of funding sources between models of service delivery groups (Shavelson, 1996). An overall significant difference was found in the amount of foundation grants received in residential and

itinerant teaching models [ $F(2, 32) = 17.330, p = .000$ ]. Table 25 shows significance group means between funding sources by service model groups.

Table 25

*ANOVA results for difference in source of funding means between service delivery groups*

Source	$F(2, 32)$	Sig.
School/district sources	2.264	.120
State/federal sources	1.665	.205
Foundation grants	17.330	.000*
Corporate gifts	1.943	.160
Private gifts	.454	.639

*Note.* \*significant at the .05 level

A post hoc analysis utilizing Tukey's HSD post hoc test (Shavelson, 1996) revealed that the sources of variances can mainly be attributed to the differences between the means of the residential group versus the resource room group ( $p=.001$ ) and the residential group versus the itinerant group ( $p=.000$ ). There was not a significant difference between the resource room group and the itinerant group ( $p=.889$ ). The results of the Tukey's HSD post hoc test are shown in Table 26. The ANOVA tests found no other significant mean differences in funding sources between service delivery model groups at the .05 level.

Table 26

*Tukey's HSD post hoc test for significant difference in percentage of foundation source means between service delivery groups*

Model	Model	Mean difference	<i>p</i>
Residential	Resource room	58.250	.001*
	Itinerant	63.393	.000*
Resource room	Residential	-58.250	.001*
	Itinerant	5.143	.878
Itinerant	Residential	-63.393	.000*
	Resource room	-5.143	.878

*Note.* \*significant at the .05 level

### Research Question 7

Are there differences in the extent of low and high-tech AT use as determined by the student's primary learning media or educational placement?

**Results.** A data record was created for each student anonymously reported on by the respondents. Records were created for 673 students who used braille, print/large print, or audio as their primary learning medium (PLM). It was found that the largest group of students used print/large print as their PLM ( $f = 471, 70\%$ ). Braille learners represented the next largest group ( $f = 123, 18.3\%$ ) and auditory learners comprised the smallest group ( $f = 79, 11.7\%$ ). The frequency and percentages of students by primary learning media is shown in Table 27.

Table 27

*Primary Learning Media by Students*

Primary Learning Media	Frequency	%
Print/large-print	471	70.0
Braille/tactile	123	18.3
Auditory	79	11.7
Total	673	100

Examining the extent of low-tech AT and high-tech AT use by PLM found that 86% of print/large-print users were reported to use low-tech AT ( $f = 407$ ) and 65% used high-tech AT ( $f = 304$ ). Of the braille readers, 91% ( $f = 112$ ) used low-tech AT and 64% used high-tech AT. Of the auditory learners, 81% ( $f = 64$ ) used low-tech AT and 51% ( $f = 40$ ) used high-tech AT. The frequencies and percentages of low-tech and high-tech AT use by student reading mode are shown in Table 28.

Table 28

*Percentages of low-tech and high-tech AT use by PLM groups*

Primary Learning Media	<u>Low Tech AT</u>		<u>High-tech AT</u>	
	Frequency	%	Frequency	%
Print/large print (N=471)	407	86	304	65
Braille (N=123)	112	91	79	64
Auditory (N=79)	64	81	40	51

Low and high-tech use for each student record was coded using 0 for non-use and 1 for use and entered into SPSS (Landau & Everitt, 2004). A one-way ANOVA test was conducted for significant mean differences in the use of low-tech AT between braille,

print/large-print and auditory learning groups at the .05 level (Shavelson, 1996). The frequency and means of low-tech and high-tech AT use are shown in Table 29.

Table 29

*PLM group means for low and high-tech use.*

Primary Learning Media	<u>Low tech use</u>		<u>High-tech AT use</u>	
	<i>Frequency</i>	<i>M</i>	<i>Frequency</i>	<i>M</i>
Print/large print	407	.86	304	.65
Braille	112	.91	79	.64
Audio	64	.81	40	.51

No significant difference in group means were found [ $F(2, 670) = 2.130, p = .120$ ]. Similarly, a one-way ANOVA test was conducted for significant mean differences in the use of high-tech AT between braille, print/large-print and auditory learning groups at the .05 level. No significant difference in group means were found [ $F(2, 670) = 2.876, p = .057$ ] at the .05 level, though marginal significance was found at the .10 level. Table 30 shows significance of group means of low-tech and high-tech AT use between primary learning media groups.

Table 30

*ANOVA results for difference of low-tech and high-tech means between PLM groups*

<u>Assistive technology type</u>	<u><i>F(2,670)</i></u>	<u><i>Sig.</i></u>
Low-tech	2.130	.120
High-tech	2.876	.057

*Note.* No significant difference of group means at the .05 level.

Of the 673 students reported on in this study, 625 (92.9%) were receiving services in non-residential settings. Forty-eight (7.1%) of the sampled students were placed in a

residential setting. Table 31 shows the frequency and percentage of students placed in residential and non-residential settings.

Table 31

*Educational placement of students*

Placement	Frequency	%
residential	48	7.1
non-residential	625	92.9
total	673	100

A higher percentage of students placed in the residential setting vs. the non-residential settings used assistive technology. Of the residential students, 98% used low-tech AT compared to 62% of non-residential students who were reported to be using low-tech AT. As for high-tech AT use, 73% of residential students were reported to be using high-tech AT, compared to 62% of the non-residential group. Table 32 presents the frequency and percentage of low-tech and high-tech AT use by residential and non-residential students.

Table 32

*Percentages of low-tech and high-tech AT use by educational placement groups*

Primary learning media	<u>Low-tech AT</u>		<u>High-tech AT</u>	
	<i>frequency</i>	<i>%</i>	<i>frequency</i>	<i>%</i>
residential (N=48)	47	98	35	73
Non-residential (N=625)	537	86	388	62

Using SPSS (Landau & Everitt, 2004), one-way ANOVA tests were conducted to determine if the difference in placement group means of AT use were significant (Shavelson, 1996). The difference in group means of low-tech AT use between the

residential and non-residential students was shown to be significant at the .05 level [ $F(1,671) = 5.718, p = .017$ ]. The difference in group means of high-tech AT use between the residential and non-residential students was not shown to be significant at the .05 level [ $F(1,671) = 2.243, p = .135$ ]. Because the group sizes were so dissimilar (residential  $N = 48$ , non-residential  $N = 625$ ), caution should be taken interpreting these results. Table 33 shows the significance of group mean difference of low-tech and high-tech AT use by residential and non-residential groups.

