A CONCEPTUAL ANALYSIS OF THE APPROPRIATE ROLE OF ASSISTIVE TECHNOLOGY IN THE EDUCATION OF STUDENTS WITH DISABILITIES

by

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ABSTRACT

A Conceptual Analysis of the Appropriate Role of Assistive Technology in the Education of Students with Disabilities

by

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Assistive technology allows students with disabilities opportunities for greater independence, improved productivity, and increased functional capabilities. It removes obstacles, helps students overcome disabilities, and holds great promise for enriching educational outcomes and affecting the lives of students. However, for over 90% of special education students, assistive technology is not part of their education. One reason for not applying assistive technology to help students is the lack of a clear vision of what assistive technology is, what it can help students accomplish, and how to appropriately access it through individualized education programs (IEPs).

In this study a comprehensive concept analysis clarified key assistive technology concepts, and identified critical relevant and critical irrelevant attributes of assistive technology. Multiple focus groups and a survey of 191 special educators
validated the concept analysis. The survey also provided valid and reliable data about the relevant and irrelevant critical attributes identified in the concept analysis. The survey identified discrepancies between understanding of the concepts and actual applications of assistive technology. The study applied a unique combination of concept analysis, focus group research, and survey research methods.

The appropriate application of assistive technology considers (a) the role of technology, (b) how technology meets students' unique functional needs, (c) the appropriateness of assistive technology applications, and (d) the use of technology to expand the environment of the student. Although special educators agree these concepts are critical, they seldom apply them. Other irrelevant, misconceived attributes often dictate the nonapplication or misapplication of assistive technology.

Although the IEP is the programmatic method whereby students with disabilities access special education services, 86% of IEPs do not consider possible technology applications. This oversight occurs because IEP participants lack valid information, do not have assistive technology assessments available, perceive funding as a major obstacle, lack training, and/or there are not polices and procedures in place concerning assistive technology. Recommendations for special education providers, local education agencies, and parents are included.

(202 pages)
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Martell Menlove
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Technology—like language, ritual, values, commerce, and the arts—is an intrinsic part of a cultural system... In the broadest sense, technology extends our abilities to change the world: to cut, to shape, or put together materials; to move things from one place to another; to reach farther with our hands, voices, and senses... Anticipating the effects of technology is therefore as important as advancing its capabilities. (Science for All Americans, p. 39, [AAAS, 1989])

The potential for notable improvement in the education of students with disabilities escalates with the introduction of assistive technology (Behrmann, 1995; Burnette, 1990; Scherer & Galvin, 1994). For most of us, technology is an expected convenience. Access to technology promotes efficiency and increases accuracy (Fifield, 1990). However, for those with disabilities, technology increases, maintains, and improves functional capabilities (Heumann, 1993). The Special Educator (“Ten Things Administrators Should Know,” 1994) stated, “Assistive technology can really help students with disabilities succeed in the classroom” (p. 164). Assistive technology today is designed, developed, and used by students with an increasingly wider range of cognitive and physical abilities and disabilities (Behrmann, 1995; Fifield, 1990). In the classroom, technology benefits students with and without disabilities, enabling more independence, self-confidence, and productivity (Lahm & Morrissette, 1994; Parette, Hourcade, & VanBiervliet, 1993). Furthermore, assistive technology can facilitate
including students with disabilities in the mainstream of schools and society (Council of Administrators of Special Education [CASE], 1993; Lahm & Elting, 1989; Wilds, 1989).

Legislative and programmatic vehicles for using technology to improve the lives of students with disabilities officially began in 1975 with passage of the Education of the Handicapped Act. This Act, last amended in 1990 and now known as the Individuals with Disabilities Education Act (IDEA), emphasizes technology applications in delivering services to meet the individual needs of students with disabilities. IDEA now includes definitions of the terms “assistive technology device” and “assistive technology service.”

... Assistive technology device means any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve functional capabilities of children with disabilities. (34 CFR § 300.5)

... Assistive technology service means any service that directly assists a child with a disability in the selection, acquisition, or use of an assistive technology device. The term includes - (a) The evaluation . . . (b) Purchasing, leasing . . . (c) Selecting, designing, fitting, customizing . . . (d) Coordinating . . . (e) Training . . . a child . . . and (f) Training . . . professionals . . . (34 CFR § 300.6)

The federal Rules and Regulations (34 CFR § 300.308) also state:

Each public agency shall ensure that assistive technology devices or assistive technology services, or both, as those terms are defined in §§ 300.5-300.6, are made available to a child with a disability if required as a part of the child's -

(a) Special education under § 300.17;
(b) Related services under § 300.16; or
(c) Supplementary aids and services under § 300.550(b)(2).
However, despite recent efforts, accessing assistive technology continues to be problematic for many students with disabilities:

1. Technology is not a part of many students' educational program (National Council on Disability, 1993).

2. Identifying, purchasing, and appropriately applying the right technology is not easy ("Ten Things Administrators Should Know," 1994).

3. There exists a lack of trained personnel and information about the availability and potential of technology (Administration on Developmental Disabilities [ADD], 1993; Inge, Flippo, & Barcus, 1995).

4. School systems often lack the fiscal resources and staff capacity to provide the necessary technology-related assistance (Technology-Related Assistance for Individuals with Disabilities Act [Tech Act] Amendments of 1994).

Schools provide services to students with disabilities through individualized education programs (IEPs). The IEP is a written statement developed and implemented according to federal and state rules and regulations (34 CFR § 300.340). Appropriate applications of assistive technology in the future must focus on IEPs that expand technology access and opportunities. For students with disabilities, IEPs can offer access to assistive technology by effectively integrating technology with content and pedagogy (Hofmeister, Carnine, & Clark, 1994). Clark (1992) used the term "technocentric" to describe technology by its mechanical and electronic aspects. Today, technology must "stress the integration of machine, curriculum content, and
instructional context as an indivisible and educationally functional entity” (Hofmeister et al., 1994, pp. 4-5).

The IEP is the programmatic vehicle for applying assistive technology to the lives of students with disabilities (Cramer, 1992). However, Bateman (1991) reported that school personnel continue to use the IEP process mainly to identify the best classification for a child with a disability, and then place that child in a program already designed for that classification. Examples of the inclusion of assistive technology in the IEP, or any indication that assistive technology was even considered during the IEP process, are rare (Parette et al., 1993).

Legislative changes, new federal and state rules and regulations, and current administrative opinions foster an atmosphere supportive of the use of assistive technology (Heumann, 1993). However, the actual application of technology in the IEP continues to be problematic (“Some Thoughts on Assistive Devices and Services,” 1992). In 1990, an Office of Special Education Programs’ opinion letter mandated that "a child's need for assistive technology must occur on a case-by-case basis in connection with the development of the child's IEP" (J.A. Schrag, personal communication, August 10, 1990). However, little evidence exists that public educators have taken this mandate for action seriously (Parette et al., 1993).

Recent technology and rehabilitation engineering advancements have dramatically increased interest in the use of assistive technology (Daggett, 1995). There is also increased commercial availability of equipment and devices designed for students with
varying disabilities (Parette et al., 1993). However, teachers and parents continue to be unaware of what is available (Scherer & Galvin, 1994).

Technological advances have had a tremendous impact on our lives. We see, hear, write, calculate, feed, and amuse ourselves daily with technology ("Ten Things Administrators . . .", 1994). Adapted toys, alternate input and output devices for computers, eating systems, powered mobility devices, augmentative communication devices, special switches, and so forth, are available for students of all ages. These commercially available, or adapted, assistive technology devices and services improve students' abilities to study, learn, compete, work, and interact with family and friends (ADD, 1993). If appropriately applied, these technology devices and services promote efficiency, increase accuracy and often act as sensory stimulations (Parette, 1991). For those with disabilities, appropriately applied assistive technology removes obstacles and helps circumvent disabilities (Fifield, 1990). In particular, access to technological advances holds great promise for enriching educational opportunities and affecting the lives of students with disabilities (Barker, 1990; Gradel, 1990; Parette et al., 1993).

During the past decade, there have been major advances in modern technology. Technology is now a powerful force in the lives of all residents of the United States. Technology can provide important tools for making the performance of tasks quicker and easier. For some individuals with disabilities, assistive technology devices and assistive technology services are necessary to enable the individual . . . to participate in . . . school . . . and to otherwise benefit from opportunities that are taken for granted by individuals who do not have disabilities. (Technology-Related Assistance for Individuals with Disabilities Act of 1988 as Amended in 1994, P.L. 103-218)
Statement of the Problem

Individualized education programs (IEPs) developed by school personnel rarely address an individual student's needs for assistive technology. The problem is a lack of a clear vision of the appropriate role of assistive technology in the education of students with disabilities and the lack of integration of this vision in the development of IEPs. The lack of policy statements addressing assistive technology, and appropriate preservice and inservice training concerning the role of assistive technology reflect this lack of a clear vision.

A comprehensive review of the current literature suggests that additional information is needed: (a) to help develop policy statements to clarify what assistive technology is appropriate, and what is not; (b) to help design effective training programs; (c) to help insure effective and appropriate assistive technology applications; and (d) to help understand how important IEP components relate to assistive technology. For example, there is a dearth of information on effective assistive technology assessments, and using assessment information to design IEPs to meet students' technological needs.

Those involved in developing and carrying out IEPs, those involved in developing special education policy, and those involved in training programs need valid information synthesizing findings from the literature. Valid information makes it easier for educators to make effective decisions concerning the appropriate application of technology in meeting the individual needs of students with disabilities.
Rationale for This Study

Rationale of the need for a comprehensive evaluation of assistive technology as it relates to the IEP rests on three key points:

1. the urgency of the problem;
2. the pervasiveness of the problem; and
3. the generally troublesome nature of the IEP process.

Practitioners are constantly placed in situations where they must make difficult decisions concerning the appropriate application of technology. Federal legislation, particularly IDEA, contains requirements for providing assistive technology devices and services, and yet special educators do not understand what is needed. The technology explosion and constantly changing information about the latest assistive technology developments makes maintenance of accurate, up-to-date, item-specific information nearly impossible. Consequently, students with disabilities are daily denied learning opportunities. Decision makers are not aware of available technology, assistive technology policies do not exist, special educators lack training, and IEP teams do not adequately address assistive technology.

Technology is an acceptable part of everyday life. Many conceptual functions of instruction, both for students with and without disabilities, are based on technology. Technology is a part of everything we do, including teaching and learning. However, as overtly pervasive as technology is in our lives, it is often neglected in the education of students with disabilities.
The need to evaluate the IEP process in the application of any technique, program, instructional delivery systems, or other component of instruction is complicated. If access to assistive technology depends on the IEP process, any analysis of assistive technology must address the already complex and often misunderstood nature of the IEP. The IEP is troublesome for many reasons. Some reasons that apply particularly to the application of assistive technology are:

1. The need to agree on what is appropriate. IDEA is clear in that each IEP must provide a free appropriate public education (FAPE) but definitions of appropriateness vary.

2. The IEP must provide "educational benefit." Again, there is some question about what constitutes benefit, and what level of benefit is required.

3. The IEP is a very individualized process. Each IEP is different and the need for assistive technology varies with each student.

4. IEPs are developed on a local level. Decisions are made by local participants attending the IEP.

5. One decision the IEP team makes that may affect the application of technology is the student's placement. This placement must be in the least restrictive environment (LRE) that is appropriate.

6. IEPs should be based on the strengths and weaknesses of the student. Inadequate assessments in the area of assistive technology make consideration of a student's unique technology needs difficult.
Purpose and Research Questions

The purpose of this study was to increase the reliable and valid information available to develop policy statements, provide training, and make appropriate service delivery decisions concerning access to assistive technology. Through a comprehensive concept analysis and needs assessment, I attempted to identify and validate information essential for integrating assistive technology into the IEP process. Through the concept analysis I identified a set of relevant attributes. A subset of these attributes was identified as critical. Additionally, I identified attributes that are considered irrelevant because they do not consistently define the relevant attributes and may lead to misperceptions. These findings make a significant contribution to the existing assistive technology knowledge base.

Contributions to the knowledge base include information on the appropriate application of technology in special education. Recommendations are included for the development of effective policy statements and staff development programs. In addition, steps and procedures to take during the IEP process to increase the probability of the appropriate application of technology are outlined.

1. What are the critical relevant and irrelevant attributes that describe the appropriate application of assistive technology in the education of students with disabilities?

2. What currently occurs, and does not occur, during the IEP process that results in the consideration and application of assistive technology in the IEP?
3. To what extent do current IEP practices incorporate the identified critical attributes of applying assistive technology?

4. What actions can special educators, personnel preparation programs, and parents of students with disabilities take to increase the probability that assistive technology will be appropriately applied in the IEP?
CHAPTER II
REVIEW OF RELATED LITERATURE

The review of related literature includes current literature-based discussions of various aspects of this study. Although people have used assistive technology informally for decades, it is a relatively new area of study. References specifically to assistive technology are therefore quite current, most within the past 10 years. Besides reviews specific to assistive technology, this chapter contains brief reviews on some research methodologies employed in this study. Each topical review offered in this chapter summarizes the literature reviewed and identifies salient points. Reviews are not comprehensive for any specific area, but provide a literature-based foundation for the research conducted.

Historical Perspective

Assistive devices labeled as “low tech” have been developed and used for centuries with children with disabilities (Lahm & Elting, 1989). However, formal technological applications for students with disabilities do not precede passage of the Education of the Handicapped Act in 1975. Some people place the beginning of the assistive technology era in 1981. That year Johns Hopkins University held their First National Search for Applications of Personal Computing to Aid the Handicapped. In March 1983, The Council for Exceptional Children held its First National Conference on the Use of Microcomputers in Education. The Council for Exceptional Children first
published *Microcomputers in Special Education* by Florence M. Tabor in 1983, and in 1984 the U.S. Office of Special Education Programs (OSEP) first published *Microcomputer Implementation in Schools* by Robert K. Yin and J. Lunne White. In September 1984, Closing the Gap held its first conference on Computer Technologies for the Handicapped. In the 12-15 years since these initial projects, assistive technology has played an increasingly important role in special education programs.

One noteworthy historical aspect of technology in the classroom is that as technological applications continue, the greatest educational gains have been among students with disabilities (Hawkridge, Vincent, & Hales, 1985).

In addition to educational programs, current educational legislation now addresses assistive technology. In 1988, congress passed the Technology-Related Assistance for Individuals with Disabilities Act (P.L. 100-407), providing increased emphasis on assistive technology. This legislation, amended in 1994, is now referred to as P.L. 103-218. The 1992 reauthorization of the Rehabilitation Act of 1973 also emphasized assistive technology. As outlined previously, assistive technology has received increased attention in each reauthorization of P.L. 94-142 (IDEA). These legislative mandates, as well as various administrative events, significantly influenced access to, societal acceptance of, and use of assistive technology by both students in school and others in society (Wallace, Flippo, Barcus, & Behrmann, 1995).

Heightened interest and increased awareness of technology are encouraging, but cause for caution remains. We often assume that bigger, newer, and sophisticated means
better. This may not be true with technological applications (Church & Glennen, 1992).

Excitement over high technology must be tempered by realism (Sweeney & Rucker, 1995).

Lack of Information

Although assistive technology is recognized as an important service for students with disabilities, research-based knowledge and information concerning the appropriate application of assistive technology in IEPs are practically nonexistent (Inge et al., 1995). An ERIC computer search conducted in December 1994 using the ERIC descriptors Assistive Devices for the Disabled and Individualized Education Programs resulted in locating no entries containing these two descriptors. This search, repeated in December 1995, yielded the same results.

Experts who testified at hearings preceding passage of the Technology-Related Assistance for Individuals with Disabilities Act of 1988 emphasized the need for increased information for professionals (Elting & Meidenbauer, 1991). Inservice training for individuals who are already in the field providing services to people with disabilities was the most critical need identified by The Coalition on Technology and Disability (Beattie, 1990). Because of limited understanding and exposure to devices, therapists generally only recommend the few devices with which they are most familiar (Sommerville, Wilson, & Mack, 1990). The need for training and information dissemination in assistive technology is evident at both the local and national levels (Elting & Meidenbauer, 1991; Lahm, 1991; Smith, 1991). The appropriate application
of technology for students with disabilities often involves professionals not familiar with disability issues (Lewis, 1993). With a trained staff working together, the likelihood increases of accessing assistive technology as an effective tool (Todis & Walker, 1993). Failure to incorporate technology is often the result of insufficient knowledge, and not applying that knowledge in meeting individual students' needs (Scherer & Galvin, 1994).

Technology moves ahead at such a rapid rate it often overwhelms nonprofessionals (Fleisch, 1990). Parents of students with disabilities generally possess limited knowledge about assistive technology and are unaware of where to go for help (Lahm & Elting, 1989). The information parents do have concerning assistive technology is usually based on advertisements and brochures designed to market a specific device (Inge et al., 1995). Individuals with disabilities often understand the need they may have for technological help but seldom understand technology well enough to know what is possible (Church & Glennen, 1992).

Imperfections in the IEP Process

Teachers continue to use the IEP process primarily to identify an acceptable classification for a child with a disability, and then place that child in a program already designed for that classification (Asen, 1994; Bateman, 1991; Smith, Christiansen, & Vanderheiden, 1990). Bateman (1991) and Bryen (1992) proposed that the appropriate
application of assistive technology increases if the IEP process is highly individualized and designed to:

1. Identify the unique educational characteristics and technology needs of the student that must be considered in a truly individualized education program.

2. Determine what the LEA will do/provide in response to each of the identified characteristics and needs.

3. Develop goals and objectives that serve to evaluate the technology services offered.

For this to occur, teachers must understand the basic concepts behind the application of assistive technology (Behrmann, 1995). This understanding improves the educational opportunities of students with disabilities and allows appropriate education in the least restrictive environment (LRE) (Scherer & Galvin, 1994).

The appropriate application of assistive technology would significantly increase if teachers used the IEP process Bateman (1991) suggested. Lahm and Morrissette (1994) outlined multiple areas of instruction where assistive technology could help students with disabilities. Panyan, Hummel, and Jackson (1988) have also supported this concept and have suggested that the appropriate incorporation of technology for students with disabilities includes "incorporation of technology-related goals or objectives into the IEP for students, and achievement of these goals or objectives" (p. 120). Similar to other IEP decisions, technology applications are best achieved with a
logical, systematic decision-making approach guided by certain fundamental principles (Galvin & Phillips, 1991; Lahm & Morrissette, 1994).

Assistive Technology Assessments

One reason technology is seldom considered during the IEP is that assistive technology assessments seldom occur (Guzzo & Guzzo, 1992). Evaluations must include an assessment that will enable the IEP team to determine whether the child needs assistive technology in order to receive a free appropriate public education (FAPE) (T. Hehir, personal communication, December 4, 1995). Although mandated in IDEA, Section 300.532, that the child is assessed in all areas related to the suspected disability, appropriate assistive technology assessments are rare (Heumann, 1993). Individual teachers and assessment teams are often unfamiliar with what assistive technology is available. Additionally, they seldom understand how to determine technology needs (“Ten Things Administrators . . .”, 1994). As a result, they do not know what to recommend (Heumann, 1993). There is a need for assessments designed to identify how to use technology to maximize student potential. Such assessments need to become an accepted step in the assessment process (Bragman, 1987). Technological considerations can augment the traditional assessment by providing information about the student's ability to access and use technology (Scherer & Galvin, 1994). Technological considerations should be an integral part of the student
assessment/evaluation process so that the IEP meets the unique needs of the student (Bragman, 1987).

Staff Development and Assistive Technology Training

Assistive technology training is all but nonexistent in most colleges and universities training special educators (“Assistive Technology: It’s the Law But How Do You Do It?”, 1996). Helping teachers develop expertise in the use of assistive technology is a difficult task (Cramer, 1992; Inge et al., 1995). At least three problems influence the extent to which teachers receive training in incorporating assistive technology in instructional methods. First, although competencies have been developed by different individuals (Smith et al., 1990), there is no commonly agreed upon set of competencies that special educators must achieve to be considered “proficient” in the use of technology to help students with disabilities (Blackhurst, MacArthur, & Byrom, 1987; Daggett, 1995). According to a survey conducted by the Office of Technology Assessment in 1987, there are no consistent requirements within or across states regarding training in the use of technology. Second, there is a lack of consensus regarding how to teach competencies (Cramer, 1992; Inge et al., 1995). For example, some teacher preparation programs integrate technology-related concepts throughout their programs; others use a single intensive technology course. Third, the lack of exposure to equipment and individual expertise exists both at the college/university level
and the practical level where teachers do their student teaching and are ultimately employed (Lahm & Morrissette, 1994; Trieschmann & Morimoto, 1989).

State Education Agencies and Local Education Agencies

Policies Governing Assistive Technology

With the ever-increasing possibilities brought about by educational technology comes the need to develop responsible policies. These policies will direct the use of technology in a manner beneficial to the student, the educator, and other service providers. (CASE, 1993, p. 10)

A review of the literature found multiple references to the need for state education agencies (SEAs) and local education agencies (LEAs) to develop policies governing the appropriate and effective application of assistive technology (Burrello, 1992; Christopher & Barney, 1993; CASE, 1993; Edyburn, 1994; NCD, 1993). The Council of Administrators of Special Education (CASE, 1993) even identified some issues and reported that “policies need to be developed which will ensure that appropriate technology is available to all who can benefit and that proper training is provided” (p. 37). Edyburn (1994) noted that policies need to operationalize a plan for allocating resources and assist in creating instructional priorities. However, as a result of the literature search, I did not identify any current policies, examples of policies, or any information beyond the previously identified basic issues concerning the components of a LEA policy.
Policy Letters and Legislation

As noted in the introduction, IDEA contains definitions for the terms “assistive technology device” and “assistive technology services.” However, beyond these definitions, IDEA and the regulations contained in Section 34 of the Code of Federal Regulations (CFR) do not provide additional clarification on the use of assistive technology in special education.

Most of the legal opinions governing the application of assistive technology in special education programs today come from a series of Office of Special Education Programs (OSEP) policy letters. In lieu of other legislative or judicial mandates or opinions, these policy letters are generally accepted as “policy.” To date there have been six OSEP policy letters directly addressing assistive technology issues. In the first letter Judy A. Schrag (personal communication, August 10, 1990) stated that “assistive technology must be determined on a case-by-case basis in connection with the development of the IEP.” She also stated that assistive technology can be provided as: (a) special education, (b) related services, or (c) supplementary aids and services for children with disabilities who are educated in the regular classroom. In the second letter, Schrag (personal communication, November 27, 1991) clarified that assistive technology may be required for home use if necessary to provide a child FAPE. The next letter was written by Thomas Hehir (personal communication, November 19, 1993) and he stated that a hearing aid is a covered device and must be provided if the IEP team determines that it is needed for the child to benefit from his/her educational program. Thomas
Hehir, OSEP Director, issued another policy letter in 1994 (personal communication, August 9, 1994) in which he stated that schools must assume liability for a device even if the parents provided the device in order to carry out the IEP. In the next letter (personal communication, January 13, 1995) Hehir expands the generally accepted scope of assistive technology by reporting that LEAs are responsible for evaluating vision and providing eyeglasses if the child needs them to receive FAPE. In the most recent policy letter Hehir (personal communication, December 4, 1995) clarifies the responsibility of LEAs to evaluate a child in all areas of suspected disability including functional capabilities of the child as they relate to the need for assistive technology.

Besides requirements of FAPE and LRE under IDEA, there are equal access requirements of Section 504 of the Rehabilitation Act and the Americans with Disabilities Act (ADA). These access issues are often resolved by the appropriate application of assistive technology ("Assistive Technology: It's the Law . . .", 1996).

Concept Analysis

Concept analysis is a necessary prerequisite to the development of policy statements and staff development programs (Englemann & Carnine, 1991). Concept analysis has proven to be a critical component in the development of instructional material and the building of basic knowledge bases (Dempsey, 1990; Le Xuan & Shinghal, 1989). The training of special education service providers to accurately identify and apply appropriate assistive technology incorporates empirical and
theoretical knowledge identified through the concept analysis process. Learning about
the "latest in assistive technology" is of little or no value because the "latest" may be
obsolete before the learners have an opportunity to apply their knowledge (Church &
Glennen, 1992). The constantly changing nature of assistive technology requires the
identification of "critical and irrelevant attributes" of assistive technology that will not
change as the technology itself changes, and that generalize to specific application
situations (Scherer & Galvin, 1994).

A model of concept analysis developed by Markle and Tiemann (1970)
facilitates the generalizations of basic knowledge to new instances. Markle and Tiemann
referred to a concept as "a class the members of which share some properties in
common. It is these shared properties that enable the learner to generalize to new
examples" (p. 5). Concepts are the fundamental structure for thought processing.
Concepts have defining attributes, or attributes that differentiate the example of a
concept from examples of other concepts (Prater, 1993).

A critical attribute refers to any attribute that is essential to an example for
the example to be classified as a member of a given concept class. An
attribute that may be present but is not essential is an "irrelevant
attribute." (Hofmeister, 1977, p. 98)

In any analysis of a concept, it is necessary to identify irrelevant attributes and
nonexamples as well as critical attributes and examples. Both examples and
nonexamples are necessary for teaching what is distinctive about a given concept
(Prater, 1993). Lack of understanding of irrelevant attributes often leads to
misperceptions about a concept (Hofmeister, 1977). For example, there are those with
the misperception that assistive technology always involves computers. Although computers may be present in assistive technology, they are not always essential, and much assistive technology does not include computers. Nonexamples are of most value when they differ only subtly from their matched examples (Englemann & Carnine, 1991).

For educational research on assistive technology, concept analysis has several functions. First, if special education service providers “have the concept” they can generalize to the application of specific technology (Markle & Tiemann, 1970). Second, the concept analysis facilitates the identification of instructional objectives that can be implemented in staff development (Tennyson & Cocchiarella, 1986). For example, if a critical attribute of assistive technology is that it increases a student’s independence and may allow students to function in a less restrictive environment, then assistive technology should be incorporated into IEP placement decisions. Third, identification of specific concepts can be used to assess knowledge acquisition (Champagne, Klopfer, Desena, & Squires, 1981).