Table 33

*ANOVA results for difference of low and high-tech means between placement groups*

Type of assistive Technology	$F(1,671)$	<i>Sig.</i>
Low-tech	5.718	.017*
High-tech	2.243	.135

*Note:* \*significant at the .05 level

## **CHAPTER V**

### **Discussion**

This chapter begins with an overview of the study purpose, population and methodology. Discussion, conclusions and implications for practice follow the summary of results for each question. The chapter concludes with an examination of the study's limitations and suggestions for further research.

### **Overview**

Visual impairments can negatively affect a student's ability to access the school curriculum. Appropriate adaptations and assistive technologies can help students with visual impairments, ranging from low-vision to no vision, access reading, writing, math, science, social science, the arts, daily living, and orientation and mobility. Research has demonstrated that many students with visual impairments are not benefiting from the use of assistive technologies (Abner & Lahm, 2002; Corn & Wall, 2002; Edwards & Lewis, 1998; Kapperman, et al., 2002; Kelly, 2008; Land, 1998; Livingston-White, et al., 1985; Parker, et al., 1990; A. J. Smith, et al., 2004; Thurlow, et al., 2007; Uslan, 1992).

The purpose of this study was to seek a better understanding of the various factors related to the extent of assistive technology use by students with visual impairments. Factors studied included teacher demographics, teacher training, and student characteristics. Correlates were identified which may lead to a better understanding of why there is not a greater extent of assistive technology use by students with visual

impairments. The results of the Assistive Technology for Students with Visual Impairments (ATSVI) survey is related to this study's seven research questions.

Question 1 was to determine the extent of assistive technology (AT) use by students with visual impairments. This included assessing the extent of general low-tech and high-tech AT use, as well as the extent of specific technologies used by these students. The second, third and fourth questions were to determine the types of AT training both received and desired by teachers of the visually impaired (TVIs) and the relationship of training with the extent of assistive technology use. Question 5 was to determine the relationship between demographic characteristics of TVI's and the extent to which their students used AT, while the sixth and seventh questions were to determine the relationship between student characteristics and the extent to which they used assistive technologies.

### **General procedures**

In December of 2010, the ATSVI survey was sent via the online service, *Survey Monkey™* (Finley, 1999) to all currently teaching TVI's in the state of Kentucky. Data were gathered about teacher demographics, teacher training, student characteristics and specific low-tech and high-tech assistive technology being used in the classroom.

After tabulation, variable percentages were calculated. Then data variables were tested for correlation, and group means were tested for significance using *SPSS ver. 13* (Landau & Everitt, 2004). Results are presented in chapter four and discussed below as they relate to each of the study's guiding questions.

## **Research Question 1**

To what extent are Kentucky students with visual impairments using low and high tech assistive technology devices?

**Research question 1 results summary and discussion.** Responding to a survey of teachers of the visually impaired (TVIs) in Kentucky, seventy-three teachers provided data about assistive technologies (AT) they use with their students. AT data were collected for 673 students. Of these students, 87% were reported to be using low-tech AT and 63% were reported to be using high-tech AT.

There are many factors contributing to the acceptance of new technologies, including perceived usefulness and ease of use (Davis, 1989). The TAM2 model of technology acceptance includes job relevance, experience, intention, usage behavior and time as factors (Legris, Ingham, & Collette, 2003). Of these factors, Sharpe reported that teachers that used AT most perceived its usefulness and value. They also felt that time constraints and lack of training contributed to AT disuse (Sharpe, 2010). The ATSVI survey investigated the AT use factors of training and teacher experience, and in addition, other factors including caseload size, district size, AT funding sources and student characteristics.

In 2002, Kapperman, et al. reported that less than half of students with visual impairments used high-tech AT (Kapperman, et al., 2002). Additionally, Abner and Lahm published a study of AT use by VI students in Kentucky in 2002. They found “303 of 605 (50%) VI students used high-tech computers” (p. 101). Furthermore, in a study examining the results of the Special Elementary Longitudinal Study (SEELS), Kelly concluded that less than half of VI students were utilizing high-tech assistive technology

(Kelly, 2008). In comparison, the ATSVI Kentucky survey found a slightly higher use of high-tech AT (63%).

The ATSVI survey was conducted almost ten years later than the Abner and Lahm, Kapperman et al. and SEELS studies. Attitudes towards technology may be changing as more and more people get on board with cell phone, computer, and high-tech entertainment technology use. So perhaps the slightly higher AT use rate may be due to wider acceptance of technology by teachers, parents and their students. The correlation in general high-tech acceptance and the use of high-tech AT warrants further research.

**Types of assistive technology used by students.** In the ATSVI survey, various technologies were reported to be used. The most popular low-tech devices included the braillewriter, long white cane, optical aids, bold markers, wide lined paper and manipulatives. The results of the survey showed 93% of braille readers used braillewriters. While this is a high percentage, one must ask what the other 7% of braille-readers use for writing. It is possible that they are using high tech braille writing devices such as electronic brailers or electronic braille notetakers exclusively for writing. Perhaps some are reading braille, but writing on QWERTY keyboards with the computer or notetaker. What braille readers are using to write with warrants investigation. This will be further discussed in the future research section.