Discrepancy Evaluations

Ralph Tyler’s work on curriculum evaluation (1949) caused a major change in educational evaluations (Worthen & Saunders, 1987). Many evaluation models reflect Tyler’s emphasis on measurement of explicit objectives as the basis for deciding the merits of an educational program (Borg & Gall, 1989). One example of this is the work
of Malcolm Provus (1971), who developed the Discrepancy Evaluation Model. Discrepancy evaluation emphasizes the search for discrepancies between the established objectives of a program and the actual achievement of those objectives. The resulting information about discrepancies is then used to develop needs statements and guide program management decisions.

Provus (1971) introduced the Discrepancy Evaluation Model as an objective-based evaluation procedure used in quantitatively oriented evaluations of public schools. Provus viewed evaluation as a continuous information management process designed to result in sound decision making. The basic model developed by Provus was first presented to the professional community at the annual meeting of the American Educational Research Association in Los Angeles, California, in 1969. According to Provus (1971):

The Discrepancy Evaluation Model posits three stages of evaluation. A comparison is made between reality and some standard or standards. The comparison shows differences between the standard and reality; this difference is called discrepancy. On the basis of the comparisons made at each stage, discrepancy information is provided . . . giving a rational basis on which to make adjustments . . . (p. 46)

Focus Groups

Focus groups are a valid research method if they are used carefully and in a way that is suitable for focus group inquiry (Krueger, 1994). Focus groups are an effective method of gaining information about a program not just at its end, but at its beginning or
midpoint (Buttram, 1990). Focus groups can improve the planning and design of new programs and provide means of evaluating existing programs (Bers, 1989).

Focus groups do not typically generate quantitative data, information, or numbers that project to larger populations (Bers, 1989). Acceptable activities for focus groups include validating information and designing information gathering strategies and instruments (Krueger, 1994). Conducting a concept analysis is beyond the purview of focus group research, and using a focus groups to gather data designed to be gathered by the survey research is not an acceptable focus group activity (Bers, 1989).
CHAPTER III
PROCEDURES/METHODS

The procedures/methods chapter includes discussions of: (a) the research design used to address the identified problem, (b) the variety of research procedures employed, (c) the instrumentation development, (d) the identification and selection of subjects, and (e) the collection and analysis of data. Concept analysis, discrepancy evaluation, and focus groups were reviewed in Chapter II. Specific applications of these procedures are discussed in greater depth in this chapter.

Research Design

Borg and Gall (1989) stressed the importance of matching the research design with the research problem. In this study, the problem is “the lack of a clear vision of the role of technology,” and the missing information needed to (a) increase consideration of assistive technology during the IEP process, (b) produce effective policy statements, and (c) guide teacher preparation and staff development. Considering the nature of this problem, an evaluation research design is appropriate. Borg and Gall (1989) stated:

... evaluation research is usually initiated by someone's need for a decision to be made concerning policy, management, or political strategy. The purpose of the research is to collect data that will facilitate decision making. (p. 743)

If applied, the information from this study will improve decisions in the IEP process, decisions concerning the need for policy development, and decisions on training
and staff development. Information from this study will help ameliorate what CASE (1993) and the NCD (1993) called the vital need for effective decision making in the appropriate and consistent application of assistive technology.

The evaluation research design adopted for this study incorporated the joint applications of concept analysis, focus groups, discrepancy evaluation, and survey research. The concept analysis identified critical attributes, and possible irrelevant attributes to be considered during the IEP, and incorporated into policy statements and training programs. Focus groups validated findings of the concept analysis and identified areas of possible discrepancies. Provus's (1971) discrepancy model helped identify and validate discrepancies between identified critical attributes and what actually occurs among practicing service providers. Discrepancy evaluation data were gathered using survey research. Critical attributes, validated by focus groups and discrepancies with actual application, form the foundation for an assistive technology knowledge base.

By necessity, any knowledge base in the assistive technology field must be highly generalizable. Training activities must go beyond the memorization or application of specific points of information (Scherer & Galvin, 1994). Memorization of specific device information and developing policies around specific devices and services is of little value because of the constantly changing nature of the technology (Lewis, 1993). This research design allows for generalizing the findings to new situations.
The previously identified problem statement and the research questions lead the researcher to the research design presented in Figure 1. This design applies various research procedures in (a) identifying and defining critical and irrelevant attributes of the appropriate application of assistive technology in special education, (b) validating those findings and definitions, and (c) identifying discrepancies in teachers’ current level of understanding, and between the comprehension of the critical attributes and the actual application of those concepts in delivering assistive technology.

The concept analysis work of Markle and Tiemann (1970), and the Discrepancy Evaluation Model developed by Malcolm Provus (1971) are major components of this design. As presented in Figure 2, these processes parallel each other. Applying a parallel combination of the two processes allowed for:

1. Identifying critical attributes that serve as criteria for a clear, practical description of the appropriate application of assistive technology;

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<th>Need</th>
<th>Research Procedure</th>
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<td>1. Define Assistive Technology in a Special Education Context</td>
<td>Comprehensive Concept Analysis ➔ Focus Groups</td>
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<td>2. Validate Findings and Definitions</td>
<td>Focus Groups ➔ Survey Research</td>
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<td>3. Identify Weaknesses (Discrepancies)</td>
<td>Discrepancy Evaluation Model ➔ Survey Research</td>
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*Figure 1. Research design, alignment of needs, and research procedures.*
Comprehensive Concept Analysis
Markle and Tiemann (1970)
1. identifying critical attributes consistent with the phenomenon being evaluated
2. identifying irrelevant attributes that exist and are the basis for misconceptions
3. recommend instruction based on conceptual understanding and designed to avoid predictable errors

Discrepancy Evaluation Model
Provus (1971)
1. agreeing upon standards
2. determining whether a discrepancy exists between the performance of some aspect of a program and the standards set for performance
3. using information about discrepancies to make decisions concerning the program policies and training needs

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<tr>
<td>3. recommend instruction based on conceptual understanding and designed to avoid predictable errors</td>
<td>3. using information about discrepancies to make decisions concerning the program policies and training needs</td>
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Figure 2. Comparing comprehensive concept analysis with a Discrepancy Evaluation Model.

2. Identifying irrelevant attributes and associated misconceptions that need consideration in crafting of policy statements or designing staff development; and,

3. Determining discrepancies between current levels of understanding and the application of the critical attributes by practicing service providers.

This design provides a structure for answering the previously listed research questions. The three-step Provus (1971) and Markle and Tiemann (1970) processes listed above allowed for filling those gaps identified in the literature review while maintaining the unique and evolving nature of assistive technology. The research design helped provide validated data and information needed by service providers to improve and increase the appropriate access to technology for students with disabilities. If applied, such data help increase the probability that data-based decisions, meeting
students' unique technology needs, become part of the IEP, and are used in developing effective assistive technology policies, and designing and carrying out staff training.

Although the literature review process did not identify any specific examples that used a combination of concept analysis and discrepancy evaluation in the same research design, this approach is appropriate for the identified problem. The two processes are conceptually consistent with the need for effective decision making. The validity of this study in fact increases through the application of a research design that triangulates information.

To the extent the research clarifies and operationalizes concepts and attributes under consideration, the validity of the discrepancies identified increases (Provus, 1971). The concept analysis and discrepancy evaluation processes facilitated identifying valuable and useful information. This information augments the existing literature base and provides information applicable to policy and staff development projects. As Markle and Tiemann (1970) noted, validity and generalizability of the information obtained increase through (a) multistage conceptual analysis, (b) identifying and analyzing critical and irrelevant attributes, (c) validating concept information and processes with multiple sources, and (d) avoiding predictable errors in practices and applications.

Although assistive technology applications are often device or product specific, this study concentrated on generalizable concepts, attributes, and processes. Identifying policies or training materials for specific devices or products for individual
children is often counterproductive. What is productive is identifying generalizable concepts that lead to the appropriate application of assistive technology in multiple and various situations. Once these concepts and their associated critical and irrelevant attributes are identified, additional research can address how to incorporate these concepts into policy statements, IEP procedures, and training programs.

Research Procedures

Concept Analysis

The first step outlined by Provus (1971), agreeing upon standards, was accomplished by conducting a comprehensive concept analysis. This analysis identified key concepts and validated those concepts (Markle & Tiemann, 1970). “Task analysis [concept analysis], regardless of how it is defined, is an integral, probably the most integral part, of the instructional development process” (Jonassen & Hannum, 1991, p 170). The application of a comprehensive concept analysis also provided a solid framework for establishing criterion, content, and construct validity (Cronbach, 1971). This framework provided the basis upon which conclusions were drawn and recommendations were made. The various steps of the comprehensive concept analysis helped establish validity for both the conceptual information base and the development of the discrepancy evaluation instrument.

The information contained in the chart, Support Document for Concept Analysis, in Appendix A, is the result of a thorough review of the literature, public
laws, federal regulations, administrative opinions, and case law associated with assistive
technology. From this information I identified both “Content Validity” and “Legal
Validity” for concepts associated with the appropriate application of assistive
technology in special education (see Appendix A).

Initially this information was grouped into eight or nine concepts with three to
six critical attributes identified for each concept. When it was determined that all
probable concepts and critical attributes were identified and validated, both for content
and legal validity, the crafting process began. The eight or nine original concepts, 30-35
potential critical attributes, and an approximately equal number of potential irrelevant
attributes were individually examined. As they were refined and defined, they were
manipulated, realigned, consolidated, reorganized, rearranged, and crafted into a
comprehensive concept analysis. This crafting process involved expert reviews and
significant input from both focus groups. The results of the concept analysis are
discussed in greater detail in the Chapter IV.

One inconsistency encountered in combining the concept analysis process of
Markle and Tiemann (1970) with the discrepancy evaluation model of Provus (1971)
was in the identification of irrelevant attributes and discrepancies. Markle and Tiemann
identified irrelevant attributes as a part of the concept analysis. Provus identified
discrepancies through comparing performance on some aspect (attribute) of a program
(concept) and the standards set for performance. In this combined research design,
potential irrelevant attributes were identified during the concept analysis. These
potential irrelevant attributes were then compared with the survey data to identify
discrepancies and validate irrelevant attributes. This process is reported in the Chapter
IV.

Focus Groups

The complexity and level of expertise associated with assistive technology
required careful organization of the focus groups. With complex issues, large groups are
unworkable; smaller groups offer opportunities for individuals to talk and are more
practical to set up and manage (Krueger, 1994). Focus groups consisted of six to eight
members for this study.

This study involved two separate focus groups. Focus Group 1, whose
membership is listed in Appendix B, consisted of the Leadership Council of the Utah
Augmentative, Alternative, and Assistive Device Communication Teams (UAAACT).
This group consists of practitioners, special education administrators, and Utah State
Office of Education personnel. The group was selected because their membership
includes individuals with high levels of expertise in the application of assistive
technology in special education.

Focus Group 2, whose membership is also listed in Appendix B, consisted of
members of the Utah Assistive Technology Program’s (UATP) Consumer Council.
This group consists of users of assistive technology, including individuals who use
technology for mobility, speaking and hearing assistance, computer access, and vision
enhancement. This group was selected because they understand the practical
applications of technology and use it on a daily basis. Several members of this group are parents of children with disabilities and have had direct experience with IEPs, especially IEPs in which technology was considered, or was not considered but was probably appropriate for consideration. This group added an important consumer element to the study. Together these two groups provided valuable criterion-related, content, and construct validation.

The focus groups helped validate the concept analysis. Focus groups used their experience and knowledge as providers and consumers in considering criterion-related validity. Content validity was addressed as concepts were examined and critical attributes defined. Several important constructs including appropriateness and environment were also considered for validity. These same activities allowed the focus groups to actively participate in developing and validating procedures for the survey instrument based on the validated concept analysis.

Cronbach (1971) explained that criterion-related (predictive) validity increases through external consideration of the characteristics in question. When the concept analysis reached the point at which eight or nine concepts were identified and 30-35 critical and irrelevant attributes were listed, Focus Group 1 received this information. Their task was to use Cronbach’s (1982) two-phase analysis. The first phase, the divergent phase, intended to generate additional concepts, attributes, questions, issues, concerns, and information needs not included in the current materials, but necessary as part of the concept analysis. Focus Group 1 reviewed the materials and made several
additions. This process helped establish content validity for the analysis. When Cronbach’s first phase was complete, Focus Group 1 used Cronbach’s second phase, the convergent phase, in which they were asked to consolidate, eliminate, or alter any of the information provided. Information received from five members of this group provided valuable information used to help craft and validate Figure 3 (shown later).

Focus Group 2 was approached about their participation in the conceptual analysis and chose not to participate because of their self-reported lack of understanding of the process. They did, however, review the information, apply informal consumer criteria, and provide valuable feedback that further validated the concept analysis. Focus Group 2 took a more active and formal role in the development of the survey instrument. The use of both focus groups is discussed further in the Survey Instrumentation Development section that follows.

**Survey Research**

Like all measurement, survey measurement is not error free. The procedures used to conduct a survey greatly affect the likelihood that the resulting data accurately describe what is intended to be described (Fowler, 1993). Recent developments and the identification of specific research procedures have increased the effectiveness of survey research (Katz, 1993). To assure that validated procedures are followed in conducting the survey associated with this study, two main sources were referenced. Those two sources are *Survey Research Methods* (Sage Publications) by Floyd J. Fowler, last published in 1993, and *Mail and Telephone Surveys: The Total Design Method* (John
Survey Instrumentation Development

Provus's (1971) second step, determining whether discrepancies exist, took place through the application of a comprehensive data collection process. A mail survey, one of the major tools that educational researchers use to gather data, was used (Johnson, 1991; Miller, 1994). A survey instrument was developed with assistance from both focus groups and appropriate steps were followed to establish acceptable levels of validity and reliability. This instrument was designed to gather data on (a) whether service providers understood the concepts and critical attributes identified in the concept analysis, (b) if they agreed with the critical nature of these concepts and critical attributes, and (c) if they actually applied these concepts in the IEP process. The survey instrument was designed so that data gathered from the instrument could be easily and reliably coded and entered in a statistical software program for analysis.

Survey Instrument

A mail survey was selected for the following reasons. Mail surveys are particularly appropriate when working with well-defined populations and special interest groups (Katz, 1993). They are free of interviewer bias and pose no threat to the respondents (Katz, 1993). Threats to the respondents are important in this data collection process because data on attitudes, and actual assistive technology
applications, were sought. Anonymity was felt to be crucial. Mail surveys are also convenient and relatively inexpensive compared to interviews or ethnographic research (Miller, 1994).

To accomplish the goals of this study, the survey instrument was designed to include three sections. Section 1 was designed to assess teachers' understanding and comprehension of the concepts and critical attributes identified in the concept analysis. Section 2 was designed to assess teachers' agreement or disagreement with the critical nature of these concepts and attributes, further establishing criterion-related and content validity for the concept analysis (Cronbach, 1971). Section 3 was designed to measure the actual application of these concepts by examining the implementation of assistive technology. The information garnered from the three sections, especially Section 3, was the basis for identifying discrepancies.

With input from two different sessions with each focus group, the survey was drafted. While in draft stage, it was presented to the focus groups for their review and concurrence. The three sections each contain items specific to the eight critical attributes. This parallel format allowed for using individual sections, from a single administration, to estimate reliability for the survey, and for correlational analysis across the three sections.

Another issue discussed at some length while developing the survey instrument was anonymity. The anonymous survey technique poses several research problems, but, if conducted correctly, actually increases reliability (Fowler, 1993). Follow-ups are
difficult and inefficient because one cannot identify nonrespondents. Some statistical breakdowns of the group are impossible (Borg & Gall, 1989). The essential question was whether anonymity was necessary to obtain accurate responses. This issue came before both focus groups and the consensus was that teachers are more likely to respond accurately and honestly, and the response rate will be higher, if the surveys were anonymous. Thus statistical breakdowns are not available for specific schools or school districts, geographic locations, and so forth. Items on the survey do allow for breakdowns by teaching experience, teacher grade level assignment, students served (i.e., mild/moderate or severe), and teaching assignment (i.e., resource, self-contained, or itinerant).

In surveys, answers are of interest not intrinsically but because of their relationship to something they are supposed to measure. Good questions are reliable (providing consistent measures in comparable situations) and valid (answers correspond to what they are intended to measure). (Fowler, 1993, p. 69)

**Survey item generation.** Items for the survey came directly from the concept analysis. Content and context validated items are found in the table in Appendix A. Multiple items were initially generated to correspond with each of the eight critical attributes (see Figure 3, shown later). Survey items were then discussed at meetings with the two focus groups. During this process, items were rewritten, eliminated, and added. This process increased the content validity of the survey. Survey items included both examples and nonexamples. The complete survey is included in Appendix C.
In addition to the survey items generated to correspond with the concept analysis, 16 additional items were added to collected some descriptive information about the respondents. These items were added in response to suggestions and requests from the focus groups. Although additional items were suggested, the total number of items was limited to 100 to increase the ease of responding and, thus, the return rate.

Validity of instrument. Once a major draft of the survey was completed, multiple steps were taken to systematically examined validity. Borg and Gall (1989) discussed various forms of validity examined in constructing tests, and survey instruments. These validity issues closely parallel validity concerns already discussed.

1. Content Validity is the degree to which the sample of test (survey) items represent the content that the test intends to measure.

2. Construct Validity is the extent to which a particular test (survey) measures a hypothetical construct.

3. Interpretive Validity is the degree to which a test (survey) appears to measure what it purports to measure.

Following approval of a draft survey by the candidate’s committee chair, an additional “expert review” occurred to further substantiate the content and construct validity. The survey was given to two currently practicing special education teachers and they were asked to respond to the following questions recommended in Sage Publication’s *Survey Research Methods* (Fowler, 1993, pp. 94-104):

1. Are the instructions clear and did they provide enough direction to respond to the items?
2. Are the questions clear and do the possible answers allow one to answer each question efficiently and accurately?

3. Are there any problems in understanding the kind of answers expected, or providing answers to the questions posed?

The two “experts” provided written responses to each question. Further verbal discussion of each question also took place. After receiving their initial comments and written suggestions, the concept analysis and purpose for the survey were shared with the reviewers and they were asked to provide additional comments. Suggestions for changes were minimal. The two expert reviewers were comfortable that the survey would achieve its intended purpose. These activities were undertaken to increase assurance that interpretative validity was also adequately addressed.

After making changes according to recommendations from the expert reviewers, the final draft survey went to Focus Group 1, the UAAACT Leadership Council. The purpose of this final review was to further examine the instrument for content, construct, and interpretative validity. These individuals, as members of the focus group that helped in the concept analysis development, were familiar with the concepts associated with this survey. Group members were asked to complete the survey as if they had received the survey in the mail. They were also asked to complete an accompanying questionnaire. Seven of eight members completed the survey and six members completed the questionnaire. With their expertise as the criteria, members responded to 10 questions using a Likert-type scale with 5 = definitely yes, 4 = yes, 3 = probably, 2 = maybe not, and 1 = definitely not. The 10 questions, recommended in
Sage Publication's, *Survey Research Methods* (Fowler, 1993), and the mean scores for the six respondents are in Appendix B.

The mean scores for the 10 questions ranged from 3.50 to 4.83 with only one mean less than 4.50. A review of the data suggests that the UAAACT Leadership Council members were confident that content, construct, and interpretative validity were adequate. At this point it was determined that validity was adequately addressed and that the survey instrument indeed measured what it was designed to measure.

**Reliability of instrument scores.** Estimating the reliability of the instrument's scores from a single administration of the survey to seven members of the UAAACT Leadership Team, and the two expert reviewers, a relatively small sample, was not straightforward but was possible (Traub, 1994). In an ideal situation, the correlation between scores on two parallel tests estimates reliability. However, for this study a split-half technique was used to estimate reliability from a single administration. This technique divides the instrument by odd and even items to create two “half-tests.” The correlation between the scores provides an estimate of the reliability of either half-test. The coefficient of correlation between scores on the half-test were corrected using the Spearman-Brown formula to estimate what the coefficient would have been had two whole tests been administered (Borg & Gall, 1989; Traub, 1994). The assumptions for conducting a correlation are discussed later in this chapter in the section entitled Assumptions for Statistical Procedures.
All surveys were coded and entered by two different individuals to assure accuracy. Complete agreement was found for both the coding and entering of data. The data were entered in an SPSS file and a half-test was run for the 24 items in Section 1.

The Spearman-Brown coefficient for Section 1 for these nine cases is .8397. The Guttman Split Half coefficient for Section 1 for these nine cases is .8394. Table 1 displays the SPSS results when selecting the Statistics-Scale-Reliability Analysis functions for the nine cases of the first 24 variables in Section 1. These coefficients suggest that the survey scores are reliable, and provide fairly consistent measures across comparable situations.

Subjects

Whereas special education teachers conduct most IEPs, this population was the major target of this study. However, as noted previously, data collected from this population can be important to other IEP participants, helping to identify their

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<td><strong>Split Half Reliability for Survey Section 1</strong></td>
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<tr>
<td>Reliability Coefficients</td>
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<tr>
<td>Correlation between forms = .7237</td>
</tr>
<tr>
<td>Equal length Spearman-Brown = .8397</td>
</tr>
<tr>
<td>Guttman Split-half = .8394</td>
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respective roles in the application of assistive technology. This study has application for all those involved in the IEP, including teachers, parents, school administrators, LEA representatives, SEAs, and those individuals providing assessment and evaluation services.

**Identification of Subjects**

The estimated number of special educators employed in Utah and certified by the Utah State Office of Education (USOE) is approximately 2,300. This number does not include speech language pathologists, school counselors funded under special education, school psychologists, physical therapists (PTs), or occupational therapists (OTs). Listings of OTs and PTs are not even maintained by USOE because licensing for these professions is not handled by USOE.

Although a larger service provider population was available, this study surveyed only special education teachers. Special education teachers are those individuals primarily responsible for initiating, conducting, and reviewing IEPs. PTs, OTs, speech language specialists, and so forth, are often included on IEP teams but are generally viewed as itinerant team members. Also, the research suggesting that the effective use of a mail survey necessitates working with a well-defined population (Katz, 1993) was a factor in narrowing the study population.

In Utah, approximately 100 service providers are part of the Utah Augmentative, Alternative, and Assistive Communication Teams (UAAACT teams). These providers include special education teachers, PTs, OTs, speech/language
It was the leadership of this group that comprised Focus Group 1. These teams have been in existence since 1988 and have considerable experience with some types of assistive technology. As a result of their different experience, it was decided not to include them in the sample. This decision was made with input from Focus Group 1.

The next consideration was sample size. Several factors were considered in making this decision. The intent was to have a sampling of at least 10% of the population. Sampling 10% or more of a population increases the ability to generalize from a sample to a population (Fowler, 1993). In addition, confidence ranges for variability attributable to sampling increases steadily up to sample sizes of 150 to 200. After that point, there is a much more modest gain when increasing sample size (Fowler, 1993). Ten percent of the population results in a sufficient number, exceeding the 200 base figure. The other factor included the need to allow for adequate representation from various special educator subgroups, that is, hearing impaired, visually impaired, mild/moderate, severe emotionally disabled, severe intellectually disabled, and so forth. After considering all these factors, a sample size of 250 was selected.

The Utah State Office of Education (USOE) maintains listings of teachers according to their certification, endorsements, and current teaching assignments. Historically, special education teachers have had assignment codes of Resource, Severe Handicapped, Severe Handicapped IH, Severe Handicapped EH, Severe Handicapped LD, Visually Handicapped, or Hearing Handicapped. However, USOE was in the
process of changing all Resource assignment codes to Mild/Moderate and all Severe
codes to a single Severe code. Because USOE was in the middle of this change, it was
necessary to use the two different assignment codes to identify all teachers currently
working in the schools. Following several conversations with people in the At Risk
Students Division and the Certification and Personnel Divisions at USOE, it was
determined how to obtain the most comprehensive listing of classroom special education
teachers responsible for developing IEPs. A request was made for a listing of all
personnel with assignment listings for Visual, Hearing, all Severe categories, and both
Mild/Moderate assignments and Resource assignments. USOE provided this
comprehensive listing of 2,220 special educators, without duplication of names.

Sampling Procedures

Table 2 shows the number of mailing labels received from USOE, the number of
teachers selected from each category and the percentage of names used in the survey.

Stratification of the sample was based on the following:

1. All teachers listed as current members of UAAACT teams were eliminated
from the sample because their additional experience with implementing assistive
technology is different from other teachers.

2. A minimum of 15 teachers in each category was selected to assure adequate
representation from each category.

3. All teachers, except those who are members of UAAACT, with Visual and
Hearing assignments were included because the population size was so small.
4. To assure adequate representation, 10% of the Severe IH category was selected.

5. The remaining slots, up to 250, were filled by selecting an equal percentage (9.1%) from the Mild/Moderate and the Resource categories.

After deciding on the number to survey from each category, the random sampling of the acquired mailing labels was accomplished by dividing the labels into

Table 2

<table>
<thead>
<tr>
<th>Current Assignment</th>
<th># of Names on USOE List</th>
<th># of Surveys Sent</th>
<th>% of Names Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hearing Impaired</td>
<td>19</td>
<td>17</td>
<td>89</td>
</tr>
<tr>
<td>Visually Impaired</td>
<td>17</td>
<td>15</td>
<td>88</td>
</tr>
<tr>
<td>Mild/Moderate</td>
<td>416</td>
<td>38</td>
<td>9</td>
</tr>
<tr>
<td>Resource</td>
<td>1208</td>
<td>110</td>
<td>9</td>
</tr>
<tr>
<td>Severe</td>
<td>106</td>
<td>15</td>
<td>14</td>
</tr>
<tr>
<td>Severe EH</td>
<td>115</td>
<td>15</td>
<td>13</td>
</tr>
<tr>
<td>Severe IH</td>
<td>254</td>
<td>25</td>
<td>10</td>
</tr>
<tr>
<td>Severe LD</td>
<td>85</td>
<td>15</td>
<td>18</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>2220</strong></td>
<td><strong>250</strong></td>
<td><strong>11</strong></td>
</tr>
</tbody>
</table>
individual labels, placing all labels in paper sacks according to the stratification outlined in Table 2, and randomly selecting labels from the sacks, one at a time.