Another tool that students use to write braille with is the slate and stylus. The slate and stylus is a portable tool traditionally comprised of a hinged metal plate (the slate) that clamps on the front and back of braille paper. One side has holes arranged in the shape of braille characters that are used to guide a metal pin (the stylus) as it is pressed on the paper, forming indented dots. When the paper is removed from the slate,

it is turned over to reveal the raised braille. Because the user is writing on the backside of the paper, they must write from right to left, reversing the order of the dots in each character. This may seem difficult, but even young users learn the technique quickly (Willoughby & Duffy, 1989). Furthermore, the slate and stylus is quick, portable and inexpensive (Koenig & Holbrook, 2000). Rex, et al. consider “the mastery of the slate and stylus an indispensable skill for persons who are blind” (Rex, Koenig, Wormsley, & Baker, 1995). It is important enough that one sixth of the National Braille Competency Test for new TVIs is devoted to slate and stylus writing competencies (Bell, 2010).

However, a 1999 study indicated that teachers of the visually impaired “did not consider it necessary to be fluent in writing with a slate and stylus” (Knowlton & Berger, 1999. p.153). This finding was reflected in the ATSVI study, in which the respondents reported that only 20% of braille readers used the slate and stylus. The relatively low use of the slate and stylus should also be further investigated.

The most popular high-tech devices included talking calculators, computer screen readers, computer screen enlargers, video magnifiers and digital book readers. Talking calculators ranked high on the lists for braille, print/large print, and auditory learners.

With none of the 72 respondents indicating its use, electronic canes (e.g. sonar, laser) seems not yet to have caught on in Kentucky. Another device apparently not used much in Kentucky is the electronic hand-held magnifier (19% of print/low print users). Possibilities for low use of the later include the high expense and bulkiness of the hand-held electronic magnifiers compared to compact optical inexpensive magnifiers such as the dome magnifier or monocular. Little is found in the literature concerning the

effectiveness of electronic magnifiers compared to traditional optical magnifiers. This also warrants further investigation.

One interesting finding was the comparatively low use of audio-description technologies by the auditory-learning group (3.2%). It would seem that primarily auditory learners with visual impairments would benefit most from audio description. Research has shown that half of those with visual impairments know about audio description (Ipsos-MORI, 2009) that indicates a lack of awareness of audio description by some of those who may need it most. According to one meta-analysis, very little research has been conducted on the use of descriptive video (Ferrell, Finnerty, & Monson, 2006). The extent to which descriptive video is being used by TVIs to help students with visual impairments access the curriculum needs further investigation.

## **Research Question 2**

How have Kentucky teachers of visually impaired students received training in the area of assistive technology, and which methods of AT training do they prefer?

**Research question 2 results summary and discussion.** The largest number of teachers received AT training by attending workshops, PD or vendor presentations (81%). This is not surprising due to the high number of professional development opportunities available to state TVIs through the Kentucky School for the Blind, regional co-ops and vendors. Other common methods of training received were self-study (66%), college/university classes (59%), specialist support (44%) and on-line webinars (16%).

Previous studies have suggested that few special education teachers feel prepared teach assistive technologies to students (Bauder, 1999; Ellis, 2007; Iskander, 2008; Sharpe, 2011), which may impact the extent of AT use in the classroom. This may also

be true for teachers of the visually impaired. Kapperman, et al. found that a majority of TVIs in Illinois didn't know enough about AT to answer specific questions in a statewide survey (Kapperman, et al., 2002). Abner and Lahm reported that half the TVIs in Kentucky who participated in their survey did not feel competent to teach their students assistive technology (Abner & Lahm, 2002). Clearly AT training is important for special education teachers and, more specifically, teachers of the visually impaired in Kentucky.

The ATSVI results reflect what was found in other studies, including a nationwide study of AT training for TVIs conducted in 2000 that showed conferences and vendor presentations as the top source of AT information, and books and journals (self-study) as the next (Corn & Wall, 2002). Abner and Lahm also found that in-service training (PD) and conference presentations were the predominant form of AT training in Kentucky (2002).

In addition, the ATSVI survey asked teachers to rank how they most preferred to receive AT training. Ranked in order of most-desired to least-desired method of AT trainings were: 1) AT workshops, PD or vendor presentations, 2) webinars, 3) self-study, 4) specialist support and 5) college/university classes. Receiving most AT training through PD or vendor presentations agrees with those types of trainings as reported to be most desired by TVIs. It was interesting, however, that despite on-line training being preferred as the second favorite type of training, it was the least type of training received.

### **Research Question 3**

In what areas of assistive technology, and to what extent in those areas have Kentucky teachers of the visually impaired received training?

**Research question 3 results summary and discussion.** ATSVI results showed some notable differences between specific AT training received and specific AT training desired. Some technologies for which TVIs have received training were not high on the desired training list. For example, 68.5% of the teachers indicated that they received training in video magnifiers yet only 15.1% indicated a desire for video magnifier training. The only three devices that the need for training exceeded the training received were audio description technologies, talking tactile tablets and electronic mobility devices. These are some of the newest technologies available and perhaps the least familiar to TVIs. Other devices rated high on the training needs list were the electronic/digital file book reader (43.8%), the accessible PDA with refreshable braille (41.1%), and electronic whiteboard technologies (39.7%).

#### **Research Question 4**

What is the correlation between high-tech assistive technologies used by students with visual impairments and the extent of high-tech assistive technologies training received by their teachers?

**Research question 4 results summary, and discussion.** The ATSVI survey showed no significant correlation between the training and use of listed assistive technologies ( $p < .05$ ). This suggests that specific AT training is not a factor in the use of specific technologies. However, the correlation between the number of different technologies trained in and overall high-tech use with students was significant ( $p < .05$ ). This finding implies that teachers who attend more AT trainings tend to use more AT with their students. Perhaps this was due to their higher interest in technology, since the

additional areas of training they received were not specific to the assistive technologies they actually used with their students.

### **Research Question 5**

What is the correlation between the size of the district in which the teacher is employed, the teacher's years of experience, caseload size, level of education and the extent of their students' assistive technology use?

**Research question 5 results summary and discussion.** On average, teachers reported that 68% of their students were using high-tech assistive technologies. However, since caseload sizes varied from as little as one to more than 25 students per TVI, the average high-tech AT use by the total number of students was 63%.

The ATSVI survey results indicate that 51% of TVIs taught in small districts (those with under 5,000 students). Only 20% taught in large districts (over 20,000 students). There was little correlation found between the size of the district and the extent of high-tech AT use.

In the analysis of the results, there was little correlation between teacher's years of experience and high-tech AT use. This substantiates findings in previous studies conducted in Florida and Minnesota (Edwards & Lewis, 1998; Thurlow, et al., 2007). It seems that the experience level of a teacher is not a factor of AT use by the student.

A teacher's caseload size was found to be negatively correlated with the percentage of their students using high-tech AT [ $r(72) = -.26, p = .02$ ]. Thurlow, et al. found a similar correlation between caseload size and reading accommodations (2007). One likely explanation would be that with less students, TVIs with smaller caseload sizes can better focus on the AT needs of the individual students.

In Kentucky, a teacher who has completed a Rank 1 program generally has completed 30 graduate hours past a Master's degree. A Rank 2 requires a Master's degree or roughly 30-36 graduate hours. A teacher with Rank 3 certification has only a bachelor's degree with a teacher's certification. The majority of TVIs in Kentucky held a Master's degree (86%) and 60% were Rank 1 teachers. Only 6.8% of the TVIs indicated that they held a Rank 3 certification. There was no significant correlation among the teachers' rank or level of education and the percentage of students using high-tech AT.

### **Research Question 6**

What funding sources are used to provide assistive technology to Kentucky students with visual impairments?

**Research question 6 results summary and discussion.** There are many funding sources available to purchase AT for Kentucky students with visual impairments. These sources include Supporting Excellence in Education in Kentucky (SEEK) funds, federal Individuals with Disabilities Educational Act (IDEA) part-b funds, Kentucky Educational Technology System (KETS) money, Medicaid, Private Insurance, Kentucky Vocational Rehabilitation Office funds, private foundation and individual grants (Bauder, Lewis, Bearden, & Gobert, 1997). TVIs reported that overall, the highest percentage of AT funding was received from the local school district (59%). State and federal funding sources accounted for an average of 21%, while private foundations contributed an average of 12%. A notable exception to these averages was the Kentucky School for the Blind (the only residential school represented in the ATSVI survey) which according to the teacher responses, received around 90% of its AT funding from foundations. Though the Kentucky School for the Blind is a state agency, it is interesting that they depend on

donated money (foundations) as their primary source of AT funds as opposed to state or federal funding sources. The reasons why primary AT funding sources seem to vary widely between districts warrants further investigation.

### **Research Question 7**

Are there differences in the extent of low and high-tech AT use as determined by the student's primary learning media or educational placement?

**Research question 7 results summary and discussion.** Expanding the ATSVI data to create a record for each student resulted in a count of 471 (70%) print or large print readers, 123 (18%) braille readers and 79 (12%) auditory learners. A 1999 national AT survey showed a similar ratio of braille students (17% of teachers caseload) but less print readers (43%) and a large group of "non-readers" (37%) (Corn & Wall, 2002). An earlier study of AT use by Kentucky students with visual impairments showed 12% braille users, 52% print/large-print readers and 35% non-readers (Abner & Lahm, 2002). Although data does not provide a clear understanding of these findings, one might speculate that the ATSVI survey's choices probably led TVIs to classify non-readers as auditory learners.

Of the print/large print readers, 86% used low-tech AT and 65% used high-tech AT. Of the braille readers, 91% used low-tech AT and 64% used high-tech AT. Of the auditory learners, 81% used low-tech AT and 51% used high tech AT. It seems that students reading media may not be a factor in the extent of low-tech AT use, but could be a factor of high-tech AT use. Further tests were conducted for significant difference of group means.

Low-tech AT use was not significantly different between learning media groups. High-tech usage was highest among braille and print reading students, and lowest among auditory learners. One hypothesis could be that many auditory learners are non-readers, thereby affecting the need for computers, notetakers and other high-tech AT. However, there are high-tech assistive technologies designed for non-readers, such as audio book players. Although the ANOVA test did not show significant difference in-group means of high-tech use between reading media groups ( $p = .057$ ), the significance was marginal and further study may shed light on the apparent percentage difference.

The ATSVI data substantiate that a higher percent of residential students use both low-tech and high-tech assistive technologies. This reflects findings of earlier studies. Kapperman et al. found a significantly higher use of AT by VI students placed in residential settings (2002). In an examination of the SEELS data, Kelly found significantly higher AT use of residential students as compared to non-residential students (Kelly, 2008).

There may be several reasons why students in residential settings use more AT than students in non-residential schools. Perhaps the immersion in a residential setting provides an environment rich in adaptations, including assistive technologies. For example, every classroom and every teacher has access to AT in a residential setting at KSB. This also carries over to AT access and support in after school activities and dormitory settings. This study also provided insight as to the higher degree of foundation funding at Kentucky's residential school, which may have contributed to higher numbers of assistive technology devices available.

## **Implications**

There are several implications as a result of this study. These implications are categorized into 3 major themes: practice, training and funding.

**Implications for practice.** More students may benefit from greater use of all types of assistive technology. It is hard to imagine that some students may not be using any assistive technologies at all. In fact, respondents reported that 15% of all visually impaired students use no low-tech AT and 39% use no high-tech AT.

Of course, each student's needs are unique and accordingly the law requires the IEP committee to consider AT needs of the individual student. Given the nature of the differences in individual student needs, general prescriptions for assistive technology use seems impractical and improper. On face value, it is questioned how some visually impaired students can access the curriculum at all - without the use of even the simplest low-tech AT. In the end, of course, it is up to the IEP committee to which the certified TVI, as vision specialist, should have great influence. Further investigation is warranted as to how individuals who are blind or have low vision access the curriculum without any type of AT.

Of all the correlates of teacher characteristics and the extent of AT use, only caseload size was significant. District administrators should be cognizant of caseload size when determining staff numbers of TVIs. The needs of the students should be the primary consideration. Teachers responsible for large numbers of students may be overworked and unable to spend the time learning a variety of AT. Students of these teachers may not be provided with the necessary AT that addresses their learning needs to effectively access the curricula.