Collection and Analysis of Data

Steps Taken to Improve Response Rates

A comprehensive review of the literature on mail surveys and response rates, and conversations with others who have conducted mail survey research in the past, led to the identification of several things designed to increase the response rate. The response rate is largely under the control of the researcher (Boser & Clark, 1993; Fowler, 1993; Katz, 1993). The following items were considered to increase the response rate:

1. Preliminary Letter—Although the research is mixed, most references reviewed suggested that response rate is not improved by sending a preliminary letter and it increases the cost per response (Boser, 1990). A preliminary letter was also not necessary since a main purpose of a preliminary letter is to identify bad addresses and undeliverable questionnaires. Knowing that the addresses provided by USOE are for schools, no preliminary letter was sent.

2. Characteristics of the Respondents—Although this was not a controllable variable, response rates were expected to be high because educated persons, those with more experience with the subject, and those with strong interest in the subject are more likely to respond (Johnson, 1991; Katz, 1993).
3. Appropriate Appeal in Cover Letter--The review of the literature led to considering several items in composing the cover letter: (a) lacking the authority to require a response, the cover letter was written from a colleague position; (b) the cover letter suggested that the responses would influence the allocation of resources; (c) the letter indicated the amount of time required to complete the survey; and (d) the letter attempted to show the value of each individual response (Grosset, 1994). A copy of the cover letter is in Appendix C.

4. Length and Form of the Survey--The review of the research found that response rates begin to decrease if surveys are more than three to five pages in length (Green, Jacobi, Lam, Boser, & Hall, 1993). Conversations with others, and the two focus groups suggested that the length should be as short as possible but long enough to gather needed data. This survey is three pages in length.

5. Incentive to Respond--The literature is consistent in that incentives increase response rates. Miller (1994) reports an increase of 8.8% in the overall return rate for those who received an incentive. Each survey included a nice ballpoint pen as a token of appreciation for participation. The anonymity of the survey necessitated an up-front reward.

6. Confidentiality and Anonymity--As discussed previously, all responses were confidential and respondents remained anonymous. Most respondents prefer anonymity and confidentiality (Katz, 1993).
7. Follow-up--A review of the research is conclusive about the value of some type of follow-up in improving response rates. Boser (1990) reported that sending a reminder improved response rate by 8.8%, and that a reminder is more effective and less expensive than a preliminary letter. Follow-up letters and monetary incentives are the best techniques for increasing response rates (Katz, 1993). Because of the anonymity of the responses, the follow-up letter for this survey was sent to all members of the sample. Therefore, the letter thanked those who had already responded, and encouraged those who had not responded.

8. Timing of Follow-up Letter --The literature review was inconclusive concerning the timing of the follow-up letter. Time restraints with the end of the school year required sending the letter after one week, although sending a reminder after 2 weeks may have been more effective (Boser, 1990).

9. Salience--Response rates increase if the survey looks different from other surveys. The survey was printed one sided, on color paper, with the pen included in the initial mailing.

Mailing of Survey

All of the surveys, along with a cover letter (see Appendix C), a self-addressed, stamped, return envelope, and a ballpoint pen were sealed in envelopes and delivered to USU campus mail service on May 12, 1995. All surveys were delivered on the same date to access bulk rates, realizing considerable savings. The surveys actually left USU campus mail service on May 16 and 17, 1995. On May 19, 1995 the follow-up letter
(see Appendix C) was written to all who received the initial survey. This letter left USU campus mail service on May 22, 1995.

Conversations with several people who had previously conducted mail surveys with educators suggested that this was a poor time of year to be asking teachers to respond. However, the nature of many questions makes a response near the end of the year logical. Teachers were asked to respond as to their actions concerning assistive technology during the past year. The need for accuracy and awareness in reporting year-end information offset the request for information during an often busy and chaotic time of year.

Coding of Data

An item-by-item code description was developed (see Appendix C). This description contained the item number, a description of the variable, the type of data the variable produced, and a detailed description of how to assign numeric values to each survey item. This code description outline was shared with all involved in the coding process.

The first 75 surveys returned were coded using the code description outline and a one-page coding sheet. This one-page sheet (see Appendix C) presents numeric responses to each of the 100 survey items. Items coded include the 95 items on the survey plus the survey number, the date the survey was received, whether the survey was received in the self-addressed envelope or not, and a numeric value for a "noise
factor” indicating what Stanley (1971) referred to as the “logical and empirical aspects” of reliability (see Reliability of Data section in Chapter IV).

Twenty percent of these first 75 surveys returned (15 total surveys) were then randomly selected using a table of random numbers and coded by a second person. Agreement was 100% on 11 of the 15 surveys compared, 3 surveys had one item of disagreement, and 1 survey had two items of disagreement. Of the 100 items coded for each survey, agreement was 100% for 96 of the 100 items, 3 items had one disagreement, and 1 item had two disagreements. The item with two disagreements was then recoded on an additional 15 randomly selected surveys and no additional disagreements were found. Only five disagreements were found in the 1,500 items recoded, for a disagreement rate of .00333. Such a low rate of disagreement helped substantiate the reliability of the coding process.

**Entering Data**

When all 191 surveys were coded, the data were entered into the SPSS program. Accuracy of the data entry was examined by randomly selecting 10% of the entries (19 surveys) and checking the entered data against the code sheet. This was accomplished by reviewing the numbers in the SPSS program as the code sheet was read verbally. Agreement with 17 of the surveys was 100% and agreement with the 2 remaining surveys was 99%. The data were determined to have been entered accurately with only three errors identified in the 1,900 items checked for an error rate of .0016 or an accuracy rate of 99.84%.
Analysis of Data

Differences between means were analyzed with \( t \) tests. Pearson product moment correlations were calculated to determine relationships. These analyses were accomplished using SPSS for Windows, Release 5.0.1. SPSS is a comprehensive and flexible statistical analysis and data management system that has the capabilities to generate tabulated reports, charts, and plots of distribution and trends; descriptive statistics; and complex statistical analyses.

The data collected were analyzed to identify trends and differences between established criteria and current knowledge levels and practices. The information collection and analysis process provided data necessary to identify and validate discrepancies between best practices and current practices and to prioritize needs for training and policy development. Information of this nature can make a contribution to the knowledge base and help in policy and staff development processes.

In addition to reporting the results, the intent of this dissertation was to develop easy-to-follow conclusions and recommendations that those persons involved in the IEP process can apply to assure that, when appropriate, assistive technology is incorporated into the IEP.

**Statistical and practical significance.** Both statistical and practical significance were estimated as part of the data analysis. Given the relatively large \( N \) size (\( N = 191 \)) in many situations, minimal importance was given to statistical significance. Probability (\( p \)) values resulting from \( t \) tests and correlations are reported and interpreted as the
probability of achieving differences or correlations as large or larger than those calculated from this sample when the null hypothesis is true, with continued random sampling, using the sample size of 191.

Educational or practical significance was estimated by calculating standardized mean difference effect sizes and interpreting correlation coefficients as effect sizes. Effect sizes are statistics that are independent of N sizes and are comparable across studies. When looking at mean differences, a standard mean difference effect size was calculated. The denominator used for the standardized mean difference were pooled standard deviations for the t tests. Pearson product moment correlations were calculated for some analysis.

Determining a standard for the importance of an effect size is difficult. There have been few studies about teachers’ attitudes toward assistive technology, and none of the research I reviewed reported effect sizes. The U.S. Department of Education Joint Review Panel considers standardized mean difference effect sizes as low as .25 to be important with achievement tests (Tallmadge, 1977). Cohen (1988) suggested an effect size (mean difference) of .2 might be used with new research, but that it takes an effect size of .5 for an obvious (can be detected by the naked eye) difference. It is best to make conclusions on obvious differences; however, I did not set a priori standards for statistical or practical significance. I reported both p values and effect sizes and left it to the reader to judge the appropriateness of my conclusions.
Cohen (1988) also considered .30 to be a medium effect size when considering correlation coefficients. This is relatively small considering the associated $r^2$ is .09. In other words, there is 9% common variance between the two variables. With respect to correlation coefficients, $r^2$ values were reported and interpreted in terms of common variance.

Assumptions for statistical procedures. Likert-type scales or dichotomies were used with the questionnaire items to collect data (see questionnaire in Appendix C). When means for individual scores, subgroup scores, or total scores are calculated from these scales, the mean scores are typically considered as continuous scores. The grouping of scores according to subgroups allowed for analysis of the data gathered relating to the concept analysis.

I believe that all assumptions associated with the various statistical procedures were met. The population sampled should have a normal distribution and scores were obtained from independent random samples. Homogeneity of variance was assumed. All correlation coefficients are calculated using paired scores, from at least interval data. An examination of scatter plots for correlations approximated rectilinear relationships.
CHAPTER IV
RESULTS AND DISCUSSIONS

This chapter contains results and discussions of (a) the concept analysis, (b) the focus groups, and (c) the survey. The identification of these results was essential to accomplishing the final step in Provus’s (1971) model, “using information about discrepancies to make decisions” (p. 48). Conclusions and recommendations for improvement, based on the concept analysis, will incorporate viewpoints garnered in the focus groups, and data gathered in the survey.

Conceptual Analysis

In this study, the concept analysis process resulted in what Provus (1971) called, “agreeing upon standards” (p. 46). A set of “agreed upon standards” was something that was not found in the reviewed literature. These standards, concepts, and attributes, validated by the concept analysis, focus groups, and survey data, facilitate increased applications of technology, effective policy development, and the identification of instructional strategies for staff development recommendations (Tennyson & Cocchiarella, 1986).

The conceptual analysis of the appropriate role of assistive technology in the education of students with disabilities involved multiple steps, a crafting process, and was cyclic in nature. Successive modifications were evaluated against both the literature and consultant reviews.
Content Validity

A review of the literature, as summarized in Chapter II, on the appropriate application of technology for students with disabilities provided content validity for examining the role of assistive technology for students with disabilities. This review of more than 50 articles, books, conference reports, and training documents resulted in the identification of the salient content items. These items form the basic content of the concept analysis and are listed in the “Content Validity” column of the table in Appendix A.

Validity via Legal Literature

In the process of conducting a literature review to establish content validity, public laws, federal regulations, administrative opinions, and case laws were also reviewed (see Policy Letters and Legislation section in Chapter II.) The intent of this review was to assure consistency between content items and legal definitions and opinions. It was also necessary to establish a legal framework for studying the appropriate application of technology in the IEP. Because of the litigious nature of special education services, conclusions and recommendations for application must have a substantial legal foundation. The emerging nature of assistive technology has generated substantial legal opinions. The major sources for current legal opinions are Office of Special Education Programs (OSEP) opinion letters and lower court decisions. Assistive technology cases have not yet found their way through the time-extensive
court system to District Courts or the U.S. Supreme Court. Legal information is listed in the “Legal Validity” column of the table in Appendix A.

Identification of Concepts

With a framework of content and legal validity established, identification of specific concepts began. Markle and Tiemann (1970) refer to a concept as “... a class the members of which share some properties in common. It is these shared properties that enable the learner to generalize to new examples” (p. 5). As noted previously, the evolving nature of assistive technology, and the complex array of services and devices available, requires that special education service providers understand concepts. They can then generalize their understanding of concepts to the application of specific technology devices and services (Markle & Tiemann, 1970).

Initially, three to six critical attributes and two to four irrelevant attributes were identified for each subconcept. Many of these attributes were duplicative and repetitive across subconcepts. With all probable attributes for each subconcept identified, both content and legal validity were established for each of the critical attributes. At this stage the crafting process truly began. The first attempt at graphically representing the conceptual analysis resulted in a confusing array of circles, boxes, and lines. The major concept of assistive technology was in the middle, seven subconcepts surrounded the major concept, and 26 critical attributes surrounded that. Lines connecting everything to show relationships crossed one another and went in every direction. Additional crafting was clearly necessary. The final graphical presentation is Figure 3.
The major concept is the application of assistive technology in a special education context. Beyond this major concept, four subconcepts were identified. These subconcepts are technology, function, appropriateness, and environment. Each subconcept is a descriptor of the major concept. These subconcepts are consistent with the literature, and legal opinions support them. The identification of a major concept and associated subconcepts was the first step in the concept analysis crafting process.

With the major subconcepts identified, the process of identifying critical attributes and irrelevant attributes for each subconcept began. For example, one critical attribute of assistive technology is that “assistive technology increases a student’s functional abilities.” By definition, if the technology does not accomplish this, it is not assistive technology. An example of an irrelevant attribute is that “assistive technology is always high tech.” Although some assistive technology involves computers and other complex electrical and mechanical devices, assistive technology may also be as simple as a pencil grip, a strip of velcro, or a button hook.

The results are summarized in Appendix A, and in Figure 3 and are described below in greater detail. Figure 3 presents three conceptual levels:

1. the major concept of assistive technology as defined in IDEA,
2. four major subconcepts, and
3. critical attributes of each subconcept.

The first level defines assistive technology in a special education context. This definition, contained in the Individuals with Disabilities Education Act (IDEA), is
Conceptual Analysis of the Appropriate Role of Assistive Technology in the Education of Students with Disabilities

The term assistive technology means any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified or customized, that is used to increase, maintain, or improve functional capabilities of children with disabilities. (IDEA - 34 CFR § 300.5)

**ASSISTIVE TECHNOLOGY**
In a Special Education Context

- **Technology**
  - Includes an item, piece of equipment, or product system
  - Extends abilities...to reach farther...promotes efficiency or increases accuracy

- **Function**
  - Provides educational benefit as defined in statutory and case law
  - Meets the unique needs identified in the student's IEP

- **Appropriate**
  - Considers the student's acceptance and comfort with the device
  - Maintains or increases the social acceptance and personal dignity of the student

- **Environment**
  - Facilitates student's successful placement in the least restrictive/most inclusive environments
  - Assures that the device provided is based on student priorities rather than existing environmental resources

**Figure 3.** Conceptual analysis of assistive technology in special education.
consistent across all special education programs. IDEA also contains a definition of Assistive Technology Services (IDEA - CFR § 300.6). This definition, found on page 3, has applications within this conceptual analysis.

The second level of the concept analysis presents four major subconcepts: technology, function, appropriate, and environment. These four subconcepts are all important to the appropriate application of assistive technology. Bowser and Reed (1995) and Zabala (1995) found that appropriate applications of assistive technology will be more effective if multiple factors (concepts) are considered in the decision-making process. Bowser and Reed, and Zabala identified concepts parallel to these four. However, they also considered the “student” as a separate concept. For this analysis, the student was not considered as a separate subconcept but each subconcept addresses its relationship to the student. Eliminating the students as a separate subconcept, and incorporating the student as an integral part of the remaining subconcepts eliminated much of the repetitiveness and duplication mentioned above.

**Technology.** When considering the appropriate application of technology for a student in special education, the technology should increase the student’s functional abilities, be appropriate in its complexity, and allow increased access to other already available technology. To qualify as assistive technology in an IEP, those increased functions must relate to the student’s education. When examining technology, it is important to distinguish between (a) technology necessary for the student to receive a free appropriate public education (FAPE), (b) technology that may be helpful but not
necessary, and (c) medically necessary technology. Local education agencies (LEAs) are not required to provide technology that is not necessary for FAPE. Medically necessary technology may be necessary for the student to maintain life functions, but not be needed for the student to benefit from special education services. Such technology may not be appropriate for inclusion in the IEP.

It is also important to note that the sophistication or complexity of technology is not a determinant of its appropriateness. "Low-tech" devices may be as necessary and appropriate as "high-tech" devices. Assistive technology may also be a piece of a greater technology system, for example, software or hardware that allows a student access to already available computers or other technology that is part of the curriculum.

**Function.** The concept of "function" is based on the individual and unique needs of each student. In this definition, technology "functions" only if it meets the unique needs of students and allows them to benefit from their "individualized" education programs. A motorized wheelchair may allow a student with quadriplegia to move from room to room and "function" in a school. A screen magnifier may allow a student with vision impairments to "function" at a computer. A modified pencil may allow a student to write legibly and "function" during a spelling test. Each of these examples increases functional abilities. Initially, personal items such as hearing aides and eyeglasses, items needed for an individual to do "personal functions," were not considered as assistive technology. However, recent OSEP opinion letters reported that both these items may now be considered as assistive technology and schools may need
to provide them if the IEP team determines that the child requires them to receive FAPE (T. Hehir, personal communication, November 19, 1993; T. Hehir, personal communication, January 13, 1995).

**Appropriate.** When considering whether a piece of technology is appropriate, it is necessary to examine the students’ comfort level with the technology and if the technology affects students’ personal dignity or social acceptance. A piece of technology that lessens students’ social acceptance is likely to be abandoned (Galvin & Phillips, 1991). Phillips and Zhao (1993) found that the primary reason for technology abandonment was the lack of consideration of the user’s opinions, and the individual never feeling comfortable with the device. Assistive technology, although functional, may not be appropriate if students do not believe that it increases their personal dignity or social acceptance.

**Environment.** It is important that students’ needs, and students’ technology-enhanced functional abilities, not the environment, determine technology use. Too often the opposite occurs and the environment determines the student’s use of technology. Often, students have opportunities to use certain technology only if their placement is where the technology is available. For example, students with disabilities have opportunities to use a computer when in “resource classrooms” but accommodations are not made for computer usage in their “inclusive classrooms.” Use of technology may also be inappropriately determined by the student’s classification. For example,
only students classified as "severe" and placed in a "self-contained" classroom may have access to a computer with voice output.

Applications that allow students to be placed in the LRE are factors often overlooked when considering assistive technology. A nonverbal student, who with the use of a communication board can function successfully in a regular classroom, should not be placed in a more restrictive environment based on the unavailability of technology. The consideration of technology, as a means of moving students to a LRE, is a major issue yet to be addressed adequately in the literature, or by the special education legal review system.

The third level of Figure 3 presents critical attributes of the four subconcepts of assistive technology. Although these critical attributes contain some concepts that could be further defined and isolated, knowledge of these attributes as listed allows those involved in the IEP process to make appropriate decisions concerning assistive technology. Table 3 contains brief descriptions of the eight critical attributes. These brief descriptions, along with a more indepth descriptions follow:

Technology #1--it includes any item, piece of equipment, or product system. By definition, assistive technology must be technology. As technology, the device may be an item (i.e., a computer, communication board, or mobility device), a piece of equipment (i.e., a walker, magnifying glass, or tape recorder), or a product system (i.e., software for a computer, an alternate input/output device, or a talking calculator).
Technology #2--it extends ability to reach farther, promotes efficiency, or increases accuracy. By definition, the technology must increase, maintain, or improve the functional capabilities of the student. Schools are concerned with a student’s ability to read, write, calculate, interact with peers, become positive members of society, etc. Technology that allows students to perform these functions, or perform them with more speed, accuracy, consistency, ease, etc., is assistive technology.

Function #1--it provides educational benefit as defined in statutory and case law. By law, schools are required to provide special education services that allow students to benefit from their schooling. Although the term “benefit” is not clearly defined, we do know that schools are not required to provide optimal educational services, but minimal or no services are also not acceptable. We also understand that schools are required to provide educational services and that most medical services are not required to be provided by schools.

Function #2--it meets the unique needs identified in the student’s IEP. As part of the student’s Individualized Education Program (IEP) the school must assess qualified students’ needs, and provide a program of services designed to meet the unique needs of the student. Assistive technology may be part of the assessment process and should be considered on a case-by-case basis in developing the student’s IEP.

Appropriate #1--it considers the student’s acceptance and comfort with the device. Research studies list the main reason for technology not being used is that the user of the technology never accepted the device and was not comfortable with the
device. Technology use should be based on input from the student who will be using
the device as well as the professional expertise available.

Appropriate #2—it maintains or increases the social acceptance and personal
dignity of the student. By nature, technology may be personally intrusive. Priority
should be given to eliminating the personally intrusive nature of the device and assuring
personal dignity. Technology, especially technology that facilitates communication and
accessibility, provides avenues to increased social acceptance.

Environment #1—it facilitates students’ successful placement in the least
restrictive/most inclusive environments. By law, assistive technology may be provided
as special education services, as a related service, or as a supplementary aid. Assistive
technology as a supplementary aid may allow a student to remain in the regular
education classroom. Even if the technology does not improve a student's functional
capabilities, it may be provided to allow a student to function in a more inclusive
environment.

Environment #2—it assures that the device provided is based on the student
priorities rather than existing environmental resources. The provision of assistive
technology is based on the needs of the student. Neither the environment nor the
classification of the student determines the use of technology. Technology may be as
appropriate in a regular classroom as in a self-contained classroom. Technology may be
as appropriate for a student with mild disabilities as for a student with multiple and
profound disabilities.
This conceptual analysis provides a well-documented framework on which to base appropriate applications of assistive technology. The critical attributes have application in the writing of assistive technology policies, training special education service providers, and developing procedures to facilitate the appropriate application of assistive technology in the IEP.

External Validation of the Concept Analysis

The research design incorporated focus groups to validate initial study activities. Triangulation, between the author's work and the two focus groups increased the reliability and validity of the concept analysis. Validation of the process, and product, during the development phase was accomplished using the focus groups. Contact with other professionals in the field following completion of the concept analysis further validated the process and content of the concept analysis.

This concept analysis of assistive technology in a special education context was completed in May 1995. Since then, several other published papers have contained results that validate the findings of this concept analysis. Table 3 compares the major concepts identified in this concept analysis with major concepts identified in other publications. This analysis validates the concept analysis findings by comparing them with other current research. Arthur Strahler (1992), in his book Understanding Science: An Introduction to Concepts and Issues, outlines several norms developed by Robert K.Merton that are central to the ethos of science.
Table 3

<table>
<thead>
<tr>
<th>Study</th>
<th>Technology</th>
<th>Function</th>
<th>Appropriate</th>
<th>Environment</th>
<th>Individual</th>
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<td>Missouri Dept. of Ed., 1995</td>
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<td>Goodman, 1995</td>
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One of these norms, *communality*, reports that findings made by one scientist must be shared freely and openly with the entire scientific community. Additionally, Strahler quotes philosopher John Zimmermann’s proposition “Science is Public Knowledge” in which he wrote:

Science is not merely published knowledge or information. Anyone can make an observation, or conceive a hypothesis, and if he has the financial means, get it printed and distributed for other persons to read. Scientific knowledge is more than this. Its facts and theories must survive a period of critical study and testing by other competent . . . individuals, and must have been found so persuasive that they are almost universally accepted. The objective of science is not just to acquire information . . . its goal is a consensus of rational opinion over the widest possible field. (p. 120)

In August 1995, I attended an Educational Technology Conference in Orlando, Florida and initiated Zimmermann process of “critical study and testing.” Two papers
were presented at this conference that helped validate the concept analysis described above. The first paper was “SETTing the Stage for Success: Assistive Technology and Students with Mild Disabilities” by Joy Smiley Zabala, M.Ed. In this paper, Ms. Zabala identifies the “SETT Framework.” Ms. Zabala reported: “To make effective assistive technology decisions . . . information about the Student, the Environment, the Tasks, and the Tools must be gathered and thoughtfully considered, revised, and acted upon by a multidisciplinary team” (p. 3). Ms. Zabala’s SETT framework varies slightly from the “technology,” “function,” “appropriate,” and “environment” framework of this study, but the content and constructs parallel and validate each other. Personal discussions with Ms. Zabala further substantiated the content validity of this concept analysis. At this same conference, Dr. Penny Reed presented an article published in The Journal of Special Education Technology (Spring, 1995) entitled “Education TECH Points for Assistive Technology Planning.” Here again, personal conversation with Dr. Reed further substantiated universal acceptance of the concepts and critical attributes identified in this study’s concept analysis.

Besides the two items above, several programs associated with the Technology Related Assistance for Individuals with Disabilities Act (Tech Act) have recently published materials addressing the appropriate application of assistive technology for students with disabilities. Susan Goodman (1995) with the Assistive Technology Funding and Systems Change Project in Washington, D.C. recently distributed an article entitled “Assistive Technology Devices and Services in Special Education.” In this
article she addresses the need for effective evaluations and discusses areas of evaluation. The areas of need identified include appropriateness, the environment, the functional ability of the child, and the technology available. The Connecticut and Missouri Assistive Technology Projects have both recently published assistive technology guides. A review of these guides finds that they identify critical components as technology, environment, functionality, individuals, and appropriate use of technology.

The above-listed triangulation and *communality* processes support the validity of this concept analysis. The process of scientific review will continue with the publication of this dissertation and the generation of publishable journal articles. “Critical study and testing” of this concept will be ongoing. This scientific process of universal acceptance not only contributes to the knowledge base but also establishes a foundation from which to meet the needs of students with disabilities to a greater extent.

**Focus Groups**

As noted in Chapter III, two different focus groups helped in this study. Focus Group 1 consisted of the UAAACT Leadership Council. Focus Group 2 consisted of members of the Utah Assistive Technology Program’s (UATP) Consumer Council. Membership lists for both groups are in Appendix B.

Focus Group 1 was involved in the development of both the concept analysis and the survey instrument. Besides providing ideas for the survey development, they were also an initial test group for the survey. Their involvement in the survey process
was explained in the Chapter III and in the assessment data found in Appendix B. Focus Group 2 was involved in the concept analysis and the development of the survey instrument. They also reviewed the survey but decided it was of little value for them to complete it.

The focus groups proved to be an efficient and meaningful method of obtaining additional input to the process. Both groups offered valuable suggestions and provided information that influenced final products. However, their greatest value was in validating both process and content of the conceptual analysis and the survey instrument. The following results are noted:

1. Whereas both groups are ongoing groups, their functioning as focus groups for this study was an efficient method of obtaining important and valuable input.

2. The focus groups played an important role in developing and validating both the concept analysis and the survey instrument.

3. Both focus groups were consistent in their validation of the process and contents, and provided valuable triangulation across group functions.

4. The consistency between groups, and their consensus regarding the concept analysis increase the strength of the research design and the validity of the findings.

Both focus groups strongly influenced the development of the concept analysis, and the survey instrument. Their conclusions and opinions are important and reflect their divergent views. The final activity of the focus groups was a presentation to them of the conceptual analysis as contained in Figure 3 and Appendix A. Both groups
completed a short questionnaire asking for their assessment of the process and the products. The short questionnaire was completed at the end of the final focus group sessions. For the final sessions, Focus Group 1 had seven members present and Focus Group 2 had six members present. The table in Appendix B presents summary data for the questionnaire. From these data it was concluded that:

1. Both groups were actively involved in the process and felt they influenced the outcome.

2. Both groups agreed with the concept analysis findings and agreed that the findings are valuable.

3. Both groups expressed concerns that the populations they represented did not understand the concepts included.

4. Focus Group 1 expressed concerns with encouraging additional applications of assistive technology without allocating additional resources.

Consistency across both groups further validates the concept analysis and increases the strength of the research design.

Survey

Instrument Validity

Chapter III describes the processes and steps taken in examining the criterion-related, content, construct, and interpretive validity of the survey instrument. Each
step, including the initial content reviews, the experts' reviews, and the two focus groups' reviews helped substantiate the validity of the survey instrument.

**Survey Instrument Reliability**

The reliability of the survey instrument was determined by examining several factors associated with the survey. The following sections will discuss (a) response rates, (b) respondent demographics, and (c) statistical reliability. Data reliability resulted from statistically analyzing survey "noise factors," split-half coefficients, and various correlations within the data.

**Response rates.** When conducting surveys, a high response rate is always desirable (Boser, 1990). Researchers consistently identify bias due to nonresponse as a major disadvantage of mail surveys (Aikens, 1990; Miller, 1994). The literature suggests that as people have increasing demands on their time, they become less willing to cooperate and respond. Therefore, the return rate of surveys has declined (Clark & Boser, 1993; Johnson, 1991).

Babbie (1990) reported that a response rate of 50% was generally adequate for analysis and reporting. A response rate of 60% is considered good and 70% or higher is in the very good category. Return rates for mail surveys vary from 10% for the general population to as high as 80% for a well-motivated group (Katz, 1993). Goyder (1987) collected data on 385 mail surveys in the U.S.A. and Canada between 1930 and 1980. On average, the response rate for mailed questionnaires was 58.4%. For a general population sample without appropriate follow-up procedures, the return rate is likely
to be < 50% (Katz, 1993). Edith de Leeuw (1992) examined various data collection methods and arrived at a mean response rate for educational mail surveys of 68%. The Office of Management and Budget for the federal government, which reviews surveys done under federal contract, generally asks that procedures be likely to yield a response rate of 70% (Fowler, 1993).

The response rate for the survey associated with this study was 76.4%, 250 surveys sent, 191 returned. This is considered very high for a mail survey with minimal follow-up. The high response rate supports the reliability of the findings.

Demographics of respondents. Table 2 in Chapter III presents information on special education teachers in Utah. Information was listed by USOE category, the number of surveys sent in each category, and the percentage of names used. The data in Table 4 show the number of surveys sent, the percentage this number represents of the total surveys sent, the number of surveys returned, the return rate, and the percentage for each category of the total surveys returned.

Although the return rate varies from 60% to 83%, the percentages of the total surveys returned parallel the percentages of the total surveys sent. These data substantiate that the respondents represent the stratified population sampled and helps verify the sampling procedures. Specific conclusions regarding the students that survey respondents work with may be problematic because 16% of the respondents indicated that their main assignment was either a combination of the variables offered, or another assignment not listed on the survey.
Table 4

<table>
<thead>
<tr>
<th>Assignment as Self-Reported</th>
<th>Surveys Sent</th>
<th>% of Total Sent</th>
<th>Surveys Returned</th>
<th>Return Rate %</th>
<th>% of Total Returned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hearing or Visually Impaired</td>
<td>32</td>
<td>13</td>
<td>19</td>
<td>69</td>
<td>10</td>
</tr>
<tr>
<td>Mild/Moderate or Resource</td>
<td>148</td>
<td>59</td>
<td>106</td>
<td>83</td>
<td>55</td>
</tr>
<tr>
<td>Severe</td>
<td>70</td>
<td>28</td>
<td>36</td>
<td>60</td>
<td>19</td>
</tr>
<tr>
<td>Other/Combination</td>
<td>30</td>
<td></td>
<td>30</td>
<td></td>
<td>16</td>
</tr>
<tr>
<td>TOTAL</td>
<td>250</td>
<td>100</td>
<td>191</td>
<td>76.4</td>
<td>100</td>
</tr>
</tbody>
</table>

Note. All surveys were sent within the three assignments listed, however 30 of the respondents self-reported on the survey that their assignment was something other than, or a combination of two or more of the categories.

Logical and empirical reliability. Figuring reliability for data collected using survey research methods is often difficult (Fowler, 1993). Referring to educational and psychological measures involving people responding to surveys, Traub (1994) stated that “classical reliability theory cannot be used to identify the flaws in the measuring process . . .” (p. 3). Julian Stanley (1971) stated: “In many discussions of reliability determination, the lion’s share of attention is devoted to the statistical techniques involved. Much attention also needs to be given to the logical and empirical aspects” (p. 359). Examination of logical and empirical aspects, response rate, and the quality of the responses received indicate that the data collected in this survey is reliable.
Although survey research presents some inherent concerns, there are also advantages to this type of data collection.

1. Survey research allowed for physical access to the entire population.

2. Mail surveys often increase the quality, and representation, of the population (Fowler, 1993). No one was forced to complete the survey; therefore, there were no forced answers.

3. Responses were totally anonymous. Self-reporting decreased the possibility of interviewer error or bias in recording responses (Fowler, 1993).

4. Respondents had time to give thoughtful answers and to look up records if needed (Fowler, 1993).

5. Responses were unbiased if an adequate return rate was attained (Johnson, 1991; Miller, 1994). Fowler (1993) noted that as response rates increase, reliability increases also.

Substantiation of the reliability of the data increases the generalizability of the findings. Although some of the threats to reliability that are easily controlled in some research designs are lost, the natural environment in which the study was conducted increased the generalizability of the results.

Although there is no agreed-upon minimum standard response rate to insure reliability (Fowler, 1993), a comparison of the response rates found in the literature, with the 76.4% response rate for this survey, leads to positive conclusions. Using response rate as a criterion, the data obtained are reliable.
**Noise factor.** While assessing data reliability, I examined what Stanley (1971) called "logical and empirical aspects." Each survey was examined using the 10 "criteria" listed below, and assigned a "noise factor."

1. More than one unanswered question in questions #1-#25.
2. Questions #25 and #26 with the same answer.
3. Question #36 with a higher value than #35.
4. If question #35 was 1 or 2, more than five 3s or 4s in Section 3.
5. If question #35 was 1 or 2, more than four 4s in section 3.
6. Obvious multiple answers of a particular value in section 2 (seven or more in a row of the same answer, or two sets of five or more of the same answer).
7. Variant answers on questions #12 and #23.
8. Obvious multiple answers of a particular value in section 3 (seven or more in a row of the same answer, or two sets of five or more of the same answer).
9. Comments on survey suggesting a lack of understanding.
10. An entire page not complete.

This information provides an unobtrusive measure of commitment and/or competence of the respondents. The noise factor value for each survey is equivalent to the number of criteria met. Whereas none of the surveys met more than five of the criteria, there was no need to assign values greater than five. Examination of the surveys found that 179 of the surveys (93.7%) had a noise factor of two or less. Only eight (4.2%) had a noise
factor of three, only three (1.5%) had a noise factor of four, and only one survey (0.5%) had a noise factor of five.

Confidence in the reliability of the survey data increased after examining the noise factor results. An analysis suggests that respondents, (a) completed the entire survey, (b) took the survey seriously, (c) were consistent in their responses, and (d) understood the survey questions. Where appropriate, this noise factor may be incorporated into additional statistical analyses. When statistical analyses do not include those 21 cases with a noise factor of two, three, four, or five, the results will be noted as “clean data” or an N of 170 will be indicated.

Internal consistency. Reliability was further examined using additional split-half analyses. This is the same analysis used previously when attempting to predict reliability of survey scores. Results presented in Table 5 show that SPSS split-half reliability analysis resulted in Spearman-Brown coefficients of .6614 ($r^2 = .437$) for section 1, .8222 ($r^2 = .676$) for section 2, and .8041 ($r^2 = .647$) for section 3. These coefficients all exceed the .50 coefficient criterion established by Cohen (1988) and are interpreted to have high practical significant.

Reliability of scores for the data gathered in the survey has been examined using a variety of procedures. Both traditional statistical measures and “logical and empirical” methods were used. All indications from these measures are that the survey scores are highly reliable.
Table 5

**Split-Half Reliability Coefficients for Each Survey Section**

<table>
<thead>
<tr>
<th>Section</th>
<th>Reliability Coefficients</th>
<th>Total Items</th>
<th>Items Part 1</th>
<th>Items Part 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Spearman-Brown = .6614</td>
<td>24</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>Spearman-Brown = .8222</td>
<td>30</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>Spearman-Brown = .8041</td>
<td>25</td>
<td>13</td>
<td>12</td>
</tr>
</tbody>
</table>

**Demographics/Information Section**

Whereas most of the survey items related directly to the concept analysis, items #25-#40 (see Appendix C for a complete listing of survey items) were designed to gather informational/demographical information from the participants. The intent of this survey was not to gather comprehensive demographical data, but several specific items are addressed in this section. Several informational type items emerged at the request of Focus Group 2. Specific conclusions may be difficult to infer because of the limited number of items; however, the following items are of interest:

1. Training—92.1% of the 191 respondents indicated that they have not received enough training in the area of assistive technology. In addition, 91.5% indicated interest in additional training.

2. Assistive Technology in the IEP, Why Not—83 of the 191 respondents agreed that at times they felt pressure not to discuss assistive technology during an IEP meeting. Ninety-one respondents reported that such pressure was based on insufficient
funding to purchase devices. Although the survey was not structured to identify why those who felt pressure not to discuss assistive technology felt that way, eight more people responded to the second part of the question, listing funding as a reason not to consider assistive technology, than responded to the first part of the question.

3. Assistive Technology at Home--98.4% of those responding reported that students with severe disabilities need assistive technology at home, as well as at school.

4. Assistive Technology Policies--24.1% of respondents responded that their district had a written policy addressing assistive technology. Eighty percent responded that it would be best if the district had a written policy. Of those respondents indicating that their district had a written policy, 23.9% responded that the policy specifically addresses taking technology home.

5. Assistive Technology Budget--Only 15.6% of those responding reported that their school has a budget specifically for the purchase of assistive technology.

6. IEPs and Assistive Technology--95 of the respondents (44%) reported that they were involved in more than 20 IEPs during the past year, 66 respondents (34.5%) were involved in 11-20, and 30 respondents (20.4%) were involved in 10 or fewer IEPs. However, 159 respondents (83.7%) reported that assistive technology was considered in five or fewer IEPs and 55 respondents (28.9%) reported that they had not considered assistive technology in any IEPs during the past year. In addition, 176 respondents (92.6%) reported that fewer than five of the IEPs they were involved with actually
contained assistive technology and 91 respondents (47.9%) reported that they were involved with zero IEPs that contained assistive technology.

7. Numbers of IEPs Considering and Containing Assistive Technology--

Teachers reported being involved in an average of 24.35 IEPs during the 1994-1995 school year. Of those 24.35 IEPs, assistive technology was considered in an average of 3.35 IEPs. The number of IEPs respondents were involved in that actually contained assistive technology was 2.32 IEPs. These numbers are calculated estimates because data were collected as range scores (see items 34, 35, and 36 on survey in Appendix C). Mean values were calculated using a median value for each range score, that is, the range 1-5 = 3, the range 6-10 = 8, and so forth. These figures show that assistive technology was considered in approximately one in eight IEPs. However, assistive technology was actually contained in about two of three of IEPs in which it was considered.

Besides the data provided above, several questions in the demographics section sought information specifically about the respondents, such as years of experience, teaching assignment, and so forth. This information, when compared with general results from the survey, provides a profile of those respondents who best understand the concepts associated with the appropriate application of assistive technology. Comparing these data with data gathered, in Section 3, on the actual application of technology identifies a profile of those most likely, and least likely, to actually provide technology. This information is included at the end of this chapter in a section titled Provider Profiles.
Demographics/information and the current literature. Findings from the Demographics/Information questions were compared with findings from the current literature on which the concept analysis was based. This comparison was conducted in several key areas. This process allows for application of Provus's (1971) Discrepancy Evaluation Model and the identification of discrepancies.

In the area of training, the survey found that respondents need and would be receptive to additional training on assistive technology. The review of the current literature found that: (a) inservice training for individual who are already providing services was the most critical need identified by the Coalition on technology and Disability (Beattie, 1990); and (b) the need for training in assistive technology is evident at both the local and national level (Elting & Meidenbauer, 1991; Lahm, 1991; Smith, 1991).

On the issue of considering assistive technology, the survey found that other issues, including the availability of funding, may be reasons for not discussing assistive technology during the IEP. The review of the literature found that: (a) failure to incorporate technology is often the result of insufficient knowledge, and resources in meeting the individual needs of students (Scherer & Galvin, 1994); and (b) examples of the inclusion of assistive technology in the IEP, or any indication that assistive technology was even considered during the IEP process, are rare (Parette et al., 1993).

On the issue of assistive technology policies, the survey found that most school districts do not have written policies addressing assistive technology issues. Most
respondents agree that it would be best if districts had written policies. The review of the literature found that "with the ever-increasing possibilities brought about by educational technology comes the need to develop responsible policies. These policies will direct the use of technology in a manner beneficial to the student, the educator, and other service providers" (CASE, 1993, p. 10).

Concerning the issue of school/district budgets for assistive technology, the survey found that most school districts do not have budgets specifically for assistive technology. No information was found on this topic in literature review.

On the issue of financial consideration for assistive technology, respondents reported pressure not to discuss assistive technology during an IEP, and 86.7% reported that the pressure was based on insufficient funding to purchase devices. The National Council on Disabilities (1993), however, reported "that assistive technology is as cost-effective as it is necessary . . ." (p. 1). The report also stated that with appropriate assistive technology, "almost three-quarters of school-age children were able to remain in the regular classroom, and 45 percent were able to reduce school-related services" (p. 1).

The survey found that many IEPs do not consider assistive technology. When assistive technology is considered, it is often included. The review of the literature found that the appropriate incorporation of technology for students with disabilities includes "incorporation of technology-related goals or objectives into the IEP for students, and achievement of these goals or objectives" (Panyan et al., 1988, p. 124).
Demographics/Information Discrepancies. Funding is a major factor in whether assistive technology was considered in the IEP. This is based on items #27, #28, and #33, Section 1. More providers reported that their districts have an assistive technology policy than special education directors and USOE staff report. This is based on item #32 and previous conversations with LEA directors. Many IEPs never consider assistive technology although it may be appropriate. This is based on the number of IEPs in which assistive technology is considered and the number of students that the literature reports may benefit from assistive technology.

Section 1--Understanding Critical Attributes

Section 1 of the survey was designed to assess the respondent's knowledge and understanding of the eight critical attributes identified in the previously discussed concept analysis. Identification of specific concepts is an acceptable method to assess knowledge acquisition (Champagne et al., 1981). Information on the level of understanding of the critical attributes, and the subconcepts may be useful in designing training and developing policies.

Section 1 consists of 24 items, 3 items corresponding to each of the eight identified critical attributes. Each survey item was written as a statement and respondents were asked to agree or disagree with the statement. Correct responses to these items demonstrated understanding of the critical attributes. At least one item associated with each attribute was written as a nonexample. The correct response to these nonexample items was "disagree."
For all 191 respondents, the mean correct response rate was 84% for all 24 items. Table 6 provides a further breakdown of the respondents' scores. The distribution of the data is skewed with almost 70% of the respondents' scores being between 80%-90%.

The mean correct response rate for the 24 individual survey items in Section 1 ranges from 67% to 98% correct. Table 7 provides a further breakdown of the correct response rate for individual items. A complete listing of individual item scores is included in Appendix C.

When responses are grouped according to the eight critical attributes, the mean

Table 6

<table>
<thead>
<tr>
<th>Criteria</th>
<th># of Respondents</th>
<th>% of Respondents</th>
<th>Cumulative %</th>
</tr>
</thead>
<tbody>
<tr>
<td>100% Correct</td>
<td>6</td>
<td>3.1</td>
<td>3.1</td>
</tr>
<tr>
<td>90-99% Correct</td>
<td>66</td>
<td>34.6</td>
<td>37.7</td>
</tr>
<tr>
<td>80-89% Correct</td>
<td>65</td>
<td>34.0</td>
<td>71.7</td>
</tr>
<tr>
<td>70-79% Correct</td>
<td>34</td>
<td>17.8</td>
<td>89.5</td>
</tr>
<tr>
<td>60-69% Correct</td>
<td>10</td>
<td>5.2</td>
<td>94.7</td>
</tr>
<tr>
<td>50-59% Correct</td>
<td>10</td>
<td>5.2</td>
<td>99.9</td>
</tr>
<tr>
<td>&lt; 50% Correct</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>
Table 7

<table>
<thead>
<tr>
<th>Individual Item Correct Response Rates, Survey Section 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criteria</td>
</tr>
<tr>
<td>100% Response Rate</td>
</tr>
<tr>
<td>90-99% Response Rate</td>
</tr>
<tr>
<td>80-89% Response Rate</td>
</tr>
<tr>
<td>70-79% Response Rate</td>
</tr>
<tr>
<td>60-70% Response Rate</td>
</tr>
<tr>
<td>&lt; 60% Response Rate</td>
</tr>
</tbody>
</table>

percentage scores range from 75.7% to 92.4%. Table 8 presents data that help identify those critical attributes most, and least understood by the respondents. The table contains the mean score for each critical attribute, standard deviations for each mean score, and standardized mean difference effect sizes. These mean scores were determined using the percent of correct responses to each of the three survey items associated with each critical attribute. An omnibus total mean score for the first 24 items in Section 1 is also shown. The identification of which scores are statistically and practically significantly different from the omnibus mean is problematic. An analysis of variance was inappropriate because the scores are not independent.
### Table 8

**Mean Correct Response Rate for Each Critical Attribute and Comparison with an Omnibus Mean, Section 1**

<table>
<thead>
<tr>
<th>Critical Attribute</th>
<th>Mean Score</th>
<th>SD</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology #1</td>
<td>.878**</td>
<td>.206</td>
<td>.233</td>
</tr>
<tr>
<td>Technology #2</td>
<td>.826</td>
<td>.232</td>
<td>.087</td>
</tr>
<tr>
<td>Function #1</td>
<td>.854</td>
<td>.204</td>
<td>.082</td>
</tr>
<tr>
<td>Function #2</td>
<td>.766**</td>
<td>.255</td>
<td>.408</td>
</tr>
<tr>
<td>Appropriate #1</td>
<td>.866</td>
<td>.207</td>
<td>.094</td>
</tr>
<tr>
<td>Appropriate #2</td>
<td>.859</td>
<td>.214</td>
<td>.110</td>
</tr>
<tr>
<td>Environment #1</td>
<td>.924**</td>
<td>.178</td>
<td>.572</td>
</tr>
<tr>
<td>Environment #2</td>
<td>.757**</td>
<td>.236</td>
<td>.483</td>
</tr>
<tr>
<td>Section #1 First 24 Items</td>
<td>.841</td>
<td>.112</td>
<td></td>
</tr>
</tbody>
</table>

** Signif. LE .01 (2-tailed)

Dependent mean scores were used. Considering that a series of repeated t-tests may lead to an inflated Type I error, an alpha level of .01 rather than the .05 was used for calculating statistical significance. Standardized mean difference effect sizes for all mean differences were also calculated.

The subset of items where the percentage of correct responses is statistically significantly higher than the omnibus mean, and where the effect size is near .50, is the
subset in which respondents recognized using assistive technology to facilitate placement in the least restrictive or most inclusive environment (Environment #1). The subsets of items where the percentage of correct responses is statistically significantly lower than the omnibus mean, and where the effect size is near .5, included the subset of items in which the respondents were asked to recognize that assistive technology should meet the unique needs identified in the IEP (Function #2), and that access to assistive technology is not dependent upon existing resources (Environment #2).

The highest and lowest scores occurred on the two critical attributes addressing the “environment” in which assistive technology is appropriate. Both scores are statistically different from the omnibus mean at an observed statistical significance level < .01, and have standardized mean difference effect sizes near or above .50. The high score was on the “environment” critical attribute addressing placement while the low score was on the “environment” critical attribute addressing the use of existing environmental resources. Respondents apparently recognized that assistive technology facilitates students’ successful placement in the LRE. However, the concept of basing the appropriate provision of assistive technology on student needs, rather than existing environmental resources, is not as well understood. The fact that 91 of the 191 participants (48%) responded that they felt pressure not to discuss assistive technology during the IEP meeting because of insufficient funding further substantiates this finding. It appears that resources and fiscal concerns, and not students’ needs, may be driving the provision of assistive technology.
When results were grouped according to the four subconcepts, that is, technology, function, appropriate, and environment (see Table 9), the percentage scores range from 80.9% to 86.2%. With an omnibus mean score for Section 1 of 84.1%, all scores fall within 3.2% of the omnibus mean. The low score was for the concept of "function" and the high score was for the concept of "appropriate." As was explained with Table 8, t tests for dependent means found these two scores significantly different from the omnibus mean at an observed statistical significance level < .01. However, the effect sizes for the statistically significant differences are minimal, and therefore, these differences have little practical significance.

Table 9

Mean Correct Response Rate for Each Subconcept and Comparison with an Omnibus

<table>
<thead>
<tr>
<th>Critical Attribute</th>
<th>Mean Score</th>
<th>SD</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology</td>
<td>.852</td>
<td>.176</td>
<td>.076</td>
</tr>
<tr>
<td>Function</td>
<td>.809**</td>
<td>(lower) .166</td>
<td>.230</td>
</tr>
<tr>
<td>Appropriate</td>
<td>.862**</td>
<td>(higher) .163</td>
<td>.153</td>
</tr>
<tr>
<td>Environment</td>
<td>.841</td>
<td>.161</td>
<td>.000</td>
</tr>
<tr>
<td>Section #1 Omnibus Mean</td>
<td>.841</td>
<td>.112</td>
<td></td>
</tr>
</tbody>
</table>

** Signif. LE .01 (2-tailed)
Discrepancies and staff development recommendations. As described in Chapter III, one purpose of this study was the identification of discrepancies. With understanding of the critical attributes identified in the concept analysis process as the standard, discrepancies between that standard and understanding of those attributes by the survey respondents were identified.

Several survey items with low percentages of correct responses deal with the concept of placement as a factor in the application of assistive technology. According to the criteria established in the concept analysis, 33% of respondents incorrectly agreed “that the provision of assistive technology depends on the student’s placement.” Thirty-one percent incorrectly agreed “that students placed in severe/profound programs are more likely to need assistive technology.” From the concept analysis, I concluded that the application of technology should not be contingent upon the student’s placement. The survey results reflect the perception, among approximately one third of the respondents, that assistive technology application is contingent upon a student’s placement. From the concept analysis, I found that placement and the appropriate application of assistive technology should be based on student needs and not the environment.

These same discrepancies were identified when examining the eight critical attributes. Critical attribute Function #2, “meets the unique needs identified in the student’s IEP,” and critical attribute Environment #2, “assures that the device provided is based on the student priorities rather than existing environmental resources,” are the
two critical attributes with the lowest scores and therefore with the greatest amount of discrepancy.

The fact that discrepancies exist cannot alone lead to a judgment that staff development is needed. Discrepancies between performance on some aspect of a program and the standards set for performance should, however, trigger a decision-making process. Figure 4 is an example of how such a process may lead to the development of effective staff development.

Using critical attribute Function #2, "meets the unique needs identified in the student’s IEP" as an example, the following questions may be asked in deciding if staff

![Diagram](image-url)

**Figure 4.** A process for making staff development decisions following identification of discrepancies or the identification of irrelevant attributes.
development is necessary, and if so, what the content should be:

1. Are the discrepancies and irrelevant attributes instructionally relevant? Are the discrepancies relevant to special education instruction? The answer is most likely yes because meeting the unique needs identified in the student’s IEP is relevant to special educational philosophy. Staff development may include a review of the purpose of the IEP and the necessity of aligning the IEP with student needs.

2. Are the discrepancies and irrelevant attributes context appropriate? Is this a special education issue? Again the answer is most likely yes because the individualized nature of assistive technology, and the need to consider technology on a “case-by-case” basis, are consistent with developing individualized education programs. An irrelevant attribute that may need addressing is that the application of assistive technology should not be based on the student’s placement or classification.

3. Are the discrepancies instructionally appropriate? Can staff development address the discrepancies? Again the logical answer is yes because meeting the unique needs identified in the student’s IEP is a necessary part of the IEP process. Again, an irrelevant attribute that may need to be addressed is the misperception that assistive technology should meet the needs of several students and not the unique needs of the student being considered.

If the process outlined in Figure 4 results in a “no” answer to one of the questions, the need for staff development or policy adaptation may still exist. For example, the critical attribute “assures that the device provided is based on student
priorities rather than existing environmental resources," may result in a "no" answer when considering instructional relevancy. This is because instruction is not based on existing environmental resources. This, however, does not eliminate the possible need for staff development or policy adaption. Staff development to address those discrepancies identified in Section 1 could be based on Barbara Bateman's 1991 work (see page 14).

Section 1 and the current literature. Findings from Section 1 of the survey were compared with information and data from the current literature. Survey items and current literature were compared in several key areas. This process summarizes Section 1 and facilitates application of Provus's (1971) model to identify discrepancies.

In the area of student need versus placement/classification, the survey found that the application of assistive technology is often based on classification or placement and not on student needs. The review of the literature found that the use of devices should emerge as a result of the assessment of the needs, desires, and capabilities of the child (Parette et al., 1993).

The survey found that teachers understand that students benefit from the appropriate application of assistive technology. This is consistent with the literature, which notes that access to technology advances holds great promise for enriching educational opportunities and affecting the lives of students with disabilities (Gradel, 1990; Barker, 1990).
Survey item #20 suggests that many professionals feel they know what is best, and may not respond to needs/wants of students. (This will be further discussed below.) The study by Batavia and Hammer (1989) found that a major factor in assistive technology abandonment is not considering what the client wants, although the survey suggests that respondents have a basic understanding of the critical attributes. Failure to incorporate technology is often the result of insufficient knowledge, and the application of that knowledge in meeting the individual needs of students (Scherer & Galvin, 1994).

Section 1 discrepancies. The literature reviewed did not identify any studies that examined the level of special education teachers' understanding of assistive technology concepts. Therefore, a priori standards were not set. As a result, discrepancies from a standard were not identified. However, post hoc examination of the data resulted in several identifiable discrepancies.

1. Respondents understand some critical attributes better than others. This is based on the variation in mean scores (76-92%) in Section 1 for the eight critical attributes.