To increase the use of assistive technologies in non-residential settings, students need to have the same continuous access to assistive technology during school in all classrooms, after school in extra-curricular activities and at home, that are available to students in residential settings. This may or may not be incorporated in the student's IEP. Schools are often reluctant to provide AT for home use. If ownership is an issue, TVIs, students and their parents should explore AT funding sources that allow for student ownership.

**Implications for training.** There appears to be many AT workshops, in-service PDs, and vendor training for teachers of the visually impaired in Kentucky. However, given the relatively high desire for on-line training, there should be more webinar-type trainings offered. Research has suggested that teachers can receive meaningful training on-line (Marston, 2000). Webinars could be an opportunity for state agencies and regional AT centers to expand their in-service offerings. Colleges and universities could also increase their relevancy by offering specific AT on-line courses. Another source of on-line training could come from the vendors and manufactures of AT for visually impaired students. This could both increase the effective use of their products and possibly expand their concessions.

TVIs received training in some areas they needed most, but not in other areas such as audio description for multimedia products, the use of talking GPS devices and the use of talking tactile tablets for diagrams and graphs. Organizations that provide training should look carefully at what the teachers really want. Surveying the teachers about their training needs could help providers better plan training in specific AT areas.

In order to increase use of AT by students with visual impairments, teachers need to be encouraged to attend as many trainings as possible. This may increase teachers' comfort with, and knowledge of, technologies - perhaps heightening their interest in the possibilities of new AT. This kind of information should also be shared with administrators, and professional development developers in schools districts, and with members of the students' IEP committees.

**Implications for funding.** According to federal law, "It is the responsibility of the local school district to pay for any assistive technology device or service included in the student's IEP" (Dyal, Carpenter, & Wright, 2009, p. 556). In fact, federal regulations require that:

Each public agency shall ensure that assistive technology devices or assistive technology services, or both, as those terms are defined in 300.5300.6, are made available to a child with a disability if required as a part of the child's (1) Special education under 300.26; (2) Related services under 300.24; or (3) Supplementary aids and services under 300.28 and 300.550(b)(2) (Assistive Technology, p. 556).

In practice, it appears that in Kentucky the local schools and districts are the largest source of AT funding. However, other sources for AT funding are available to TVIs and their students. According to its latest three-year AT plan, The Kentucky School for the Blind Charitable Foundation (KSBCF) serves as the primary source for AT funding at the Kentucky School for the Blind, thus relieving the state of its AT funding responsibilities. The KSBCF, along with the WHAS Crusade Foundation has been a source for not just the Kentucky School for the Blind, but also other local schools and districts looking for AT funding.

On the ATSVI survey, several TVIs reported that they did not know the funding sources used for their student's AT. In the comments section of the funding question, one teacher wrote, "This information is not revealed to employees/teachers at my county." One teacher reported having trouble obtaining AT funding saying, "In our district, VI is not high on the AT list, I beg, borrow and basically use very old technology. I get what Medicaid will help buy and struggle with the rest."

TVIs in non-residential settings, their administrators, their students, parents and IEP committee members probably need to be more aware of the wide array of funding sources available for assistive technologies. There are many ways to educate the stakeholders about funding sources including in-service (PD) training or professional organization conferences and sessions. Parent meetings and newsletters could be another way of informing stakeholders about funding sources. In addition, a thorough examination of AT funding should be an important learning objective in college/university pre-service AT curriculum.

AT requests that meet certain conditions can be purchased for school and home use through Medicaid funding or private insurance. School Medicaid requires that the AT addresses medical or mental disabilities, helps the student benefit from special education, is written in the IEP, and is provided in accordance with the IEP, while non-school (community based) Medicaid requires a medical professional's authorization (Bauder, et al., 1997). Additionally, other sources in Kentucky are available to purchase AT for VI students to use both in and out of school. These sources include the Kentucky School for the Blind Charitable Foundation, The Lions Club, corporate donors such as banks, and private donors.

## **Limitations of the Study**

There are several limitations to the finding of this study a) test-retest reliability, b) verification of student data, c) limited factors, d) small sample size, and e) generalizability.

**Test-retest reliability factors.** An instrument test-retest reliability co-efficient of  $r = .780$  was obtained from a small group pilot survey respondents. This co-efficient should be interpreted with caution due to the small number of pilot participants. Testing the survey with a larger group of TVIs would produce a more reliable stability co-efficient. Another technique for testing questionnaire reliability would be to conduct a reverse records check (Lavrakas, 2008). Using this technique, teachers' responses could be correlated with school records to check for accuracy of data.

**Verification of student data.** Polling the teachers about student data introduces another limitation to this study. Direct polling of students, or direct examination of student data found in student files, would yield the most accurate information on the types of assistive technologies being used and the extent of their use. Of course, this kind of survey would require permission of parents and stringent protection of confidentiality.

**Limiting factors.** The ATSVI survey looked at a limited number of factors that may affect the extent of AT use including teacher attributes, student placement and primary reading media, teacher training, and AT funding sources. Other contextual factors, such as parent attributes and involvement, student grade level or academic functioning level, and school administrative support were not examined.

**Limited sample.** This study was limited to teachers of the visually impaired in the state of Kentucky, and may or may not be generalized to teachers and students with

visual impairments in other states or countries. By expanding research nationwide, a more thorough understanding of AT use by students with visual impairments could be achieved.

**Generalizability.** The findings of this study have limited national use. The sample of TVI's included only teachers in Kentucky's residential and non-residential schools. Additionally, completed responses were received from only 62% (73 of 117 TVIs) of these teachers. This means that AT use data from 44 teachers could not be included in this investigation.

Nationally, states may have different systems in place to address the needs of students with visual impairments. Expanding the investigation to other states would allow generalizing the findings to teachers and students elsewhere and additionally serve to validate the Kentucky results.

### **Future Research**

In review of the data and implications of the findings, several areas of future research have emerged. Resolving these questions might help clarify certain factors affecting the extent of assistive technology use.