2. Within a given subconcept, respondents have varying levels of understanding of critical attributes. This is based on observing that the Environment #1 mean = 92%, while the Environment #2 mean = 76%.

3. Respondents appear to be basing technology applications on classification or
placement and not on meeting students' unique needs. This is based on the scores on items #23 and #24, Section 1.

4. Respondents apparently do not allow enough student input in making assistive technology decisions. This is based on the scores on items # 15 and #28, Section 1.

Section 2--Importance of Critical Attributes

Section 2 of the survey was designed to assess respondents' agreement or disagreement with the critical nature of the eight critical attributes. Respondents responded to a series of 30 statements, and indicated whether each statement was "critical," "very important," "important," "not important," or "not considered" when considering assistive technology in the students' IEPs. Response were coded on a scale of 1 to 5 with 5 as "critical," and 1 as "not considered."

As in Section 1, at least three statements, and at least one nonexample were given for each of the eight critical attributes. For statistical analysis on the nonexamples, numerical values for responses were inverted. A response of "critical" was entered as "1," a response of "very important" as "2," a response of "important" as "3," a response of "not important" as "4," and a response of "not considered" as "5". This transformation was designed to keep the measurement consistent across all survey items. This process was problematic in that scores may not be equivalent when inverted. The terms "critical" and "not considered" are not antonyms and therefore the
inversion of scores may be inappropriate. This concern will be considered as
conclusions are drawn and recommendations are made.

The mean scores for each of the 30 items range from 2.287 for item #24, to 4.419
for item #6. The mean score for all 30 items is 3.5. The mean scores for each of the
191 respondents range from 2.47 to 4.37. The mean score for all 191 respondents is
3.5.

Table 10 is similar to Table 9 presented earlier. The table presents data for each
of the eight critical attributes as responded to in Section 2. As explained in association
with Table 10, this table presents means for each attribute, indication of those
differences that are statistically different from the omnibus mean at the .01 alpha level,
standard deviations associated with each mean, and standardized mean difference effect
sizes for those differences.

Table 10 is an example of the need to consider practical significance as well as
statistical significance. Although six of the eight critical attributes are statistically
significant at the .01 level, examination of the standardized mean differences using effect
sizes helps to determine those differences with practical significance.

The subset of items with statistically significantly differences higher than the
omnibus mean, and the highest standardized mean difference effect sizes are the items
viewed as more critical by the respondents. This subset of items deals with the ability
of technology to alter functional levels or improve social acceptance (Technology #2 and
Appropriate #2). For example, items with phrases such as, "increases functional
Table 10

Mean Correct Response Rate for Each Critical Attribute and Comparison with an Omnibus Mean, Section 2

<table>
<thead>
<tr>
<th>Critical Attribute</th>
<th>Mean Score</th>
<th>SD</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology #1</td>
<td>3.593**</td>
<td>.454</td>
<td>.228</td>
</tr>
<tr>
<td>Technology #2</td>
<td>4.153**</td>
<td>.679</td>
<td>1.290</td>
</tr>
<tr>
<td>Function #1</td>
<td>3.458</td>
<td>.712</td>
<td>.089</td>
</tr>
<tr>
<td>Function #2</td>
<td>3.477</td>
<td>.571</td>
<td>.060</td>
</tr>
<tr>
<td>Appropriate #1</td>
<td>3.675**</td>
<td>.523</td>
<td>.402</td>
</tr>
<tr>
<td>Appropriate #2</td>
<td>3.741**</td>
<td>.570</td>
<td>.528</td>
</tr>
<tr>
<td>Environment #1</td>
<td>3.594**</td>
<td>.456</td>
<td>.230</td>
</tr>
<tr>
<td>Environment #2</td>
<td>3.070**</td>
<td>.768</td>
<td>.793</td>
</tr>
<tr>
<td>Section #2 All 30 Items</td>
<td>3.504</td>
<td>.327</td>
<td></td>
</tr>
</tbody>
</table>

** Signif. LE .01 (2-tailed)

capabilities,” “allows the student to be more independent,” “maintaining social acceptance,” and “student’s successful functioning in the least restrictive environment,” had scores > 4.0. Some of these scores may be artificially inflated because the examples contain value-laden statements such as those listed here.

The only critical attribute in which a statistically and practically significant difference exists that is lower than the omnibus mean is Environment #2. This is
consistent with the analysis on Section 1 (see Table 9). This differences suggests that respondents may not agree that the provision of technology should be based on student need and not existing resources. This also is consistent with other findings about the importance of funding in assistive technology decisions.

In addition to the group scores in Table 10, 8 individual items have mean scores $> 4.0$ (very important to critical), and 13 items have mean scores $> 2.75$ but $< 4.0$ (important to very important). These 21 items further support validation of the concept analysis because they indicate that respondents agree with the critical nature of the attributes identified in the concept analysis. Nine items have mean scores $< 2.75$ (not considered to not important). These items help validate previously identified discrepancies and identify possible additional discrepancies.

**Section 2 and staff development recommendations.** The same filtering process applies to identified discrepancies in Section 2 as was explained earlier (see page 89). Staff development in this area may be based on the work of Marcia Scherer and Jan Galvin (1994). They addressed some common misperceptions concerning assistive technology and identified issues that if properly addressed will reduce technology abandonment. Zabala (1995) and Reed (1995) have also identified issues that need to be addressed when considering assistive technology for students.

**Section 2 and the current literature.** As with other sections of the survey, findings from this section were again compared with information and data from the current literature. This process summarizes Section 2 and facilitates application of
Provus's (1971) model to identify discrepancies. With a mean score of 3.5 on a scale of 1-5, and eight individual item scores > 4.0, it appears that the respondents agreed with the critical nature of the eight critical attributes.

Respondents recognized that the function (4.153 mean on critical attribute Technology #2) of the technology is critical. Identification of what assistive technology is, and is not, is not reported to be as critical (2.857 mean on critical attribute Technology #1). The literature review found consistent information noting that the use of assistive technology compensates for dysfunctions or disabilities (Burnette, 1990). The purpose of assistive technology is to enhance functioning, independence, and quality of life (Scherer & Galvin, 1994).

On the subject of student need versus placement/classification decisions, there are items that the respondents identified as important that may actually impede meeting individual student needs; for example, placement, classification, and use of technology by multiple students. The literature review found that teachers continue to use the IEP process primarily to identify an acceptable classification for a child with a disability, and then to place that child in a program already designed for that classification (Bateman, 1991; Smith 1990).

On the subject of student needs versus student wants, the consideration of “student needs” (4.317 mean score on item #15) rated higher than consideration of “student wants” (3.600 mean on item #17). Bateman (1991), as noted previously, contends that one of the main purposes of the IEP is to identify student needs. Once
needs have been identified, the IEP should be designed to meet those needs. In considering assistive technology it is also important to consider student wants because a major factor in assistive technology abandonment is consideration of what the client wants (Batavia & Hammer, 1989).

Respondents to the survey agreed with the critical nature of using technology to increase the personal dignity of students (3.741 mean on critical item A2). This is consistent with the literature in that assistive technology in the hands of students allows the student to be educated more appropriately and increases their potential for social interaction with their peers (CASE, 1993).

The survey found that respondents consider the level of sophistication of the technology is important (mean score of 3.295 on Item #3). Although many people associate assistive technology with complicated devices, the literature review found that most individuals with disabilities are able to be assisted by simple and easy to use technology (NCD, 1993).

The survey also found that respondents consider technology more important for students with multiple and profound disabilities (mean score of 3.266 on Item #29). The review found that in the classroom, technology benefits students with all levels of abilities and disabilities, enabling more independence, self-confidence, and productivity (Parette et al., 1993).

The survey also found that the cost of the device is a major concern for many respondents. Forty respondents marked this item as “critical,” 30 marked it as “very
important,” 89 marked it as “important,” and 31 indicated that it is “not important” or “not considered.” These responses are interesting considering that it is generally accepted that “cost” should not be a factor in the provision of special education services. Federal laws and regulations are replete with statements that devices and services should be provided without regard to cost and that assistive technology devices and services may be essential to the provision of FAPE (Fed. Reg. Sept. 29, 1992). Assistive technology devices and services are provided as special education (34 CFR 300.17); as related services (34 CFR 300.16); and as supplementary aids and services (34 CFR 300.550).

Section 2 discrepancies. The comparison survey data with data and information from the current literature allows for the identification of several discrepancies. These discrepancies are likely reasons for the following misperceptions:

1. There is a misperception that it is important that technology is designed for use by multiple students. This is based on the score on item #13, Section 2.

2. There is a misperception that the use of technology is dependent upon a student’s classification. This is based on the scores on items #27, #28, and #29, Section 2.

3. There is a misperception that technology is by nature more important for students with multiple and profound disabilities. This is based on the score on item #29, Section 2.
4. There continues to be some confusion over what assistive technology is, and what it is not. This is based on scores on items #2, #3, #8, and #9, Section 2.

5. There is a misperception that the level of sophistication of the device is a factor in the appropriateness of the device. This is based on the score on item #18, Section 2.

6. There is a misperception that the cost of the device is a dominate consideration in appropriately applying assistive technology. This is based on the score on Item #30, Section 2.

Section 3 - Application of Critical Attributes

Section 1 of the survey was designed to ascertain respondents’ understanding of the critical attributes. Section 2 was designed to determine the level of agreement with the critical nature of these attributes. Section 3 was designed to assess respondents’ actual application of assistive technology during the 1994-95 school year. Respondents were given examples of specific assistive technology devices and services and asked to respond according to their experience during the 1994-95 school year. Three progressive levels of response were possible. The first question asked: “Would an IEP team in your school ‘likely consider’ the assistive technology device or service listed?” If the answer to this first question was “NO,” further consideration for that item was not necessary. If the answer to the first question was “YES,” the second question asked: “Were you involved in an IEP during the 1994-95 school year where such an item, or a similar item ‘was considered this year’?” If the answer to this question was
"NO," further consideration for that item was not needed. If the answer to the second question was "YES," the last question asked: "Was such an item 'provided this year' as part of an IEP?" From this information, items were coded as:

"1" Yes, it is likely to be considered, but no, it was not considered this year.

"2" Yes, it is likely to be considered, yes, it was considered this year, but no, it was not provided.

"3" Yes, it is likely to be considered, yes it has been considered this year, and yes it has been provided this year.

On a scale of 1-4, the mean score for all 25 items in Section 3 was 1.781. One-hundredeighty-one of the 191 respondents completed all 25 items on Section 3. Individual respondents' mean scores range from 1.000 (two respondents) to 2.833 (one respondent). The mean for all respondents was 1.781, on a scale of 1-4. Reliability for this section of the survey was further established using items #12 and #23, which are identical items. Of the 181 respondents that responded to both items, 170 responded the same on the two items. This results in an agreement rate of 94.4%.

Some devices are considered and provided more often than others. Individual item scores range from a low of 1.153 (Item #18) to a high of 2.449 (Item #5). The survey included a wide range of devices and services so as to obtain a wide range of scores. For example, Item #5 is a pencil grip for a student who cannot grip a pencil. For this item, 33 respondents (18.8%) indicated that an IEP team in their school would
not likely consider such a device. An additional 81 respondents (46%) indicated that they would likely consider such a device but had not considered it this year. This suggests that 64.8% of the respondents either would not or had not considered an item as simple as a pencil grip in their IEPs that year. The low score, Item #18, asked if they would consider a color wheelchair even if it costs more than a basic black one. Three respondents indicated that they had provided such a wheelchair this year. However, 88.1% of respondents indicated that an IEP team in their school would not likely consider it.

Some additional examples of specific items include:

1. Of those responding, 53% are not likely to consider a three-wheel scooter for a student who can walk short distances but tires easily.

2. Of those responding, 58% are not likely to consider a power wheelchair for a student who can manipulate a manual wheelchair but cannot get from one class to another on time because of the large size of the school.

3. Of those responding, 56% are not likely to consider an electronic speller for a student who is only in special education one hour per day.

4. Of those responding, 62% are not likely to consider a computer for a student who is in resource one period a day.

5. Of those responding, 35% are not likely to consider a talking calculator.

6. Of those responding, 42% are not likely to consider a one-handed keyboard.
7. Of those responding, 48% are not likely to consider an assistive technology evaluation for an LD student.

Items designed especially for a particular student are considered less often than items that will meet the needs of several students. For example, only 19% of respondents would not likely consider an electronic communication board for a non-verbal student, but 55% would not likely consider a communication board with masculine or feminine speech to meet the specific needs of a male or female student. Sixty-one percent of respondents would likely consider a ramp to the stage so a student in a wheelchair can be in the school play, but only 10% would consider a color wheelchair if it cost more than a basic black one. Item #15 did not ask respondents to consider a specific device, but asked if they would consider a particular device, if requested by the student, even though the cost is 20% more than another comparable device. On this item, 78% of respondents reported that an IEP team in their school would not likely consider such an item.

One item, #8, was included in Section 3 as a validation of respondents understanding of the critical attributes. This item asked if an IEP team would consider corrective surgery to improve motor skills. Since this item does not meet the definition of assistive technology, the 84% response rate indicating that it would not be considered may further validate respondents' understanding of the critical attributes.

On 20 of the 25 items in Section 3, more respondents reported that they are actually providing the assistive technology, than reported that they had considered the
technology this year. This may suggest that when assistive technology was considered, it was usually determined necessary for FAPE and therefore provided. It also suggests that assistive technology was provided to students but not possibly included on the IEP. Several respondents also wrote on their surveys that they "just provide technology," but do not include it in the IEP.

From these data it appears that:

1. Respondents are likely to consider assistive technology, but they haven't considered it in the year.

2. Most assistive technology devices and services are not considered during the IEP.

3. In most situations the IEP does not provide access to assistive technology devices and services.

These data on consideration and provision of specific devices and services are consistent with the data reported in Section 1. Section 1 of the survey found that respondents reported assistive technology considered in only 13.6% of IEPs and provided in only 9.5% of IEPs.

Section 3 and staff development recommendations. Respondents do not appear to apply the research conducted on identification of appropriate technology and technology abandonment. Personal preferences such as color of a wheelchair, and gender of the voice in an electronic communication device are important factors in acceptance and continued use of assistive technology. This concept will be discussed
below in a section titled Student Input--Needs Versus Wants. Some of the research on
technology abandonment by Batavia and Hammer (1989), Galvin and Phillips (1993),
and Phillips and Zhao (1993) could be used to provide some valuable training.

Appropriate assistive technology assessments must be available and are a
necessary step in effective applications of technology. However, according to the
survey results, assessments are not likely to be considered for most students. The
research referenced earlier by Zabala (1995) and Reed (1995) stresses the need for more
effective assistive technology assessments. Research-based assessment instruments and
procedures developed by Zabala (1995) and Scherer and Galvin (1994) could be the
basis for some effective and relevant preservice or in-service training.

Section 3 and the current literature. As with previous sections, findings from
Section 3 of the survey were compared with the current literature. Several area,
including some of the areas previously examined, are discussed. This process
summarizes Section 3 and facilitates application of Provus’s (1971) model to identify
discrepancies.

Although 99% of respondents felt it important, very important, or critical that
assistive technologies meet the unique needs identified in a student assessment (item
#10, Section 2), 48% of respondents would not consider an assistive technology
assessment for a student who had just been classified as learning disabled (item #12,
Section 3). The review of the literature found that one reason technology is seldom
considered during the IEP, is that student assessments of needed technology seldom
occur (Guzzo & Guzzo, 1992; Heumann, 1993). Additionally, technological considerations can augment the traditional evaluation by providing information about the student’s ability to access and use technology (Scherer & Galvin, 1994).

As noted previously, this section of the survey also found that the cost of a device appears to be a determinant in whether or not the device is considered by the IEP team (items #15 & #18, Section 3). Federal regulations state that AT devices and services may be essential to the provision of FAPE (Fed. Reg. Sept. 29, 1992).

The survey results indicate that respondents appear more willing to consider assistive technology that meets the needs of several students than technology designed to meet a student’s individual needs. Judy A. Schrag, OSEP Director, said that consideration of “a child’s need for assistive technology must occur on a case-by-case basis in connection with the development of the child’s IEP” (personal communication, August 10, 1990).

Finally, the survey found that although respondents agree with the benefits and critical nature of applying assistive technology, few actually do it. This is consistent with the review of the literature in that examples of the inclusion of assistive technology in the IEP, or any indication that assistive technology was even considered during the IEP process are rare (Parette et al., 1993).

Section 3 discrepancies. No standards were established in the concept analysis for the actual application of technology in the IEP, so discrepancies according to the
Provus's (1971) Discrepancy Evaluation Model are difficult to determine. However, data in this section included some discrepancies.

1. Although respondents report the need to respond to unique student needs, they do not provide assistive technology assessments to identify such needs. This is based on scores on items #12 and #23, Section 3.

2. Financial consideration continues to be a factor in considering and providing assistive technology. This is based on scores on items #15 and #18, Section 3.

3. The provision of assistive technology is often dependent upon classification and placement decisions. This is based on scores on items #20, #21, #24, and #25, Section 3.

**Student Input--Needs Versus Wants**

Several major studies (Galvin & Phillips, 1993; Phillips & Zhao, 1993; Scherer & Galvin, 1994) have listed consumer input as a paramount factor in the appropriate application of assistive technology. When users' opinions are considered in the selection process, devices are more likely to be retained (Phillips & Zhao, 1993). Consumers bring special expertise and knowledge of their personal values, priorities, and attitudes toward technology (Galvin & Phillips, 1993). Results from this study indicate that special education teachers agreed with these concepts philosophically, but a significant discrepancy exists between agreeing to their importance and the actual provision of technology. Survey results show that 97.4% of the respondents agree that it is important that students feel comfortable with the assistive technology. Only
26.1% agree that professionals know best what students need. Additionally, 80% responded that it is “critical” or “very important” to consider what the student needs. However, 78% of the respondents reported that an IEP team in their school would not even consider a particular device, if requested by the student, if the device costs 20% more than a comparable device, and 88% responded that an IEP team in their school would not consider a colored wheelchair if it costs more than a basic black one.

Although respondents “report” that student input and consideration of students’ wants are important, there is little or no evidence that this occurs in the IEP.

**Use of Nonexamples/Negative Examples**

In her work on concept analysis, Markle (1975) noted the necessity of identifying irrelevant attributes. She reported that irrelevant attributes are often the basis for misconceptions associated with the concepts. Potential irrelevant attributes were identified during the concept analysis. In an effort to verify the potential irrelevant attributes, survey items included nonexamples or negative examples. For example, item #3 in Section 1 reads: “Assistive technology always involves computers or electronics.” The response to this statement demonstrating understanding was “disagree.” In Section 2, statements were also presented that would elicit a negative response if the respondents correctly agreed with the critical nature of the attribute being examined. For example, one critical attribute is that assistive technology meets the student’s unique needs. Agreement with this attribute would elicit a “not important” response to the statement: “The technology is designed for use by multiple students.”
In Section 1 of the survey (understanding of critical attributes), 11 of items 1-24 were nonexamples. The mean correct response rate for all items 1-24 in Section 1 is 84.1%. The mean correct response rate for the 13 examples is 90.72% and for the 11 nonexamples the mean correct response rate is 76.16%. A correct response for these 11 items was disagree. Table 11 presents t-test and standardized mean difference effect size information comparing the means for examples and nonexamples.

For Section 2 of the survey (agreement with the critical nature of the concepts), 11 of the 30 survey items were nonexamples. Items were rated on a scale of 1-5, with 1 being “not considered” and 5 being “critical.” The scores for the nonexamples are inverted to correct for the fact that a low score showed agreement with the nonexample. The mean response rate for all 30 items is 3.505. The mean response rate for the 19 examples is 3.8192. The mean for 11 nonexamples is 2.9588. The results of the statistical comparison of the means for the examples and nonexamples (t test and

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number of pairs</th>
<th>2-tail Sig</th>
<th>Mean</th>
<th>SD</th>
<th>Effect Size</th>
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</thead>
<tbody>
<tr>
<td>Section 1, negative examples,</td>
<td>.7616</td>
<td>.178</td>
<td>191</td>
<td>.000</td>
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<td>Section 1, positive examples</td>
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<td>.094</td>
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</tr>
</tbody>
</table>
standardized mean difference effect size) are presented in Table 12. As noted previously, the analysis of data for Section 2 may be problematic because of inverting scores for nonexamples.

The difference in the mean scores between the examples and nonexamples (negative examples) has an observed statistical significance level < .001 for both Sections 1 and 2. In addition, the relatively high standardized mean difference effect sizes of 1.12 and 1.58 indicate practical significant differences. Although this study was not designed to address this issue further, this information may have implications for staff development. The Support Document Chart for Concept Analysis in Appendix A lists critical attributes and irrelevant attributes for each concept identified in the concept analysis. Since irrelevant attributes (nonexamples) may be the basis for misperceptions among providers of special education services, a necessary aspect of staff development programs would be the clarification and understanding of all irrelevant attributes.

Table 12

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number of pairs</th>
<th>2-tail Sig</th>
<th>Mean</th>
<th>SD</th>
<th>Effect Size</th>
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<tr>
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<td>.590</td>
<td>190</td>
<td>.000</td>
<td>1.07</td>
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<tr>
<td>Section 2, positive examples</td>
<td>3.819</td>
<td>.501</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Technology as a Placement Decision

Two of the critical attributes identified in the concept analysis directly relate to placement decisions. First, assistive technology should facilitate the successful placement of students in less restrictive environments. Second, students’ needs, rather than existing environmental resources, should dictate the application of assistive technology. Several responses to the survey suggest that respondents may not totally agree with and/or understand these concepts. Although 91.5% of respondents agreed that assistive technology should be discussed when considering a student’s placement, 33% also agreed that the provision of assistive technology is dependent upon the student’s placement. Additionally, 31.1% of respondents agreed that it was more likely for students in severe/profound programs to use assistive technology and 80% felt that the special education placement of the student was critical, very important, or important when considering the appropriate application of assistive technology.

These results are substantiated by additional data from Section 3. Sixty-two percent of respondents indicated they would not consider a computer for a student who was in resource (special education less than half-day) one period a day while only 30% would not consider a computer for a student who was self-contained (special education more than half-day). The idea that assistive technology is more important for those with severe/profound disabilities and is more appropriate in self-contained settings is something that needs addressing when developing policies, or designing training curriculum.
Provider Profile

The information gathered in this study provides insight into a profile of those providers more likely to consider, and actually apply, assistive technology. Such information may be of particular importance in designing personnel preparation training activities.

To use the information garnered from the survey to identify a provider profile, one must make the assumption that survey participants with the highest scores on Section 3 of the survey are those most likely to apply assistive technology. Conversely, those with the lowest scores on Section 3 are least likely to apply assistive technology. This assumption is based on the fact that respondents reported that they considered assistive technology and actually provided assistive technology more or less than the other respondents. Justification for using high scores on Section 3 as an indicator of assistive technology application was further verified by correlating the overall mean on Section 3 with item #36 on the survey, the number of IEPs the respondent was involved with that actually contained assistive technology. The Pearson product-moment coefficient for these two items ($r = .284$ and $r^2 = .08$) has an observed statistical significance level $< .001$. This $r$ value approaches the .30 level discussed by Cohen (1988) and indicates that those who scored the highest on Section 3 also reported being involved in more IEPs that actually contained assistive technology.

The development of a provider profile included several activities. The first analysis was of those respondents with high and low scores on Section 3 and how they
scored on Sections 1 and 2. The purpose of this comparison was to determine if understanding of the eight critical attributes was a factor in the actual provision of assistive technology, and to determine if agreement with the critical nature of the eight attributes was a factor in the actual provision of assistive technology.

Using an independent samples $t$ test with a cut point of 2.06 for the total mean score on Section 3, those with a score $< 2.06$ were compared with those with a score $> 2.06$. There were 42 respondents who scored $> 2.06$, approximately 20%.

On both Section 1 and 2 of the survey, there are no mean differences statistically significant at the alpha level .01. The highest standardized mean difference effect size was .34 with only three effect sizes higher than .20. Whereas these effect sizes fail to meet the .50 criteria established by Cohen (1988) for obvious differences, no practical significance was found. High scores on Section 1 of the survey, "understanding the critical attributes," and Section 2, "agreeing with the critical attributes," are not indicators of high scores on Section 3.

In addition to examining high scores on Section 3, scores for those who scored the lowest were also examined. Using an independent samples $t$ test with a cut point of 1.5 for the mean score on Section 3, those with a score $< 1.5$ were compared with those with a score $> 1.5$. There are 41 respondents who scored $< 1.5$, approximately 20%.

On both Section 1 and 2 of the survey, there was only one mean difference statistically significant at the alpha level .01. The single item with a mean difference significant at the .01 level was Technology #1. The standardized mean difference effect size for this
item is .502. For all other items comparing the 20% of respondents with the lowest scores with those not in the lowest 20%, no standardized mean difference effect sizes were higher than .20.

The critical attribute “Technology #1” has a fairly high effect size of .502. As noted previously, this difference may be attributable to the respondents' lack of understanding of the definition of assistive technology and therefore their accompanying lack of reporting assistive technology applications.

The next part of the provider profile involved an examination of items #25-#33 of Section 1 of the survey. These items are demographical/informational items. Consistent with what was described previously in this section, those respondents with scores in the top 20% (N = 42) on Section 3 were compared with those with scores not in the top 20% (N = 138). The only item with a mean difference statistically significant at < .01 was item #30, concerning district assistive technology policies (see Appendix D). With an effect size of .43, this difference is most likely not practically significant.

Another observation from this analysis was that 41 of the 42 respondents in the top 20% sample responded that they had not received enough training in the area of assistive technology. Also, 39 of the 41 respondents in the top 20% indicated an interest in additional training in this area.