Resolving these questions might help clarify certain factors affecting the extent of assistive technology use. Possible areas that warrant further investigation include:

1. Is there a correlation between greater use of high-tech technologies in the general society and greater high-tech assistive technology use by students with visual impairments?
2. If not using Braillewriters, what tools are braille students writing?

3. To what extent is descriptive video used by TVIs with students with visual impairments?
4. To what extent and by who are IEP committees informed of available assistive technologies?
5. Why does residential placement increase the extent of AT use by students with visual impairments?
6. How does teacher caseload size affect the extent to which students use assistive technology.
7. What sources and procedures are districts using to fund assistive technologies and assistive technology services?
8. To what extent are teachers of the visually impaired aware of AT funding sources and purchase procedures?

### **Summary**

There is little doubt that the use of assistive technologies benefits students with visual impairments and blindness. Assistive technologies help break down barriers to the curriculum. Reading and writing, for example, become instantly available with a refreshable braille notetaker in the hands of a student with blindness. Students with low vision can see what the teacher is writing on the board from their desk, that they ordinarily may not see by using any number of assistive technology devices, including video cameras connected to a computer monitor or white boards connected to a laptop. Simple devices, such as a pocket slate and stylus allow a student with blindness to jot down quick notes, much like a sighted student would write notes on a scrap of paper – or even the back of their hand.

There seem to be students who are not provided the assistive technologies that should be available to them. There were several factors examined in this study that may affect the extent of assistive technology use, including awareness and training of assistive technologies for all stakeholders. The teachers are receiving some AT training, but more areas of AT training could help increase AT use by their students. Concerning AT use in the school, the IEP committee probably has the largest sway. Since the committees are comprised of teachers, parents, school administrators and the students themselves, increased awareness of the value of AT for all the IEP members is important.

Another factor examined was funding. Stakeholders may be allowing a perceived lack of funding inhibit their consideration of assistive technology purchases or services. The student's school district must provide assistive technologies deemed as necessary by their IEP committee. If district funds are scarce, the district has other funding options to consider. For example, at Kentucky's residential school, foundations, and both corporate and private donations funded almost all AT purchases. With increased awareness of what assistive technologies are available and what funding is available for these technologies, the extent of AT use should increase, helping to level the playing field for students with visual impairments.

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## LISTING OF APPENDICES

- Appendix A Assistive Technology for Students with Visual Impairments: a Teacher  
Survey
- Appendix B Invitation Letter to Participants
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## APPENDIX A

### **Assistive Technology for Students with Visual Impairments: A Teacher Survey**

#### **Preamble**

Dear Kentucky Teacher of the Visually Impaired,

You are being invited to participate in a research study by answering the attached questionnaire titled, Assistive Technology for Students with Visual Impairments: A Teacher Survey. This survey examines the use of assistive technologies by Kentucky students with visual impairments. There are no known risks for your participation in this research study. The information collected may not benefit you directly. The information learned in this study may be helpful to others. The information you provide will assist the researcher in understanding the extent to which assistive technologies are being used. Your completed survey will be stored at the researcher's locked file cabinet in his office. The survey will take approximately 15 minutes time to complete. Upon completion of the survey, your email address will be added to a list of those who have responded and will be kept separate from the survey responses. Your name will not be asked nor recorded. These actions will help to assure your anonymity.

The study you are about to participate in asks about specific assistive technologies you use with your visually impaired students. Please participate in this study only if you work directly with students with visual impairments. If you share students with other teachers of the visually impaired and they also are participating in this study please answer the questions for only students for whom you are the IEP case manager.

Individuals from the Department of Teaching and Learning, College of Education and Human Development, the Institutional Review Board (IRB), the Human Subjects Protection Program Office (HSPPO), and other regulatory agencies may inspect these records. In all other respects, however, the data will be held in confidence to the extent permitted by law. Should the data be published, your identity will not be disclosed.

Taking part in this study is voluntary. By completing this survey you agree to take part in this research study. You do not have to answer any questions that make you uncomfortable. You may choose not to take part at all. If you decide to be in this study

you may stop taking part at any time. If you decide not to be in this study or if you stop taking part at any time, you will not lose any benefits for which you may qualify.

If you have any questions, concerns, or complaints about the research study, please contact: Dr. Debra Bauder, 502-852-0564.

If you have any questions about your rights as a research subject, you may call the Human Subjects Protection Program Office at (502) 852-5188. You can discuss any questions about your rights as a research subject, in private, with a member of the Institutional Review Board (IRB). You may also call this number if you have other questions about the research, and you cannot reach Dr. Bauder, or want to talk to someone else. The IRB is an independent committee made up of people from the University community, staff of the institutions, as well as people from the community not connected with these institutions. The IRB has reviewed this research study.

If you have concerns or complaints about the research or research staff and you do not wish to give your name, you may call 1-877-852-1167. This is a 24 hour hot line answered by people who do not work at the University of Louisville.

By checking yes, you agree.

1. \_\_\_ Yes

**Directions: Please check the response that best applies to you.**

2. Do you presently have teaching responsibilities with VI students?

\_\_\_ Yes

\_\_\_ No

3. District Size: (current)

Less than 5,000 students total

Between 5,000 and 20,000 students

More than 20,000 students

4. Number of years of experience teaching students with visual impairments: \_\_\_\_\_

5. What grade level do you teach? (check all that apply)

Preschool

Elementary

Middle School

- High School
- Other (specify): \_\_\_\_\_

6. What Kentucky Teaching Rank do you hold? (Check one that best applies)

- Rank 1
- Rank 2
- Rank 3
- Other (specify): \_\_\_\_\_

7. Check the highest college degree you have?

- Bachelors
- Masters
- Specialist (Ed.S.)
- Doctorate (Ed.D. or Ph.D.)