Table 13 presents information from items #34, #35, and #36 in Section 1. Item #34 reports information on the number of IEPs the provider reports being involved with during the 1994-95 school year. Item #35 is the number of those IEPs in which assistive
Table 13

Comparison of Top Providers on Items 34-36 of the Survey

<table>
<thead>
<tr>
<th>Survey Item #</th>
<th>Total Sample Mean</th>
<th>Top 20% Mean</th>
<th>Other 80% Mean</th>
<th>Sig. Level</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>34</td>
<td>24.35</td>
<td>24.81 (1.361)</td>
<td>45.54 (1.567)</td>
<td>no</td>
<td>.04</td>
</tr>
<tr>
<td>35</td>
<td>3.32</td>
<td>3.90 (.774)</td>
<td>3.07 (.675)</td>
<td>yes</td>
<td>1.15</td>
</tr>
<tr>
<td>36</td>
<td>2.32</td>
<td>2.78 (.749)</td>
<td>2.11 (.687)</td>
<td>yes</td>
<td>.93</td>
</tr>
</tbody>
</table>

Technology was considered. Item #36 is the number of those IEPs in which assistive technology was actually provided. One can see from this table that those in the top 20% on Section 3 do not participate in more IEPs but they are more likely to consider assistive technology in more IEPs and provide it more IEPs. These differences are statistically significantly different, and as indicated by the effect sizes are also highly likely to have significant practical difference.

The final activity in identifying a provider profile was examining survey items #37-#40. These items are somewhat problematic because respondents responded by selecting one of a several options for each item. Recoding the data to a dichotomy where the value “1” indicted that the respondent was a member of the sample, or given the value “0” indicated the respondent was not a member of the sample, allowed for obtaining mean scores for each range within each item. Consistent with other procedures in this section, independent-samples t tests compared those in the top 20%
of respondents on Section 3, and those not in the top 20%. *t* tests were run for the seven options on item #37, the four options on item #38, the four options on item #39, and the seven options on item #40. Of these 22 *t* tests (see Appendix D), the only item with a statistically significant mean difference at an alpha level < .01 was item #39 for those who responded that their main assignment was "itinerant." Whereas 10% of the entire sample reported their assignment as "itinerant," 19% of those in the top 20% on Section 3 reported their main assignment as "itinerant." Although the percentage is almost double for those in the top 20%, the standardized mean difference effect size is .42. It appears from these data that respondent with "itinerant" assignments may be likely to provide assistive technology. One possible explanation for this is that itinerant personnel are included in the IEP when technology is considered because other IEP team members lack the skills to address technology issues.

Although there are few statistically and practically significant differences between those respondents that provide more technology than those who do not, the following statements are suggested about special educators who are most likely to provide assistive technology.

1. High scores on Section 1 of the survey, "understanding the critical attributes," and Section 2, "agreeing with the critical attributes," not indicators of high scores on Section 3.

2. Those individual who report providing the least assistive technology may not understand the definition of assistive technology.
3. Those respondents who reported providing the most technology are almost unanimous in their desire for more training in this area.

4. Those respondents who reported providing the most technology, consider assistive technology in the IEP process more often than others.

5. It appears that those who provide the most technology are more likely than others to have an itinerant assignment.

Cross Section Correlation

The final item examined in this chapter was the relationship between the scores on the three sections of the survey. Because two variables were involved, bivariate correlational statistics were used. A product-moment correlational coefficient was computed because both variables correlated are expressed as continuous scores (Borg & Gall, 1989). The Pearson product-moment correlation coefficient was selected because it gives the best estimate of a relationship when its assumptions are met.

Tables 14-16 contain correlation coefficients for the eight critical attributes. In these tables, the sections are listed as S1 = Section 1, S2 = Section 2, S3 = Section 3, and the critical attributes are listed as T1 = Technology #1, T2 = Technology #2, F1 and F2 = Function#1 and #2, A1 and A2 = Appropriate#1 and #2, and E1 and E2 = Environment#1 and #2.

Table 14 presents the coefficients representing the relationship between the mean scores for each critical attribute in Section 1 and the mean scores for each critical attribute in Section 2 and Section 3. Although three of the eight coefficients in each
Table 14

Correlations between Mean Scores of Critical Attributes on Section 1 and Critical Attributes in Sections 2 and 3

<table>
<thead>
<tr>
<th>Section 2</th>
<th>S1T1</th>
<th>S1T2</th>
<th>S1F1</th>
<th>S1F2</th>
<th>S1A1</th>
<th>S1A2</th>
<th>S1E1</th>
<th>S1E2</th>
</tr>
</thead>
<tbody>
<tr>
<td>S2T1</td>
<td>.0902</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>S2T2</td>
<td></td>
<td>-.0072</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>S2F1</td>
<td></td>
<td></td>
<td>-.0060</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>S2F2</td>
<td></td>
<td></td>
<td></td>
<td>.4234**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S2A1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.2950**</td>
<td></td>
<td></td>
<td></td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>.3478**</td>
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<td></td>
</tr>
<tr>
<td>S2E1</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.0290</td>
<td></td>
</tr>
<tr>
<td>S2E2</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.1363</td>
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</table>

<table>
<thead>
<tr>
<th>Section 3</th>
<th>S1T1</th>
<th>S1T2</th>
<th>S1F1</th>
<th>S1F2</th>
<th>S1A1</th>
<th>S1A2</th>
<th>S1E1</th>
<th>S1E2</th>
</tr>
</thead>
<tbody>
<tr>
<td>S3T1</td>
<td>.1747**</td>
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</tr>
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<td>S3F1</td>
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<td></td>
</tr>
<tr>
<td>S3A1</td>
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<td></td>
<td></td>
<td></td>
<td>.1700**</td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>S3A2</td>
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<td></td>
<td></td>
<td></td>
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<td>-.0701</td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td>-.1475</td>
<td></td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>.0180</td>
</tr>
</tbody>
</table>

** observed statistical significance level < .01

section have a statistical significance level < .01, a pattern across all attributes was not found. Also if the coefficients are examined as effect sizes, only two (r = .42 and r = .35) are above the .30 criteria established by Cohen (1988). The associated $r^2$ values are .18 and .12, respectively. In the absence of a pattern, these relationships show little
importance. It is also interesting that although not statistically significant, several coefficients suggest a negative correlation.

Table 15 presents coefficients between the mean score for all of Section 1 and each of the critical attributes in Section 2 and Section 3 as well as the correlation between the mean for all of Section 1 and means for all of Sections 2 (S2M) and 3 (S3M). The correlation coefficients in Table 15 suggest a moderate relationship

Table 15

Correlations between Mean Score on Section 1 and Critical Attributes in Sections 2 and Section 3

<table>
<thead>
<tr>
<th>Section #1 Mean</th>
<th>r2</th>
<th>Section #1 Mean</th>
<th>r2</th>
</tr>
</thead>
<tbody>
<tr>
<td>S2T1</td>
<td>.1643**</td>
<td>.027</td>
<td>S3T1</td>
</tr>
<tr>
<td>S2T2</td>
<td>.1343</td>
<td>.018</td>
<td>S3T2</td>
</tr>
<tr>
<td>S2F1</td>
<td>-.0228</td>
<td>.006</td>
<td>S3F1</td>
</tr>
<tr>
<td>S2F2</td>
<td>.4651**</td>
<td>.216</td>
<td>S3F2</td>
</tr>
<tr>
<td>S2A1</td>
<td>.4724**</td>
<td>.223</td>
<td>S3A1</td>
</tr>
<tr>
<td>S2A2</td>
<td>.3473**</td>
<td>.121</td>
<td>S3A2</td>
</tr>
<tr>
<td>S2E1</td>
<td>.1652*</td>
<td>.027</td>
<td>S3E1</td>
</tr>
<tr>
<td>S2E2</td>
<td>.4282**</td>
<td>.183</td>
<td>S3E2</td>
</tr>
<tr>
<td>S2M</td>
<td>.5073**</td>
<td>.257</td>
<td>S3M</td>
</tr>
</tbody>
</table>

** observed statistical significance level < .01
between the mean score on Section 1 and several critical attributes on Section 2. They also suggest there is a relationship between the mean score for all of Section 1 and the mean score for all of Section 2. Using the effect size criteria of .30 established by Cohen (1988), these results suggest that there is some common variance shared, and that there is a relationship between the respondents understanding of the critical attributes and their agreement that these attributes should be considered in the provision of assistive technology to students with disabilities.

On the other hand, the second column of Table 15 suggests little relationship between the mean score on Section 1 and scores on Section 3. This is consistent with other results in that the level of understanding does not appear to be a factor in the actual provision of assistive technology.

The last table in this section, Table 16, presents the correlation coefficients between means for each of the eight critical attributes for Section 2 and Section 3. These scores are lower, and with fewer statistically significant scores than any of the variables examined. There appeared to be little if any relationship between the respondents' agreement that the critical attributes were important, and the respondents' provision of assistive technology.
Table 16

Correlations between Critical Attributes in Section 2 and Critical Attributes in Section 3

<table>
<thead>
<tr>
<th>Section 3</th>
<th>S2T1</th>
<th>S2T2</th>
<th>S2F1</th>
<th>S2F2</th>
<th>S2A1</th>
<th>S2A2</th>
<th>S2E1</th>
<th>S2E2</th>
</tr>
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<tbody>
<tr>
<td>S3T1</td>
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<tr>
<td>S3T2</td>
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<td>.0464</td>
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<td>S3F1</td>
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<tr>
<td>S3F2</td>
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<td></td>
<td>-.0322</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>S3A1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.3080**</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>S3A2</td>
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<td>S3E1</td>
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<td></td>
<td></td>
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<td>.0360</td>
</tr>
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</table>

** observed statistical significance level < .05
CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

This chapter provides a summary of conclusions and recommendations. From these conclusions, and the recommendation that follow, one can answer the following research questions.

1. What are the critical relevant and irrelevant attributes that describe the appropriate application of assistive technology in the education of students with disabilities?

2. What currently occurs, and what does not occur, during the IEP process that results in the consideration and application of assistive technology in the IEP?

3. To what extent do current IEP practices incorporate the identified critical attributes of applying assistive technology?

4. What actions can special educators, personnel preparation programs, and parents of students with disabilities take to increase the probability that assistive technology will be appropriately applied in the IEP?

Conclusions

Eight conclusions responding directly to the research questions are summarized here. A more detailed justification for each conclusion follows.
1. There are critical attributes that special educators should understand, and apply, to assure that students have access to appropriate assistive technology through the IEP process.

2. In addition to the set of critical attributes, there are irrelevant attributes that impede the appropriate application of assistive technology in the IEP that need to be addressed.

3. Most IEP teams do not consider the student’s need for assistive technology, and therefore most IEPs do not contain assistive technology.

4. Assistive technology assessments are not clearly defined and seldom occur.

5. A major reason for not considering assistive technology during the IEP process is the perceived lack of adequate financial resources.

6. Although respondents appear to have a basic understanding of the identified critical attributes, responses to survey items examining respondents’ actual IEPs suggest that application of the critical attributes may not occur.

7. There are things that IEP participants can do that will increase the probability of assistive technology being included in the IEP.

8. Although there are statistically significant differences in some areas between those respondents who provide more technology, and those who do not, in most areas examined the differences are not statistically or practically significantly different.
Conclusion #1--Critical Attributes

Markle and Tiemann (1970) referred to a concept as a class the members of which share some properties in common. A critical attribute refers to any attribute that is essential to an example to classify that example as a member of a given concept class (Hofmeister, 1977). It is these shared properties that enable the learner to generalize to new examples (Markle & Tiemann, 1970). These critical attributes are subconcepts that considered together define the larger concept of assistive technology in a special education context. All identified critical attributes were validated through comprehensive concept, and data analysis. Multiple validation procedures assure that these critical attributes are consistent with a synthesis of the literature, special education law, regulatory literature, expert reviews, focus group reviews, and survey analysis. Identified critical attributes are generalizable to a wide range of assistive technology devices and services that are available, and/or that may become available. They are also generalizable to the wide range of functional capabilities and disabilities of students receiving special education services. In a special education context, critical attributes of assistive technology are:

1. Assistive technology includes a complete spectrum of assistive devices.

2. Assistive technology increases, maintains, or improves functional capabilities.

3. Assistive technology provides educational benefit.

4. Assistive technology meets students' unique needs.
5. Assistive technology's continued use is driven by student acceptance.
6. Assistive technology increases or maintains social acceptance and personal dignity.
7. Assistive technology facilitates placement in inclusive environments.
8. Assistive technology is not determined by existing environmental resources.

Conclusion #2--Irrelevant Attributes

One feature of a quality instructional program is the extent to which it anticipates and addresses misconceptions or misperceptions of the learner. These misconceptions occur when the learner treats an irrelevant attribute as a critical attribute. An attribute that may be present but is not essential is an irrelevant attribute (Hofmeister, 1977). Irrelevant attributes and their associated misperceptions concerning assistive technology impede access to and the appropriate application of assistive technology in the IEP process. Misperceptions result from a lack of understanding of the critical attributes listed above and a lack of understanding of the purpose of IEP.

Irrelevant attributes and misperceptions include:

1. Assistive technology is complex mechanical and electronic devices.
2. Assistive technology is expensive.
3. Assistive technology is a convenience and not necessary for a free appropriate public education (FAPE).
4. Functional capabilities are more important than personal dignity and social acceptance.
5. It is best to purchase assistive technology that meets the needs of multiple students.

6. Students with severe disabilities have a greater need for assistive technology than students with mild or moderate disabilities.

7. Assistive technology should only be considered for certain types of disabilities.

8. Assistive technology is considered only after making placement decisions.

Conclusion #3—IEPs Containing Assistive Technology

The single most significant factor in accessing assistive technology through the IEP is whether or not it was considered during the IEP process. Several possibilities exist as to why assistive technology is most often not even considered. One reason, and the only acceptable reason, is that assistive technology may not be appropriate for the student. Other reasons, which by effective IEP standards are not considered acceptable, include:

1. IEP participants, providers, parents, and students, do not understand the concept of assistive technology well enough to discuss it during the IEP;

2. Not using the IEP process to focus on meeting the student’s unique needs;

3. Fear of insufficient resources to purchase devices and services; and,

4. Inadequate, nonexistent, or inappropriately applied assistive technology policies and procedures.
Several studies have attempted to determine the number of people with disabilities that could benefit from the use of assistive technology. The results of these studies vary according to the population being considered, and whether the data are collected directly from individuals with disabilities, or from providers. A report from the National Council on Disability (1993) stated that from 37%-80% of persons with disabilities could benefit from assistive technology.

In this study, respondents who were surveyed reported they were involved in an average of 24.35 IEPs during the 1994-95 school year. Of those 24.35 IEPs, assistive technology was considered in an average 3.32 IEPs (13.6%) and contained in an average of 2.32 IEPs (9.5%). Although assistive technology is not appropriate for every student who receives special education services, the study noted above (NCD, 1993) found that it is appropriate for 37%-80% of individuals with disabilities. Even using the minimal 37% figure, assistive technology should be considered in at least four times as many IEPs as are currently considered it.

Conclusion #4--Assistive Technology Assessments

Over 86% of survey respondents reported that they had not, or would not, consider an assistive technology assessment for a recently classified student with a learning disability. The need for training in effective assessment procedures was also evident in the respondent’s lack of understanding of the primary role the student (consumer) plays in determining appropriate technology (Galvin & Phillips, 1991;
Scherer & Galvin, 1994). There appears to be a significant need to further define what an assistive technology assessment is and allocate resources to conduct such assessments.

**Conclusion #5--Financial Considerations**

Over 43% of survey respondents reported feeling pressure not to discuss assistive technology during an IEP meeting. Of those respondents reporting pressure not to discuss assistive technology during an IEP, 86.7% reported that insufficient funding to purchase devices was the basis of the pressure. Other survey items and comments on returned surveys also suggest funding as a major issue in providing assistive technology. Eighty-eight percent of respondents reported they would not even consider a color wheelchair if it cost more than the basic black one. Over 78% of respondents reported they would not consider a particular device, if requested by the student, if the cost were 20% more than a comparable device.

Although the provision of special education services is defined within financial parameters (especially in Utah), access to assistive technology is often categorically denied because of perceived financial constraints. Such denials may expose local education agencies (LEAs) to additional financial burdens as the result of due process hearing and legal challenges.
Conclusion #6--Discrepancies Between Understanding and Applying Critical Attributes

Consideration and application of the concept of assistive technology in a special education context, with its associated critical attributes, appear lacking in the IEP process. In fact, it appears that many irrelevant attributes are possibly guiding the IEP. For example, respondents reported that they understand and agree with the need to consider the individual needs of students. However, 48% of respondents reported that they are not likely to refer a student just classified as learning disabled for an assistive technology assessment. They may not see the justification for assistive technology meeting the unique needs of these students. Also, 55% are not likely to consider a communication device with masculine or feminine speech to meet the specific needs of a male or female student. Responses suggest that respondents understand, and agree, that the provision of assistive technology devices and services is not based on placement. However, 47% are likely to consider a computer for a student who was self-contained, and only 27% are likely to consider a computer for a student who was in resource one period a day. Respondents appear to understand that assistive technology may allow a student to function in a less restrictive environment. However, only 8% of respondents are likely to consider a spell checker for a student with a learning disability placed in a regular education classroom and only 7% are likely to consider word prediction software for a student with a learning disability placed in a regular education classroom.
Conclusion #7--Appropriate Courses of Action

There are specific activities that LEAs, university and college personnel preparation programs, individual providers of special education services, and parents and guardians can do to increase the probability of access to, and the appropriate application of assistive technology in the IEP process. Assistive technology is an increasingly important part of the education of students with all disabilities. Without changes in the IEP process, students, especially students with disabilities that do not typically result in technology applications, will not realize maximum benefits from available assistive technology. LEAs lack effective policies and procedures to meet students' assistive technology needs. Personnel preparation programs do not appear to provide potential service providers with competent assistive technology skills. Providers of special education services need and want additional training in this area. Parents and guardians lack a basic understanding of assistive technology concepts. The problem is the lack of a clear vision of the appropriate role of assistive technology in the education of students with disabilities and the lack of integration of this vision in the development of IEPs.

Conclusion #8--Provider Profiles

Respondents who, according to self-reporting on the survey instrument, provide the most assistive technology, understand as well as others that assistive technology meets the unique needs identified in the student’s IEP. They agree with the critical
nature of assistive technology in extending a student’s functional capabilities. They do, to a statistically and practically significant level, consider assistive technology in the IEP process more than others.

Recommendations for the Improvement of
Assistive Technology Services to
Students with Disabilities

Recommendations are linked to the conclusions and are designed to:

1. Provide information that, if used, will allow LEA administrators to develop and/or increase the effectiveness of assistive technology policies.

2. Assist college, university, and LEA in-service staff leaders as they develop assistive technology training curricula and programs.

3. Supply educators with critical attributes, which if applied, will allow for the appropriate application of assistive technology in IEPs.

4. Provide parents and guardians with a set of procedures, questions, and recommendations that, if followed, will increase the probability that assistive technology will be considered, and accessed through their child’s IEP.
1. Training, both inservice and preservice, on assistive technology is often device or disability specific. Although this type of training is necessary for appropriate application of a specific device, more training needs to be based on the above-listed critical attributes. Understanding of these critical attributes generalizes to specific disabilities or specific assistive devices and is prerequisite to device specific training.

2. LEA policies on assistive technology should be based on effective special education delivery principles and meet legal requirements. Assistive technology is not an isolated, one-time-only consideration. Assistive technology must be considered during assessment, placement, determination of services, transition planning, and so forth.

3. It is more important for parents to understand the critical attributes identified in this study than to understand specific devices. If parents understand their child’s needs, and these critical attributes, they can then ask the types of questions that lead to the appropriate application of assistive technology.

#2--Recommendations for Understanding Irrelevant Attributes and Eliminating Misperceptions

1. In all training programs, especially those addressing a new concept like assistive technology, both examples and nonexamples are necessary for teaching what is
distinctive about a given concept (Prater, 1987). All those involved in the IEP process need additional training.

2. Additional training is needed on the intent and purpose of the IEP process. According to Barbara Bateman (1991), the IEP should (a) identify the student’s unique characteristics and needs, (b) list what the LEA will do in response to each characteristic and need, and (c) identify appropriate goals and objectives for the student. This process, if followed, would assure appropriate applications of assistive technology.

3. LEA policies and procedures need to be developed so that they are specific enough to dispel the misperceptions listed previously, yet allow decisions to be made on a case-by-case basis.

#3--Recommendations for Increasing the Likelihood That Assistive Technology Will Be Considered in the IEP Process

1. Providers of special education services need to have an understanding of the appropriate application of assistive technology that allows them to access assistive technology through the IEP.

2. Providers of assistive technology need additional training on conducting assistive technology assessments. Assistive technology assessments need to become an accepted element of the evaluation process. Reed (1995), Zabala (1995), and Scherer and Galvin (1994) have all produced excellent materials to support assessment efforts.

3. LEAs need to develop policies and procedures that facilitate the open consideration of assistive technology in IEPs. Practices that presumptively deny
assistive technology (especially if based on funding concerns) are illegal and will lead to costly due process hearings and other litigation.

4. LEAs need to consider the assessment issue both from a program and a policy view. LEAs need to accept the multidisciplinary nature of assistive technology and establish multidisciplinary assessment teams. LEAs also need to assure that assessments occur if necessary, and that individuals making assessment decisions receive adequate training.

5. Parents of students with disabilities need to understand that they are important participants in the IEP, and that asking the IEP team to consider assistive technology for their child is a reasonable request. Parents have the right to request and expect appropriate assistive technology assessments.

#4--Recommendations for Reducing the Restrictive Role of Local Education Agencies Financial Resources in the Consideration of Assistive Technology

1. Special education has the responsibility to provide assistive technology when it is necessary for the student to receive FAPE. Special education does not need to stand the cost of this provision by itself. Training in the appropriate application of assistive technology should include information on alternate funding sources and how to collaborate with other funding agencies.

2. LEAs need to understand that they have the responsibility to provide assistive technology necessary for a student to receive FAPE. However, other funding
sources are available (see A Checklist for Identifying Funding Sources for Assistive Technology [Menlove, 1996]).

3. Additional training is needed so that special education providers understand the financial benefits associated with the provision of assistive technology. Training in this area might be based on the report from the National Council on Disability (1993), "Study on the Financing of Assistive Technology Devices and Services for Individuals with Disabilities."

#5--Recommendations for Eliminating the Discrepancies Between Understanding of Critical Attributes and the Application of Those Attributes in the IEP Process

1. Training for teachers needs to stress appropriate applications. Understanding of the critical attributes is insufficient if they do not understand applications. Teacher training needs to focus on the elimination of misperceptions concerning assistive technology, and relieving anxieties concerning financial constraints.

2. LEAs need to assure that services provided, including assistive technology services, are based on meeting the unique needs of the student and not factors such as placement, classification, or amount of services.

3. Research has been done on the effective application of assistive technology (Galvin & Phillips, 1991). Training needs to be based on this research and providers need to be taught to consider issues such as individual needs and wants, focus on
function, individualized solutions, keep it simple, be holistic, choose the least invasive alternative, and technology abandonment.

4. Parents must understand that the purpose of the IEP is to meet the individual and unique needs of the student. Parents have the right to expect that the IEP does this, and need to understand their rights to assure that this occurs.

#6—Recommendations for Appropriate Courses of Action for LEAs, Personnel Preparation Programs, Special Education Providers, and Parents

1. LEAs need to develop policies and procedures that cause providers to consider a child’s need for assistive technology on a case-by-case basis in connection with the development of the child’s IEP. Policies and procedures must allow for:

(a) consideration of assistive technology at various stages of the IEP,

(b) addressing the interaction of the child with the technology,

(c) consideration of the child’s functional abilities as they relate to assistive technology,

(d) determining the appropriateness of the technology for the child, and

(e) examining the environment in which the child will use the technology.

2. A synthesis of the literature finds that personnel preparation programs need to identify competencies associated with the appropriate application of assistive technology and develop a curriculum to teach these competencies. These competencies may be closely tied to other competencies, but need to be taught in a way that allows
for generalization to the assistive technology concepts. For example, personnel preparation programs all have courses on student assessments designed to teach potential teachers how to identify students’ abilities and unique needs. However, do these courses address increasing functional abilities with the assistance of technology or the identification of a student’s technology needs? The Personnel Training in Assistive Technology project at the University of Buffalo has developed courses that could serve as a basis for this instruction.

3. The assessment issue needs to be addressed immediately. Students have the right to effective technology assessments as part of the evaluation process. Reed (1995), Zabala (1995), and Scherer and Galvin (1994) have all produced excellent materials to support assessment efforts.

4. Providers currently in the education system have the same basic training needs as the preservice training needs. Practicing special education providers recognize the need for and want additional training in this area.

5. Much of the information parents have about assistive technology comes from advertisements or brochures designed to market a specific device. Parents need a basic understanding of the critical attributes of applying assistive technology so they can ask the right questions and know how to help determine if technology contained in the IEP is appropriate.
REFERENCES


Fifield, M.G. (1990, October). Defining issues within the context of assistive technology training. Paper presented at the National Outreach Training Directors 1990 Annual Meeting of the American Association of University Affiliated Programs, Madison, WI.


Ten things administrators should know. (1994). The Special Educator, 9(11), 164.


Appendix A

Support Documents For Concept Analysis
<table>
<thead>
<tr>
<th>Content Validity</th>
<th>Legal Validity</th>
<th>Critical Attributes</th>
<th>Potential Irrelevant Attributes</th>
<th>Examples</th>
<th>Nonexamples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hofmeister, Carnine, &amp; Clark 1994 - Integrating technology with content and pedagogy; technology should become transparent, stress the integration of machine, curriculum content, and instructional context</td>
<td>Parette, Hourcade, &amp; VanBiervliet - 1993 technology enhances their independence and productivity</td>
<td>• increases, maintains, ex-tends or improves functional capabilities - promotes efficiency - increases accuracy, independence or productivity • functions as a piece of equipment or product system • provides educational benefit as defined in statutory and case law</td>
<td>• technology is “high tech” • all technology that a student needs must be provided by the school</td>
<td>A student with hearing loss is provided with an assistive listening device and functional successfully in regular classes. A student with muscular dystrophy who has trouble writing is allowed to record all assignments and test on a tape recorder. A student with a learning disability is allowed to use a calculator in math class.</td>
<td>Schools are responsible for corrective surgery to help students improve gross motor skills. Schools must provide computers for all special education students. Technology should be included in every IEP.</td>
</tr>
<tr>
<td>Parette - 1993 - technology promotes efficiency, increase accuracy</td>
<td>American Association for . . . - 1989 - . . . technology extends our abilities to change the world; to cut, to shape, . . . to reach farther with our hands, voices, and senses.</td>
<td></td>
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<tr>
<td>Hawkridge, Vincent, &amp; Hales - 1985 - as technology applications continue . . . the greatest academic gains have been among students with disabilities</td>
<td>Schrag - 1990 assistive technology can be a form of supplementary aid of service Tech Act - 1988 technology is a powerful force in the lives of most residents of the United States 34 CFR 300.5 - . . . means any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized Irving v. Tatro - . . . supportive services as may be required to assist a [handicapped] child to benefit from special education . . .</td>
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<tr>
<td>Content Validity</td>
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<td>Examples</td>
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<tr>
<td>Parette, Hourcade, &amp; VanBiervliet - 1993 - use of the devices should emerge as a result of the assessment of the needs, desires, and capabilities of the child.</td>
<td>Heumann - 1993 - obstacles circumvented and disabilities overcome</td>
<td>- meets the unique needs identified in the student's assessment</td>
<td>• assists technology is only a convenience</td>
<td>A student who has trouble gripping a pencil is provided with a pencil that straps to his/her hand.</td>
<td>Assistive technology is necessary to assure that students maximize their potential</td>
</tr>
<tr>
<td>Heumann - 1993 - obstacles circumvented and disabilities overcome</td>
<td>Gradel - 1990 - technology enriches educational opportunities</td>
<td>- increases, maintains, or improves functional capabilities</td>
<td>• functional abilities are more important than person dignity and social acceptance</td>
<td>A student with a visual impairment is provided all handouts for class using a large font.</td>
<td>Assistive technology is more valuable if it meets the needs of several students.</td>
</tr>
<tr>
<td>Schrag - 1990 - technology can be a form of supplementary aid of service</td>
<td>Schrat - 1990 - assistive technology device</td>
<td>- Schrag - 1990 - definition of assistive technology device</td>
<td>• all functional limitations can be eliminated with technology</td>
<td>A student with cerebral palsy who has trouble walking is provided with a walker and now gets to and from class unassisted.</td>
<td>Computers allow students with disabilities to function at a higher level.</td>
</tr>
<tr>
<td>Schrat - 1990 - technology can be a form of supplementary aid of service</td>
<td>34 CFR 300.5 - definition of assistive technology device</td>
<td>- 34 CFR 300.5 - definition of assistive technology reduce cost to society</td>
<td>• eliminates/circumvents obstacles/barriers</td>
<td>An assistive technology assessment is included in all referral</td>
<td></td>
</tr>
</tbody>
</table>

A student who has trouble gripping a pencil is provided with a pencil that straps to his/her hand.

A student with a visual impairment is provided all handouts for class using a large font.

A student with cerebral palsy who has trouble walking is provided with a walker and now gets to and from class unassisted.

An assistive technology assessment is included in all referral.
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<th>Examples</th>
<th>Nonexamples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parette, Hourcade, &amp; VanBiervliet - 1993</td>
<td>Schrag - 1990 - technology is an element of FAPE</td>
<td>* meets the unique needs identified in the student's assessment</td>
<td>* device must be appropriate for multiple students</td>
<td>A nonverbal student is provided with an alternative communication devices that allow the student to participate in class discussions and “ask” questions.</td>
<td>A student weak upper-body strength is provided a manual wheelchair and must rely on other students to move from room to room in the school building.</td>
</tr>
<tr>
<td>technologies ... increases their ability to participate in the mainstream of society -</td>
<td>Hehir - 1994 - ...</td>
<td>* places priority on eliminating the personally intrusive nature of the device</td>
<td>* device should be purchased considering future use of the device by other students</td>
<td></td>
<td>Students with a learning disabilities are denied the use of a computer because their handwriting is adequate.</td>
</tr>
<tr>
<td>assistive technology that ... remains unused because a child is uncomfortable with it is the equivalent of no assistance at all</td>
<td>Hehir - 1995 public agencies are required, when warranted, to provide assistive technology evaluations</td>
<td>* assures that the student is comfortable with the device</td>
<td>* level of technical sophistication</td>
<td></td>
<td>A student’s choice of a wheelchairs is not considered because it involves additional expense.</td>
</tr>
<tr>
<td>CASE - 1993 - assistive technology in the hands of students allows the student to be educated more appropriately and increases their potential for social interaction with their peers</td>
<td>Fed Reg Sept 29, 1992 - The secretary believes that assistive technology devices and services may be essential to the provision of FAPE</td>
<td>* maintains the social acceptance and personal dignity of the student and promotes inclusion</td>
<td>* use of technology is dependent upon classification of student</td>
<td></td>
<td>A female student is given an electronic communication device with only masculine speech.</td>
</tr>
<tr>
<td>Parette, Hourcade, &amp; VanBiervliet - 1993</td>
<td>34 CFR 300.5 - assistive technology ... increases, maintains, or improves functional capabilities ...</td>
<td>* student “wants” are not as important as student “needs”</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>devices that are available are as diverse as the needs and characteristics of the people who benefit from them -</td>
<td>Schrag - 1990 consideration must occur on a case-by-case basis in ... IEP</td>
<td>* only academic goals are considered when purchasing devices</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>the simplicity of the operations of the equipment is an important area of consideration</td>
<td></td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>
CASE - 1993 - technology becomes a means by which students can be included in all aspects of schooling
Wilds - 1989 - the primary aim should be ... to provide for the maximum participation of the young child in social and educational environments
Schere & Galvin 1994 - technology is great equalizer when competing with non-disabled peers
Burnette - 1990 - assistive technology ... can provide the mobility and stamina needed to get to school and be integrated into regular classes for more of the school day
Lahm and Elting - 1989 technology has the potential to facilitate the inclusion of students with disabilities into the mainstream of school and society to a greater extent

<table>
<thead>
<tr>
<th>Content Validity</th>
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<th>Critical Attributes</th>
<th>Potential Irrelevant Attributes</th>
<th>Examples</th>
<th>Nonexamples</th>
</tr>
</thead>
<tbody>
<tr>
<td>CASE - 1993 - technology becomes a means by which students can be included in all aspects of schooling</td>
<td>34 CFR 300.550 - removal ... from the regular educational environment occurs only when education in regular classes with the use of supplementary aides and services cannot be achieved satisfactorily”</td>
<td>• maintains the social acceptance and personal dignity of the student and promotes inclusion</td>
<td>• technology is needed only to achieve academic related goals</td>
<td>A new bus is ordered with a wheelchair lift so students can ride the same bus as their peers.</td>
<td>Computer adaptations are only made for students in the “severe” classroom.</td>
</tr>
<tr>
<td>Wilds - 1989 - the primary aim should be ... to provide for the maximum participation of the young child in social and educational environments</td>
<td>34 CFR 300.308 - assistive technology devices and services as special education 300.17</td>
<td>• addresses the problems created by the interaction between the student and their human and non-human environment</td>
<td>• all students are most successful in the “regular” classroom</td>
<td>A communication device with human quality voice is provided for a student.</td>
<td>Students are provided with assistive technology while in school but are not allowed to take it home to complete “homework”.</td>
</tr>
<tr>
<td>Schere &amp; Galvin 1994 - technology is great equalizer when competing with non-disabled peers</td>
<td>34 CFR 300.308 - assistive technology as related services 300.16</td>
<td>• ignores placement in determining use of the technology</td>
<td>• only students in “severe” programs need technology</td>
<td>A school lunch table is modified so students with wheelchairs can sit with their friends.</td>
<td>All students with learning disabilities are provided laptop computers and assigned to “regular classrooms”.</td>
</tr>
<tr>
<td>Burnette - 1990 - assistive technology ... can provide the mobility and stamina needed to get to school and be integrated into regular classes for more of the school day</td>
<td>34 CFR 300.308 - assistive technology as supplementary aid and services 300.550</td>
<td>• facilitates student’s successful functioning in the LRE</td>
<td>• technology cannot be taken out of the classroom</td>
<td>The LEA policy states that all technology purchased must be integrated into the LRE of the student.</td>
<td></td>
</tr>
</tbody>
</table>
Appendix B

Focus Groups
Appendix B--Focus Groups--Focus Group #1 Membership

Craig Boogaard
Director
Computer Center for Citizens with Disabilities

Julie Buckingham
Teacher, Preschool
Tooele County School District

Ken Harvey
Director of Special Education
San Juan County School District

Gwen Evans
Teacher, Severe Disabilities
Millard County School District

Mona Oversteg
Occupational Therapist
Ogden City School District

Lowell Oswald
Speech Language Therapist
Davis County School District

Dale Sheld
Assistive Technology Specialist
Utah State Office of Education

Tara Wells
Physical Therapist
Granite School District
Appendix B--Focus Groups--Focus Group #2 Membership

Vickie Brenchley  
Mother of child with Cerebral Palsy  
Ogden, Utah

Elbert Brown  
Cerebral Palsy  
Salt Lake City, Utah

Laura Homer  
Hard of Hearing  
Layton, Utah

June Knudson  
Deaf  
Roy, Utah

Alan Kimball  
Wheel Chair User  
Salt Lake City, Utah

Joan Provost  
Mother of child with multiple disabilities  
Salt Lake City, Utah

Helen Roth  
Post Polio  
Logan, Utah
<table>
<thead>
<tr>
<th>Question</th>
<th>Focus Group #1 Response</th>
<th>Focus Group #2 Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1 - On a scale of 1-5, with (1) indicating no influence and (5) indicating much influence, how much influence have you had in concept analysis process? In the survey development process?</td>
<td>Concept Analysis Total 32 Mean 4.57</td>
<td>Concept Analysis Total 25 Mean 4.17</td>
</tr>
<tr>
<td></td>
<td>Survey Development Total 33 Mean 4.71</td>
<td>Survey Development Total 28 Mean 4.67</td>
</tr>
<tr>
<td>#2 - On a scale of 1-5, with (1) indicating little or nothing and (5) indicating very much, are your views represented by the concept analysis? By the survey?</td>
<td>Concept Analysis Total 34 Mean 4.86</td>
<td>Concept Analysis Total 26 Mean 4.33</td>
</tr>
<tr>
<td></td>
<td>Survey Total 32 Mean 4.57</td>
<td>Survey Total 29 Mean 4.83</td>
</tr>
<tr>
<td>#3 - On a scale of 1-5, with (1) indicating no agreement and (5) indicating total agreement, do you agree with the findings of the concept analysis?</td>
<td>Total 34 Mean 4.86</td>
<td>Total 28 Mean 4.67</td>
</tr>
<tr>
<td>#4 - On a scale of 1-5, with (1) indicating no value and (5) indicating very valuable, what is the value of the concept analysis? Survey</td>
<td>Concept Analysis Total 34 Mean 4.86</td>
<td>Concept Analysis Total 30 Mean 5.00</td>
</tr>
<tr>
<td></td>
<td>Survey Total 35 Mean 5.00</td>
<td>Survey Total 29 Mean 4.83</td>
</tr>
<tr>
<td>#4 - On a scale of 1-5, with (1) indicating none and (5) indicating total, do you feel you have made a contribution to this process as an individual? As a group?</td>
<td>Individual Total 31 Mean 4.43</td>
<td>Individual Total 28 Mean 4.67</td>
</tr>
<tr>
<td></td>
<td>Group Total 33 Mean 4.71</td>
<td>Group Total 26 Mean 4.33</td>
</tr>
<tr>
<td>#5 - What is your major concern with the concept analysis?</td>
<td>Teachers not understanding the concepts. (2) Encouraging more use of assistive technology with no additional resources. (3) What about assistive technology services? (1) (no response)(1)</td>
<td>Not enough focus on the individual student. (1) Parents not being familiar with the concepts. (2) It looks like a medical model.(1) (no response)(2)</td>
</tr>
</tbody>
</table>
### Question
### Focus Group #1 Response
### Focus Group #2 Response

<table>
<thead>
<tr>
<th>#6 - What is your major concern with the survey?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length. (3) Willingness of participants to respond. (2)</td>
</tr>
<tr>
<td>(no response)(2)</td>
</tr>
<tr>
<td>Length. (2) Respondents accuracy (truthfulness). (2)</td>
</tr>
<tr>
<td>Nothing will change. (2)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#7 - What is the major strength of the concept analysis?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accentuating the needs of the individual. (4)</td>
</tr>
<tr>
<td>Clarification of environment (LRE) issues. (2)</td>
</tr>
<tr>
<td>(no response)(1)</td>
</tr>
<tr>
<td>Accentuating the needs of the individual. (3)</td>
</tr>
<tr>
<td>Technology as more than computers. (1)</td>
</tr>
<tr>
<td>Assistive technology to determine LRE. (1)</td>
</tr>
<tr>
<td>(no response)(1)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>#8 - What is the major strength of the survey?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment of teacher knowledge. (2)</td>
</tr>
<tr>
<td>Assessment of actual assistive technology use. (2)</td>
</tr>
<tr>
<td>Anonymity. (1)</td>
</tr>
<tr>
<td>(no response)(2)</td>
</tr>
<tr>
<td>Questions concerning take-home policies. (3)</td>
</tr>
<tr>
<td>Questions about actual use of assistive technology. (2)</td>
</tr>
<tr>
<td>(no response)(2)</td>
</tr>
</tbody>
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Appendix B--Focus Groups--Group 1, Survey Validity Questionnaire

Focus Group 1, Survey Validity Questionnaire

<table>
<thead>
<tr>
<th>Question</th>
<th>Mean</th>
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<tbody>
<tr>
<td>1. Do you believe the questions in Section 1 will identify the level of a teacher’s understanding of the concepts identified in the concept analysis?</td>
<td>4.50</td>
</tr>
<tr>
<td>2. Do you believe the questions in Section 1 will discriminate between those teachers who understand these concepts and those who do not?</td>
<td>4.67</td>
</tr>
<tr>
<td>3. Do you believe the questions in Section 2 will accurately reflect teachers’ agreement or disagreement with the concepts being presented?</td>
<td>4.67</td>
</tr>
<tr>
<td>4. Do you believe the questions in Section 2 will allow the researcher to draw conclusions concerning the critical nature of the concepts identified?</td>
<td>4.50</td>
</tr>
<tr>
<td>5. Do you believe the questions in Section 3 will accurately reflect a teacher’s level of application of the concepts being presented?</td>
<td>4.83</td>
</tr>
<tr>
<td>6. Do you believe the questions in Section 3 will accurately reflect the amount of assistive technology actually being included in IEPs?</td>
<td>4.67</td>
</tr>
<tr>
<td>7. Do you believe the directions accompanying the survey are clear and provide enough direction to facilitate accurate completion of the survey?</td>
<td>4.83</td>
</tr>
<tr>
<td>8. Do you believe the questions are clear and teachers will be able to easily respond to them?</td>
<td>4.67</td>
</tr>
<tr>
<td>9. Will most special education teachers in Utah complete this survey?</td>
<td>3.50</td>
</tr>
<tr>
<td>10. Overall, will this survey accomplish its purpose as you understand it?</td>
<td>4.67</td>
</tr>
</tbody>
</table>
Appendix C

Survey Instrument
SECTION #1
For each question in this section, please indicate if you agree or disagree with the statement being made.

1. Computer software can be considered as assistive technology. agree disagree
2. A pencil grip is assistive technology. agree disagree
3. Assistive technology always involves computers or electronics. agree disagree
4. A manual wheelchair is assistive technology. agree disagree
5. A tape recorder could be considered as assistive technology. agree disagree
6. Students who write slowly and legibly most likely do not need assistive technology to increase their writing speed. agree disagree
7. A heart pace maker is considered as special education assistive technology. agree disagree
8. To be included in an IEP, assistive technology needs to provide some educational benefit. agree disagree
9. Assistive technology is necessary to assure that students maximize their abilities. agree disagree
10. All students with disabilities need some type of assistive technology. agree disagree
11. The IEP team decides if a student needs assistive technology. agree disagree
12. Assistive technology should be purchased only if it meets the needs of several students. agree disagree
13. It is important that students feel comfortable with assistive technology. agree disagree
14. Students (who have the ability to participate) are more likely to use a device if they are involved in the decision making process. agree disagree
15. Professionals know best what students need. agree disagree
16. It is important to consider a student's social acceptance when recommending a piece of assistive technology. agree disagree
17. Assistive technology can increase a student's personal dignity. agree disagree
18. A student's ability to function is more important than their social acceptance. agree disagree
19. Assistive technology may allow students to be placed in less restrictive environments. agree disagree
20. Electronic communication systems are appropriate for use in regular classrooms. agree disagree
21. Students should not be placed in inclusive settings unless they can function in that setting without the use of assistive technology. agree disagree
22. Assistive technology should be discussed when considering a student's placement. agree disagree
23. It is more likely for students in severe/profound programs to use assistive technology. agree disagree
24. The provision of assistive technology depends on the student's placement. agree disagree

The following questions relate to you personally as a teacher. Remember, all responses are anonymous.

25. I have received enough training in the area of assistive technology. agree disagree
26. I would be interested in additional training in the area of assistive technology. agree disagree
27. At times I feel pressure not to discuss assistive technology during an IEP meeting. agree disagree
28. If you agree to #27, this pressure is based on insufficient funding to purchase devices. agree disagree
29. Students with severe disabilities need assistive technology at home, as well as at school. agree disagree
30. Does your school district have written policy addressing assistive technology? yes no
31. If no to #30, would it be best if the district had a written policy? yes no
32. If your district has a written policy, does it specifically address taking technology home? yes no
33. Do you (or does your school) have a budget specifically for the purchase of assistive technology? yes no
34. How many IEPs have you been involved with during the 1994-95 school year? 0 1-5 5-10 10-20 20-30 30-40 40-50 50+
35. How many of those IEPs considered some type of assistive technology? 0 1-5 5-10 10-20 20-30 30-40 40-50 50+
36. How many of those IEPs actually contained assistive technology? 0 1-5 5-10 10-20 20-30 30-40 40-50 50+
37. How many years have you been teaching? 1-5 5-10 10-15 15-20 20-25 25-30 30+
38. Do you mainly work with students who are mild/moderate severe both other
39. Is your main assignment? resource self-contained itinerant other
40. What is your main grade level assignment? Pre-K 1-6 7-9 10-12 K-12 10-12+ other
SECTION #2

When considering the appropriate and successful application of assistive technology in a student’s IEP, please mark if the following are “critical”, “very important”, “important”, “not important”, or “not considered”:

1. The assistive technology must be a piece of equipment or a product system.
2. Software for use on purchased computers.
3. The level of sophistication of the technology.
4. The device allows the student to do more work or complete work faster.
5. AT increases, maintains, extends or improves functional capabilities - promotes efficiency - increases accuracy, independence or productivity.
6. The device allow the student to be more independent.
7. The technology provides educational benefit as defined in statutory and case law.
8. The technology is for educational, not medical purposes?
9. Technology that monitors the blood sugar level for a 504 student.
10. Assistive technology meets the unique needs identified in the student’s assessment.
11. The assistive technology eliminates/overrides obstacles/barriers.
13. The technology is designed for use by multiple students.
14. Consideration of the future use of the technology by other students.
15. Consideration of what the student needs.
16. Assuring that the student is comfortable with the device.
17. Consideration of what the student wants.
18. Consideration of the level of technical sophistication of the device.
19. Considering only the student’s academic goals when determining AT.
20. Placing priority on eliminating the personally intrusive nature of the device.
21. The technology allows the student to function more like their non-disabled peers.
22. Maintaining the social acceptance and personal dignity of the student and promoting inclusion.
23. Addressing the problems created by the interaction between the student and their human and non-human environment.
24. Considering where will the device be used (home, school, recess, etc.).
25. The device allows the student to function in a less restrictive environment.
26. The student’s successful functioning in the least restrictive environment.
27. The special education placement of the student.
28. Use of the technology is dependent upon the student’s classification.
29. Technology is more important for students with multiple and profound disabilities.
30. The cost of the device.
SECTION #3

In this section, please respond to three (3) questions. First, in your opinion, would an IEP team in your school consider the following to be appropriate applications of assistive technology and discuss it at a student’s IEP. Second, if the answer to the first question is YES, were you involved in an IEP during the 1994-95 school year where such an item, or a similar item was considered. And finally, if the answer to the second question is YES, was such an item provided as part of the IEP.

1. A talking calculator
   - yes
   - no
   - yes
   - no
   - yes
   - no

2. A one-handed keyboard.
   - yes
   - no
   - yes
   - no
   - yes
   - no

3. A word prediction software program for an LD student.
   - yes
   - no
   - yes
   - no
   - yes
   - no

4. An electronic communication board for a nonverbal student.
   - yes
   - no
   - yes
   - no
   - yes
   - no

5. A pencil grip for a student who cannot grip a pencil.
   - yes
   - no
   - yes
   - no
   - yes
   - no

6. Enlarging print materials for a student who cannot see regular print.
   - yes
   - no
   - yes
   - no
   - yes
   - no

7. An automatic page turner for a student with excellent reading ability and quadriplegia.
   - yes
   - no
   - yes
   - no
   - yes
   - no

8. Corrective surgery for a student to improve motor skills.
   - yes
   - no
   - yes
   - no
   - yes
   - no

9. A three-wheel scooter for a student who can walk short distances but tires easily.
   - yes
   - no
   - yes
   - no
   - yes
   - no

10. A monitor magnification lens for a computer monitor.
    - yes
    - no
    - yes
    - no
    - yes
    - no

11. A wheelchair lift on a bus for a student who is non-ambulatory.
    - yes
    - no
    - yes
    - no
    - yes
    - no

12. An assistive technology assessment for a student who has just been classified as LD.
    - yes
    - no
    - yes
    - no
    - yes
    - no

13. Training on the use of an electronic communication device for a regular education teacher who has a student in their class who uses the device.
    - yes
    - no
    - yes
    - no
    - yes
    - no

14. An electronic communication board with capabilities for masculine, or feminine, speech to meet the specific needs of a male, or female, student.
    - yes
    - no
    - yes
    - no
    - yes
    - no

15. A particular device, if requested by the student, even though the cost is 20% more than another comparable device.
    - yes
    - no
    - yes
    - no
    - yes
    - no

16. A keyboard with the keys arranged in “A-B-C” format instead of the usual “Q-W-E-R-T-Y” format.
    - yes
    - no
    - yes
    - no
    - yes
    - no

17. A power wheelchair for a student who is able to manipulate a manual chair but cannot get from class to class on time because of the large size of the school.
    - yes
    - no
    - yes
    - no
    - yes
    - no

18. A color wheelchair even if it cost more than the basic black one.
    - yes
    - no
    - yes
    - no
    - yes
    - no

19. An electronic spell checker for a learning disabled student placed in a regular classroom.
    - yes
    - no
    - yes
    - no
    - yes
    - no

20. A computer for an LD student who could not function in an inclusive setting without it, but could function successfully in a resource setting.
    - yes
    - no
    - yes
    - no
    - yes
    - no

21. An electronic speller for a student who is only in special education one hour per day.
    - yes
    - no
    - yes
    - no
    - yes
    - no

22. A ramp to the stage so a student in a wheelchair can be in the school play.
    - yes
    - no
    - yes
    - no
    - yes
    - no

23. An assistive technology assessment for a student who has just been classified as learning disabled.
    - yes
    - no
    - yes
    - no
    - yes
    - no

    - yes
    - no
    - yes
    - no
    - yes
    - no

25. A computer for a student who is in resource one period a day.
    - yes
    - no
    - yes
    - no
    - yes
    - no

THANK-YOU FOR YOUR TIME AND EFFORT!!!!
May 12, 1995

Dear Colleague:

A number of teachers have requested help in clarifying the role of assistive technology in the IEP process. Many questions and issues concerning the application of assistive technology in the IEP process exist, and we need your help to assure that our efforts are consistent with your needs. We are anxious to support teachers as we make decisions concerning the investment of our program resources.

We realize your time is important, and that this is a busy time of year. However, your careful and thoughtful response to the enclosed survey would be appreciated. Response to each question is critical. Please answer the questions as quickly as you can. Don’t labor over any questions. This is not meant to tax your valuable time! It should take less than 10 minutes to complete the entire survey. All items can be answered by circling the appropriate response.

All the information is strictly confidential and individual responses are totally anonymous. The information will be analyzed and reported on a statewide basis only. Because we are using a relatively small random sample of all special educators in the State, your response is critical to the findings.

Please return the survey in the accompanying self-addressed stamped envelope as soon as possible. All surveys should be returned by May 31st. Please keep the enclosed pen as a token of our appreciation for your time and effort.

I really appreciate your time and assistance in completing this project!!

Sincerely,

Martell Menlove

note If you would like a copy of the complied results, please send me your name and address, or simply call me, and I will be glad to share the findings.
May 19, 1995

Dear Colleague:

Within the past week you should have received a survey from the Utah Assistive Technology Program. It is printed on this color of paper and is three pages long. If you have already completed, and returned it, THANK YOU!! If you received it and have yet to complete it, and return it, PLEASE do so by May 31st. Because of the sampling process we have used to collect this information, it is critical that we receive as many completed surveys as possible.

The information obtained will be used to examine issues surrounding the use of assistive technology and assure that our efforts are consistent with your needs. We are anxious to support teachers as we make decisions concerning the investment of our program resources.

As was stated in the previous letter, please answer all the questions as quickly as you can. Don’t labor over any questions. This is not meant to tax your valuable time! It should take less than 10 minutes to complete the entire survey. All items can be answered by circling the appropriate response.

Please return the survey in the self-addressed stamped envelope you received with the survey. If you have questions, or need an additional survey, please feel free to call me. All surveys should be returned by May 31st.

I really appreciate your time and assistance in completing this project!!

Sincerely,

Martell Menlove

note If you would like a copy of the complied results, please send me your name and address, or simply call me, and I will be glad to share the findings.
### Appendix C--Survey Instrument--Survey Coding Sheet

<table>
<thead>
<tr>
<th>No.</th>
<th>Section</th>
<th>Item</th>
<th>Section</th>
<th>Item</th>
<th>Section</th>
<th>Item</th>
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<td>UAA ACT/SPED</td>
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</tr>
<tr>
<td>3.</td>
<td>Date Receive</td>
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<td>2-3</td>
<td></td>
<td>3-3</td>
<td></td>
</tr>
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<td>4.</td>
<td>Envelope</td>
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<td>2-4</td>
<td></td>
<td>3-4</td>
<td></td>
</tr>
</tbody>
</table>

**SECTION #1**

6. Item 1-1
7. Item 1-2
8. Item 1-3
9. Item 1-4
10. Item 1-5
11. Item 1-6
12. Item 1-7
13. Item 1-8
14. Item 1-9
15. Item 1-10
16. Item 1-11
17. Item 1-12
18. Item 1-13
19. Item 1-14
20. Item 1-15
21. Item 1-16
22. Item 1-17
23. Item 1-18
24. Item 1-19
25. Item 1-20
26. Item 1-21
27. Item 1-22
28. Item 1-23
29. Item 1-24
30. Item 1-25
31. Item 1-26
32. Item 1-27
33. Item 1-28
34. Item 1-29
35. Item 1-30
36. Item 1-31
37. Item 1-32
38. Item 1-33
39. Item 1-34
40. Item 1-35
41. Item 1-36
42. Item 1-37
43. Item 1-38
44. Item 1-39
45. Item 1-40
SECTION #1
For each question in this section, please indicate if you agree or disagree with the statement being made.