8. How many students with visual impairments do you teach? (Note, If you are a KSB teacher, report only those on your ARC case management list. If you are a JCPS teacher, do not report KSB students you share.) \_\_\_\_\_

9. Which service delivery model most closely describes how you teach your students with visual impairments?

- Residential (for example, the Kentucky School for the Blind)
- Resource room teacher
- Itinerant
- Consulting
- Other (specify): \_\_\_\_\_

### **Students Using Tactile/Braille as Primary Media**

10. Of your students (or student cases you manage if at KSB), how many students use **tactile or Braille media** as their primary learning media? \_\_\_\_\_

11. Check the types of **low-tech** assistive technologies that your **tactile/Braille-media** learners use:

- braillewriter
- slate and stylus
- tactile graphics
- manipulatives (including abacus)
- tactually marked rulers, tools and appliances
- daily living adaptive tools (long oven mitts, slicing guides, non-electronic kitchen tools etc.)
- brailled keyboard stickers
- non-electronic mobility device (e.g. long cane)
- Other (please specify): \_\_\_\_\_

12. Of your **tactile/Braille** media learners, how many use at least one **low-tech** assistive technology device as listed above? \_\_\_\_\_

13. Of your **tactile/Braille** media learners, how many use a computer? \_\_\_\_\_

14. Which **high-tech** assistive technology devices do your **tactile/Braille** media learners use? (check all that apply)

- accessible PDA with braille display (e.g. BrailleNote, BrailleSense, PacMate etc.)
- accessible PDA with voice output (e.g. VoiceNote, Braille+, Icon, Braille N Speak, etc.)
- electronic Brailler (e.g. Mountbatten Brailler)
- electronic/digital-file book reader (e.g. Victor Stream, BookPort, etc.)
- computer scanner with optical character recognition (OCR)
- Braille embosser
- talking calculator
- talking ruler, measuring tape, protractor, scale, color identifier
- talking tactile tablet for diagrams, graphs, etc. (e.g. Intellikeys overlay)
- talking appliances, kitchen and medical devices
- audio descriptors (e.g. audio described movies)
- electronic mobility device (e.g. trekker, breeze, talking GPS)

- electronic cane (sonar/laser canes)
- other (please specify): \_\_\_\_\_

15. Of your **tactile/Braille** media learners, how many use at least one high-tech assistive technology device as listed above? \_\_\_\_\_

### **Students Using Visual/Large Print as Primary Media**

16. Of your students (or student cases you manage if at KSB) how many use **print** or **large print** as their primary learning media? \_\_\_\_\_

17. Check the types of **low-tech** assistive technology that your **visual/large print** media learners use. (check all fields that apply)

- bold marker
- wide lined paper
- large print media
- optical aid (e.g. optical magnifier, optical monocular magnifying strips etc.)
- adjustable lighting
- copy stand
- high contrast keyboard stickers
- white board with erasable marker
- large print or tactually marked kitchen tools and appliances
- other (specify): \_\_\_\_\_

18. Of your primarily **visual** or **large print** media learners, how many use at least one low-tech assistive technology device as listed above? \_\_\_\_\_

19. Of your primarily **visual** or **large print** media learners, how many use a computer?  
\_\_\_\_\_

20. Which **high-tech** assistive technology devices do your **visual** or **large print** media learners use? (check all that apply)

- electronic magnifiers (e.g. Quicklook, etc.)
- video magnifier (e.g. CCTV, handheld, JORDY etc.)
- talking or large display calculator
- electronic audio books (e.g. Talking books, BookPort, Victor Reader etc.)
- electronic whiteboard technologies (e.g. Smartboard, MIMIO)
- talking measuring devices, kitchen tools, appliances or medical devices
- scanning technologies (e.g. Kurzweil, Intel Reader, etc.)
- screen enlargement software (e.g. ZoomText, Magic etc.)
- Other (please specify): \_\_\_\_\_

21. Of your primarily **visual** or **large print** media learners, how many use at least one high-tech assistive technology device as listed above? \_\_\_\_\_

#### **Students Using Listening/Audio as Primary Media**

22. Of your students (or student cases you manage if at KSB), how many use **listening/audio** as their primary learning media? \_\_\_\_\_

23. Check the types of **low-tech** assistive technologies that your **listening/audio** media learners use? (check all that apply)

- tactile graphics
- manipulatives
- large print or tactually marked rulers, tools and appliances
- optical aid (e.g. optical magnifier, optical monocular, magnifying strips, etc.)
- daily living adaptive tools (e.g. long oven mitts, slicing guides, non electronic kitchen tools)
- Keyboard stickers
- non-electronic mobility device (eg. long cane)
- white board with erasable marker
- large print or tactually marked kitchen tools and appliances
- other (specify): \_\_\_\_\_

24. Of your primarily **listening/audio** media learners, how many use at least one **low-tech** assistive technology device as listed above? \_\_\_\_\_

25. Of your primarily **listening/audio** media learners, how many use a computer? \_\_\_\_\_

26. Which **high-tech** assistive technology devices do your **listening/audio** media learners use? (check all that apply)

- electronic magnifiers (e.g. Quicklook, etc.)
- video magnifier (e.g. CCTV, handheld, JORDY etc.)
- talking or large display calculator
- electronic audio books (e.g. Talking Book, BookPort, Victor Reader etc.)
- computer screen reader (JAWS, Window Eyes, etc.)
- screen magnification software (ZoomText, Window Eyes, etc.)
- electronic whiteboard technologies (e.g. Smartboard, MIMIO)
- talking measuring devices, kitchen tools, appliances or medical devices
- scanning technologies (e.g. OmniPage, Kurzweil, Intel Reader, etc.)
- alternate keyboards
- electronic Braille (e.g. Mountbatten Braille)
- audio descriptors (e.g. audio described movies)
- electronic cane (sonar/laser canes)
- other (specify): \_\_\_\_\_

27. Of your primarily **listening/audio** media learners, how many use at least one **high-tech** assistive technology device as listed above? \_\_\_\_\_

### **Teacher Training**

28. Where have you received knowledge of assistive technology? (check all that apply)

- College/University classes
- Self study; use of manuals and tutorials
- AT workshops, professional development or vendor presentations
- Individual support by specialist
- Webinar

other (please specify): \_\_\_\_\_

29. On a scale of 1 being the most and 5 being the least, rank how you would most prefer to receive assistive technology training:

\_\_\_ College/University classes

\_\_\_ Self study; use of manuals and tutorials

\_\_\_ AT workshops, professional development or vendor presentations

\_\_\_ Individual support by specialist

\_\_\_ Webinar

\_\_\_ other (specify): \_\_\_\_\_

30. Of which devices have you received assistive technology training? (check all that apply)

accessible PDA with braille display (e.g. BrailleNote, BrailleSense, PacMate etc.)

accessible PDA with voice output (e.g. VoiceNote, Braille+, Icon, Braille N Speak, etc.)

electronic Braille (e.g. Mountbatten Braille)

braille/tactile media production

electronic/digital-file book reader (e.g. Victor Stream, BookPort)

computer scanner with optical character recognition (OCR)

talking measuring devices, kitchen tools, appliances or medical devices

talking tactile tablet for diagrams, graphs, etc. (e.g. Intellikeys overlay)

audio description (e.g. audio described movies)

video magnifier (e.g. CCTV, handheld, QuickLook, JORDY etc.)

talking or large display calculator

electronic whiteboard technologies (e.g. Smartboard, MIMIO)

scanning technologies (e.g. Kurzweil, Intel Reader, etc.)

computer screen reader (e.g. JAWS, WindowEyes, etc.)

computer screen reader w/magnification (e.g. Dolphin, Zoomtext etc.)

electronic mobility device (e.g. GPS device, electronic cane etc.)

Other (please specify): \_\_\_\_\_

31. Of which devices would you like to receive assistive technology training? (check all that apply)

- accessible PDA with braille display (e.g. BrailleNote, BrailleSense, PacMate etc.)
- accessible PDA with voice output (e.g. VoiceNote, Braille+, Icon, Braille N Speak, etc.)
- electronic Braille (e.g. Mountbatten Braille)
- braille/tactile media production
- electronic/digital-file book reader (e.g. Victor Stream, BookPort)
- computer scanner with optical character recognition (OCR)
- talking measuring devices, kitchen tools, appliances or medical devices
- talking tactile tablet for diagrams, graphs, etc. (e.g. Intellikeys overlay)
- audio description (e.g. audio described movies)
- video magnifier (e.g. CCTV, handheld, QuickLook, JORDY etc.)
- talking or large display calculator
- electronic whiteboard technologies (e.g. Smartboard, MIMIO)
- scanning technologies (e.g. Kurzweil, Intel Reader, etc.)
- computer screen reader (e.g. JAWS, WindowEyes, etc.)
- computer screen reader w/magnification (e.g. Dolphin, Zoomtext etc.)
- electronic mobility device (e.g. GPS device, electronic cane etc.)
- Other (please specify): \_\_\_\_\_

### Assistive Technology Funding

32. List the approximate percentage of total AT funding you have received from each of the following sources:

- \_\_\_% - Local school/district
- \_\_\_% - State and federal funding
- \_\_\_% - Foundation grants
- \_\_\_% - Private donations
- \_\_\_% - Corporate/business funding
- \_\_\_% - other (specify) \_\_\_\_\_

33. Thanks for taking the time to complete this survey. Please add any comments here:

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## APPENDIX B

### Invitation Email to Participants

Dear fellow TVI,

This is a request from David Hume...

Some of you know me; I teach technology at KSB and am a student at U of L. Dr. Bauder and I are conducting a study on the use of assistive technology by Kentucky teachers and their students with visual impairments. I am hoping you will participate, as I feel the information we get back from you is valuable and could be important in trying to get more technology in the hands of our students.

This questionnaire will only take a few minutes of your time and most of the answers can be done by just checking boxes. A few questions ask for numbers.

Click on the link below to begin the survey. Again, I would consider it a great personal favor and I thank you in advance for participating. ☺

David Hume, TVI Kentucky School for the Blind

## APPENDIX C

### Follow-up Email to Participants

Dear fellow TVI,

Last week, I sent an email asking teachers to participate in a survey I am doing about assistive technology use by students with visual impairments in Kentucky. This survey is important to me and, depending on what we find out, possibly all our students.

If you haven't already done so, I would greatly appreciate your participation. It's an easy survey and should only take a few minutes.

The link is below

Thanks,

David Hume, TVI Kentucky School for the Blind

## CURRICULUM VITAE

NAME: David A. Hume

ADDRESS: 419 Kaelin Drive  
Louisville, KY 40207

DOB: Solingen, Germany – March 6, 1956

### EDUCATION & TRAINING:

B.M.Ed. Music Education  
University of Louisville  
1974-1977

M.C.M Applied Music  
Southern Baptist Theological Seminary  
1978-1980

Doctoral Candidate, Applied Music  
University of Kentucky  
1986-1988

Master of Education, Special Education – Visual Impairments  
University of Louisville  
2001-2004

PRESENTATIONS: AT and the Expanded Core Curriculum  
KAER State Conference Poster Session  
2009

Assistive Technology for Students with Visual Impairments:  
An Overview  
Council for Exceptional Children  
Kentucky Conference  
2008

Assistive Technology for Students with Visual Impairments:  
An Overview  
Gateways  
Louisville Kentucky  
2007

**EMPLOYMENT  
HISTORY:**

**Fall 1998 – Present Kentucky School for the Blind**

**Teacher of the Visually Impaired**

Classes Taught

Computer Applications

Assistive Technology

A+ Certification

**Fall 1979 – Spring 1997 Kentucky School for the Blind**

**Teacher of the Visually Impaired**

Classes Taught

Instrumental Music

General Music

Music Recording Techniques

Music Technology

**Spring 2004 Southern Baptist Theological Seminary**

**Adjunct Instructor**

Class Taught:

Applied Music

**Fall 1981 – Spring 1984 Jefferson Community College**

**Adjunct Instructor**

Classes Taught:

Applied Music

Humanities 101

Jazz Ensemble

**GRANTS  
& AWARDS:**

Louisville Community Foundation Grant

For KSB Recording project

1984

Kentucky Composer of the Year Award

For Song Cycle, *Winter Scenes*

1983

Created *Computer Braille Drills* for KSB Outreach Dept

1997