1. Computer software can be considered as assistive technology. agree 97.9%
2. A pencil grip is assistive technology. agree 78.5%
3. Assistive technology always involves computers or electronics. agree 13.1%
4. A manual wheelchair is assistive technology. agree 88.2%
5. A tape recorder could be considered as assistive technology. agree 87.3%
6. Students who write slowly and legibly most likely do not need assistive technology to increase their writing speed. agree 28.5%
7. A heart pace maker is considered as special education assistive technology. agree 10.4%
8. To be included in an IEP, assistive technology needs to provide some educational benefit agree 87.3%
9. Assistive technology is necessary to assure that students maximize their abilities. agree 21.8%
10. All students with disabilities need some type of assistive technology. agree 26.2%
11. The IEP team decides if a student needs assistive technology. agree 84.5%
12. Assistive technology should be purchased only if it meets the needs of several students. agree 28.3%
13. It is important that students feel comfortable with assistive technology. agree 97.4%
14. Students who have the ability to participate are more likely to use a device if they are involved in the decision making process. agree 88.4%
15. Professionals know best what students need. agree 26.1%
16. It is important to consider a student’s social acceptance when recommending a piece of assistive technology. agree 91.6%
17. Assistive technology can increase a student’s personal dignity. agree 95.2%
18. A student’s ability to function is more important than their social acceptance. agree 32.0%
19. Assistive technology may allow students to be placed in less restrictive environments. agree 96.8%
20. Electronic communication systems are appropriate for use in regular classrooms. agree 93.7%
21. Students should not be placed in inclusive settings unless they can function in that setting without the use of assistive technology. agree 13.2%
22. Assistive technology should be discussed when considering a student’s placement. agree 91.5%
23. It is more likely for students in severe/profound programs to use assistive technology. agree 31.1%
24. The provision of assistive technology depends on the student’s placement. agree 33.0%

The following questions relate to you personally as a teacher. Remember, all responses are anonymous.

25. I have received enough training in the area of assistive technology. agree 7.9%
26. I would be interested in additional training in the area of assistive technology. agree 91.5%
27. At times I feel pressure not to discuss assistive technology during an IEP meeting. agree 43.5%
28. If AGREE to # 27, this pressure is based on insufficient funding to purchase devices. agree 86.7%
29. Students with severe disabilities need assistive technology at home, as well as at school. agree 98.4%
30. Does your school district have written policy addressing assistive technology? yes 30.7%
31. If NO to # 30, would it be best if the district had a written policy. yes 80.0%
32. If your district has a written policy, does it specifically address taking technology home? yes 23.9%
33. Do you (does your school) have a budget specifically for the purchase of assistive technology? yes 15.6%
34. How many IEPs have you been involved with during the 1994-95 school year? 0(0%) 1-5(4.7%) 5-10(11%) 10-20(34.6%) 20-30(15.7%) 30-40(17.3%) 40-50(10.5%) 50+(6.3%)
35. How many of those IEPs considered some type of assistive technology? 0(28.9%) 1-5(54.7%) 5-10(13.2%) 10-20(2.1%) 20-30(5.5%) 30-40(0%) 40-50(0%) 50+(0%)
36. How many of those IEPs actually contained assistive technology? 0(47.6%) 1-5(44.5%) 5-10(4.7%) 10-20(1.0%) 20-30(1.0%) 30-40(5.5%) 40-50(0%) 50+(0%)
37. How many years have you been teaching? 1-5(31) 5-10(23) 10-15(19) 15-20(14) 20-25(9) 25-30(3) 30+(2)
38. Do you mainly work with students who are? mild/moderate(56%) severe(19%) both(21%) other(4%)
39. Is your main assignment? resource(50%) self-contained(33%) itinerant(10%) other(6%)
40. What is your main grade level assignment? Pre-K(4) 1-6(41) 7-9(24) 10-12(11) K-12(7) 10-12+(8) other(5)
(Cont.) Appendix C--Survey Instrument--Instrument With Frequencies (Page 2)

SECTION #2

When considering the appropriate and successful application of assistive technology in a student's IEP, please mark if the following are “critical”, “very important”, “important”, “not important”, or “not considered.”

<p>| | | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>The assistive technology must be a piece of equipment or a product system.</td>
<td>2</td>
<td>11</td>
<td>33</td>
<td>45</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Software for use on purchased computers.</td>
<td>12</td>
<td>29</td>
<td>43</td>
<td>11</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>The level of sophistication of the technology.</td>
<td>13</td>
<td>30</td>
<td>36</td>
<td>18</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>The device allows the student to do more work or complete work faster.</td>
<td>23</td>
<td>40</td>
<td>32</td>
<td>4</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>AT increases, maintains, extends or improves functional capabilities - promotes efficiency - increases accuracy, independence or productivity.</td>
<td>46</td>
<td>38</td>
<td>15</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>The device allow the student to be more independent.</td>
<td>57</td>
<td>30</td>
<td>12</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>The technology provides educational benefit as defined in statutory and case law.</td>
<td>26</td>
<td>38</td>
<td>31</td>
<td>3</td>
<td>2</td>
<td></td>
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<tr>
<td>8.</td>
<td>The technology is for educational, not medical purposes?</td>
<td>16</td>
<td>28</td>
<td>33</td>
<td>16</td>
<td>8</td>
<td></td>
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<tr>
<td>9.</td>
<td>Technology that monitors the blood sugar level for a 504 student.</td>
<td>10</td>
<td>13</td>
<td>38</td>
<td>21</td>
<td>20</td>
<td></td>
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<tr>
<td>10.</td>
<td>Assistive technology meets the unique needs identified in the student’s assessment.</td>
<td>29</td>
<td>38</td>
<td>32</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>The assistive technology eliminates/circumvents obstacles/barriers.</td>
<td>26</td>
<td>47</td>
<td>26</td>
<td>1</td>
<td>1</td>
<td></td>
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<tr>
<td>12.</td>
<td>A multidisciplinary assistive technology assessment.</td>
<td>22</td>
<td>33</td>
<td>40</td>
<td>3</td>
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<tr>
<td>13.</td>
<td>The technology is designed for use by multiple students.</td>
<td>14</td>
<td>19</td>
<td>25</td>
<td>37</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>Consideration of the future use of the technology by other students.</td>
<td>17</td>
<td>22</td>
<td>34</td>
<td>23</td>
<td>5</td>
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</tr>
<tr>
<td>15.</td>
<td>Consideration of what the student needs.</td>
<td>55</td>
<td>25</td>
<td>18</td>
<td>2</td>
<td>1</td>
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<tr>
<td>16.</td>
<td>Assuring that the student is comfortable with the device.</td>
<td>40</td>
<td>35</td>
<td>23</td>
<td>1</td>
<td>1</td>
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<tr>
<td>17.</td>
<td>Consideration of what the student wants.</td>
<td>20</td>
<td>31</td>
<td>41</td>
<td>8</td>
<td>1</td>
<td></td>
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<tr>
<td>18.</td>
<td>Consideration of the level of technical sophistication of the device.</td>
<td>12</td>
<td>30</td>
<td>43</td>
<td>10</td>
<td>5</td>
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<tr>
<td>19.</td>
<td>Considering only the student’s academic goals when determining AT.</td>
<td>3</td>
<td>8</td>
<td>30</td>
<td>50</td>
<td>9</td>
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</tr>
<tr>
<td>20.</td>
<td>Placing priority on eliminating the personally intrusive nature of the device.</td>
<td>8</td>
<td>26</td>
<td>54</td>
<td>9</td>
<td>4</td>
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<tr>
<td>21.</td>
<td>The technology allows the student to function more like their non-disabled peers.</td>
<td>31</td>
<td>41</td>
<td>27</td>
<td>1</td>
<td>1</td>
<td></td>
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<tr>
<td>22.</td>
<td>Maintaining the social acceptance and personal dignity of the student and promoting inclusion.</td>
<td>45</td>
<td>28</td>
<td>24</td>
<td>2</td>
<td>1</td>
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</tr>
<tr>
<td>23.</td>
<td>Addressing the problems created by the interaction between the student and their human and non-human environment.</td>
<td>25</td>
<td>36</td>
<td>34</td>
<td>4</td>
<td>2</td>
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<tr>
<td>24.</td>
<td>Considering where the device will be used (home, school, recess, etc.).</td>
<td>17</td>
<td>43</td>
<td>36</td>
<td>4</td>
<td>1</td>
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<tr>
<td>25.</td>
<td>The device allows the student to function in a less restrictive environment.</td>
<td>34</td>
<td>45</td>
<td>18</td>
<td>3</td>
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<tr>
<td>26.</td>
<td>The student’s successful functioning in the least restrictive environment.</td>
<td>41</td>
<td>40</td>
<td>18</td>
<td>1</td>
<td>1</td>
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<tr>
<td>27.</td>
<td>The special education placement of the student.</td>
<td>14</td>
<td>27</td>
<td>39</td>
<td>14</td>
<td>7</td>
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<tr>
<td>28.</td>
<td>Use of the technology is dependent upon the student’s classification.</td>
<td>2</td>
<td>12</td>
<td>25</td>
<td>40</td>
<td>20</td>
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<td>29.</td>
<td>Technology is more important for students with multiple and profound disabilities.</td>
<td>6</td>
<td>24</td>
<td>27</td>
<td>23</td>
<td>18</td>
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<tr>
<td>30.</td>
<td>The cost of the device.</td>
<td>21</td>
<td>16</td>
<td>47</td>
<td>9</td>
<td>8</td>
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(all number are %)
In this section, please respond to three (3) questions. First, in your opinion, would an IEP team in your school consider the following to be appropriate applications of assistive technology and discuss it at a student's IEP. Second, if the answer to the first question is YES, were you involved in an IEP during the 1994-95 school year where such an item, or a similar item was considered. And finally, if the answer to the second question is YES, was such an item provided as part of the IEP.

<table>
<thead>
<tr>
<th>No likely to be considered</th>
<th>Considered this year</th>
<th>Provided this year</th>
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</thead>
<tbody>
<tr>
<td>1. A talking calculator</td>
<td>35%</td>
<td>54%</td>
</tr>
<tr>
<td>2. A one-handed keyboard.</td>
<td>42%</td>
<td>55%</td>
</tr>
<tr>
<td>3. A word prediction software program for an LD student.</td>
<td>40%</td>
<td>45%</td>
</tr>
<tr>
<td>4. An electronic communication board for a nonverbal student.</td>
<td>19%</td>
<td>49%</td>
</tr>
<tr>
<td>5. A pencil grip for a student who cannot grip a pencil.</td>
<td>19%</td>
<td>46%</td>
</tr>
<tr>
<td>6. Enlarging print materials for a student who cannot see regular print.</td>
<td>10%</td>
<td>58%</td>
</tr>
<tr>
<td>7. An automatic page turner for a student with excellent reading ability and quadriplegia.</td>
<td>40%</td>
<td>58%</td>
</tr>
<tr>
<td>8. Corrective surgery for a student to improve motor skills.</td>
<td>84%</td>
<td>10%</td>
</tr>
<tr>
<td>9. A three-wheel scooter for a student who can walk short distances but tires easily.</td>
<td>53%</td>
<td>42%</td>
</tr>
<tr>
<td>10. A monitor magnification lens for a computer monitor.</td>
<td>26%</td>
<td>57%</td>
</tr>
<tr>
<td>11. A wheelchair lift on a bus for a student who is non-ambulatory.</td>
<td>24%</td>
<td>45%</td>
</tr>
<tr>
<td>12. An assistive technology assessment for a student who has just been classified as LD</td>
<td>48%</td>
<td>38%</td>
</tr>
<tr>
<td>13. Training on the use of an electronic communication device for a regular education teacher who has a student in their class who uses the device.</td>
<td>25%</td>
<td>62%</td>
</tr>
<tr>
<td>14. An electronic communication board with capabilities for masculine, or feminine, speech to meet the specific needs of a male, or female, student.</td>
<td>55%</td>
<td>39%</td>
</tr>
<tr>
<td>15. A particular device, if requested by the student, even though the cost is 20% more than another comparable device.</td>
<td>78%</td>
<td>19%</td>
</tr>
<tr>
<td>16. A keyboard with the keys arranged in &quot;A-B-C&quot; format instead of the usual &quot;Q-W-E-R-T-Y&quot; format.</td>
<td>53%</td>
<td>44%</td>
</tr>
<tr>
<td>17. A power wheelchair for a student who is able to manipulate a manual chair but cannot get from class to class on time because of the large size of the school.</td>
<td>58%</td>
<td>36%</td>
</tr>
<tr>
<td>18. A color wheelchair even if it cost more than the basic black one.</td>
<td>88%</td>
<td>10%</td>
</tr>
<tr>
<td>19. An electronic spell checker for a learning disabled student placed in a regular classroom.</td>
<td>35%</td>
<td>47%</td>
</tr>
<tr>
<td>20. A computer for an LD student who could not function in a inclusive setting without it, but could function successfully in a resource setting.</td>
<td>47%</td>
<td>43%</td>
</tr>
<tr>
<td>21. An electronic speller for a student who is only in special education one hour per day.</td>
<td>56%</td>
<td>33%</td>
</tr>
<tr>
<td>22. A ramp to the stage so a student in a wheelchair can be in the school play.</td>
<td>26%</td>
<td>61%</td>
</tr>
<tr>
<td>23. An assistive technology assessment for a student who has just been classified as learning disabled.</td>
<td>47%</td>
<td>43%</td>
</tr>
<tr>
<td>24. A computer for a student who is self-contained.</td>
<td>30%</td>
<td>47%</td>
</tr>
<tr>
<td>25. A computer for a student who is in resource one period a day.</td>
<td>62%</td>
<td>27%</td>
</tr>
</tbody>
</table>

THANK-YOU FOR YOUR TIME AND EFFORT!!!!!
Appendix D

Statistics Support Documents
### Appendix D - Statistics Support Documents - Items #25 - #33 (page 1)

**Variable**

<table>
<thead>
<tr>
<th>Number of Cases</th>
<th>Mean</th>
<th>SD</th>
<th>SE of Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 - enough training</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S3ALLM &gt;= 2,06</td>
<td>42</td>
<td>1,9762</td>
<td>,154</td>
</tr>
<tr>
<td>S3ALLM &lt; 2,06</td>
<td>138</td>
<td>1,9058</td>
<td>,293</td>
</tr>
</tbody>
</table>

Mean Difference = .0704

**t-test for Equality of Means**

<table>
<thead>
<tr>
<th>Variances</th>
<th>t-value</th>
<th>df</th>
<th>2-Tail Sig</th>
<th>SE of Diff</th>
<th>CI for Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equal</td>
<td>1,49</td>
<td>178</td>
<td>,137</td>
<td>,047</td>
<td>(-.023; .163)</td>
</tr>
<tr>
<td>Unequal</td>
<td>2,04</td>
<td>132,66</td>
<td>,043</td>
<td>,034</td>
<td>(.002; .139)</td>
</tr>
</tbody>
</table>

**Variable**

<table>
<thead>
<tr>
<th>Number of Cases</th>
<th>Mean</th>
<th>SD</th>
<th>SE of Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>26 - like more training</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S3ALLM &gt;= 2,06</td>
<td>42</td>
<td>1,0714</td>
<td>,261</td>
</tr>
<tr>
<td>S3ALLM &lt; 2,06</td>
<td>135</td>
<td>1,0815</td>
<td>,275</td>
</tr>
</tbody>
</table>

Mean Difference = -.0101

**t-test for Equality of Means**

<table>
<thead>
<tr>
<th>Variances</th>
<th>t-value</th>
<th>df</th>
<th>2-Tail Sig</th>
<th>SE of Diff</th>
<th>CI for Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equal</td>
<td>-1,21</td>
<td>175</td>
<td>,834</td>
<td>,048</td>
<td>(-.105; .085)</td>
</tr>
<tr>
<td>Unequal</td>
<td>-1,22</td>
<td>71,59</td>
<td>,830</td>
<td>,047</td>
<td>(-.103; .083)</td>
</tr>
</tbody>
</table>

**Variable**

<table>
<thead>
<tr>
<th>Number of Cases</th>
<th>Mean</th>
<th>SD</th>
<th>SE of Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>27 - pressure not to include AT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S3ALLM &gt;= 2,06</td>
<td>42</td>
<td>1,4524</td>
<td>,504</td>
</tr>
<tr>
<td>S3ALLM &lt; 2,06</td>
<td>138</td>
<td>1,5797</td>
<td>,495</td>
</tr>
</tbody>
</table>

Mean Difference = -.1273

**t-test for Equality of Means**

<table>
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<th>df</th>
<th>2-Tail Sig</th>
<th>SE of Diff</th>
<th>CI for Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equal</td>
<td>-1,45</td>
<td>178</td>
<td>,148</td>
<td>,088</td>
<td>(-.300; .046)</td>
</tr>
<tr>
<td>Unequal</td>
<td>-1,44</td>
<td>66,95</td>
<td>,155</td>
<td>,088</td>
<td>(-.304; .049)</td>
</tr>
</tbody>
</table>
## Appendix D - Statistics Support Documents - Items #25 - #33 (page 2)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number of Cases</th>
<th>Mean</th>
<th>SD</th>
<th>SE of Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>28 - pressure to not bases on funding</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S3ALLM  &gt;= 2,06</td>
<td>26</td>
<td>1,0385</td>
<td>.196</td>
<td>,038</td>
</tr>
<tr>
<td>S3ALLM &lt; 2,06</td>
<td>77</td>
<td>1,1688</td>
<td>.377</td>
<td>,043</td>
</tr>
</tbody>
</table>

Mean Difference = -1.304

t-test for Equality of Means
Variances t-value df 2-Tail Sig SE of Diff CI for Diff
Equal -1.68 101 ,095 ,077 (-2.84; 0.23)
Unequal -2.26 83.54 ,026 ,058 (-2.45; -0.16)

<table>
<thead>
<tr>
<th>Number of Cases</th>
<th>Mean</th>
<th>SD</th>
<th>SE of Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>29 - technology needed at home</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S3ALLM  &gt;= 2,06</td>
<td>42</td>
<td>1,0000</td>
<td>.000</td>
</tr>
<tr>
<td>S3ALLM &lt; 2,06</td>
<td>133</td>
<td>1,0226</td>
<td>.149</td>
</tr>
</tbody>
</table>

Mean Difference = -0.0226

t-test for Equality of Means
Variances t-value df 2-Tail Sig SE of Diff CI for Diff
Equal -0.98 173 ,329 ,023 (-0.68; 0.23)
Unequal -1.75 132.00 ,083 ,013 (-0.048; 0.003)

<table>
<thead>
<tr>
<th>Number of Cases</th>
<th>Mean</th>
<th>SD</th>
<th>SE of Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 - district policy on AT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S3ALLM  &gt;= 2,06</td>
<td>36</td>
<td>1,5556</td>
<td>.504</td>
</tr>
<tr>
<td>S3ALLM &lt; 2,06</td>
<td>106</td>
<td>1,7642</td>
<td>.427</td>
</tr>
</tbody>
</table>

Mean Difference = -2.086

t-test for Equality of Means
Variances t-value df 2-Tail Sig SE of Diff CI for Diff
Equal -2.42 140 ,017 ,086 (-3.79; -0.38)
Unequal -2.23 53.06 ,030 ,094 (-3.396; -0.021)
### Number 31 - if no to 035, would it be best is had po

<table>
<thead>
<tr>
<th>Variable</th>
<th>Cases</th>
<th>Mean</th>
<th>SD</th>
<th>SE of Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>S3ALLM &gt;= 2,06</td>
<td>26</td>
<td>1,1923</td>
<td>.402</td>
<td>.079</td>
</tr>
<tr>
<td>S3ALLM &lt; 2,06</td>
<td>94</td>
<td>1,2021</td>
<td>.404</td>
<td>.042</td>
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</table>

Mean Difference = -0.0098

#### t-test for Equality of Means

<table>
<thead>
<tr>
<th>Variances</th>
<th>t-value</th>
<th>df</th>
<th>2-Tail Sig</th>
<th>SE of Diff</th>
<th>CI for Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equal</td>
<td>-1,11</td>
<td>118</td>
<td>,913</td>
<td>,089</td>
<td>(-,187; ,167)</td>
</tr>
<tr>
<td>Unequal</td>
<td>-1,11</td>
<td>40,06</td>
<td>,913</td>
<td>,089</td>
<td>(-,190; ,170)</td>
</tr>
</tbody>
</table>

### Number 32 - if policy, does it address taking items

<table>
<thead>
<tr>
<th>Variable</th>
<th>Cases</th>
<th>Mean</th>
<th>SD</th>
<th>SE of Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>S3ALLM &gt;= 2,06</td>
<td>24</td>
<td>1,7917</td>
<td>.415</td>
<td>.085</td>
</tr>
<tr>
<td>S3ALLM &lt; 2,06</td>
<td>63</td>
<td>1,7778</td>
<td>.419</td>
<td>.053</td>
</tr>
</tbody>
</table>

Mean Difference = .0139

#### t-test for Equality of Means

<table>
<thead>
<tr>
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<th>t-value</th>
<th>df</th>
<th>2-Tail Sig</th>
<th>SE of Diff</th>
<th>CI for Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equal</td>
<td>,14</td>
<td>85</td>
<td>,890</td>
<td>,100</td>
<td>(-,185; ,213)</td>
</tr>
<tr>
<td>Unequal</td>
<td>,14</td>
<td>42,00</td>
<td>,890</td>
<td>,100</td>
<td>(-,188; ,215)</td>
</tr>
</tbody>
</table>

### Mean 33 - does school have budget for AT

<table>
<thead>
<tr>
<th>Variable</th>
<th>Cases</th>
<th>Mean</th>
<th>SD</th>
<th>SE of Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>S3ALLM &gt;= 2,06</td>
<td>32</td>
<td>1,7813</td>
<td>.420</td>
<td>.074</td>
</tr>
<tr>
<td>S3ALLM &lt; 2,06</td>
<td>109</td>
<td>1,8716</td>
<td>.336</td>
<td>.032</td>
</tr>
</tbody>
</table>

Mean Difference = -0.0903

#### t-test for Equality of Means

<table>
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<tr>
<th>Variances</th>
<th>t-value</th>
<th>df</th>
<th>2-Tail Sig</th>
<th>SE of Diff</th>
<th>CI for Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equal</td>
<td>-1,26</td>
<td>139</td>
<td>,210</td>
<td>,072</td>
<td>(-,232; ,051)</td>
</tr>
<tr>
<td>Unequal</td>
<td>-1,12</td>
<td>43,31</td>
<td>,271</td>
<td>,081</td>
<td>(-,254; ,073)</td>
</tr>
</tbody>
</table>
### Appendix D - Statistics Support Documents - Item #37 (page 1)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number of Cases</th>
<th>Mean</th>
<th>SD</th>
<th>SE of Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Years Teaching</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>S3ALLM &gt;= 2,06</strong></td>
<td>42</td>
<td>3095</td>
<td>468</td>
<td>0.072</td>
</tr>
<tr>
<td><strong>S3ALLM &lt; 2,06</strong></td>
<td>138</td>
<td>3116</td>
<td>465</td>
<td>0.040</td>
</tr>
</tbody>
</table>

Mean Difference = -0.0021

<table>
<thead>
<tr>
<th>t-test for Equality of Means</th>
<th>Variances</th>
<th>t-value</th>
<th>df</th>
<th>2-Tail Sig</th>
<th>SE of Diff</th>
<th>CI for Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equal</td>
<td>0.03</td>
<td>178</td>
<td>980</td>
<td>0.082</td>
<td>(-0.164; 0.160)</td>
<td></td>
</tr>
<tr>
<td>Unequal</td>
<td>0.03</td>
<td>67.51</td>
<td>980</td>
<td>0.082</td>
<td>(-0.166; 0.162)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of Cases</th>
<th>Mean</th>
<th>SD</th>
<th>SE of Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>S3ALLM &gt;= 2,06</strong></td>
<td>42</td>
<td>2857</td>
<td>457</td>
</tr>
<tr>
<td><strong>S3ALLM &lt; 2,06</strong></td>
<td>138</td>
<td>2174</td>
<td>414</td>
</tr>
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</table>

Mean Difference = 0.0683

<table>
<thead>
<tr>
<th>t-test for Equality of Means</th>
<th>Variances</th>
<th>t-value</th>
<th>df</th>
<th>2-Tail Sig</th>
<th>SE of Diff</th>
<th>CI for Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equal</td>
<td>0.91</td>
<td>178</td>
<td>362</td>
<td>0.075</td>
<td>(-0.079; 0.216)</td>
<td></td>
</tr>
<tr>
<td>Unequal</td>
<td>0.87</td>
<td>62.84</td>
<td>390</td>
<td>0.079</td>
<td>(-0.089; 0.226)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of Cases</th>
<th>Mean</th>
<th>SD</th>
<th>SE of Mean</th>
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<tbody>
<tr>
<td>11-15</td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>S3ALLM &gt;= 2,06</strong></td>
<td>42</td>
<td>1667</td>
<td>377</td>
</tr>
<tr>
<td><strong>S3ALLM &lt; 2,06</strong></td>
<td>138</td>
<td>1957</td>
<td>398</td>
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</table>

Mean Difference = -0.0290

<table>
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<th>Variances</th>
<th>t-value</th>
<th>df</th>
<th>2-Tail Sig</th>
<th>SE of Diff</th>
<th>CI for Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equal</td>
<td>-0.42</td>
<td>178</td>
<td>676</td>
<td>0.069</td>
<td>(-0.166; 0.108)</td>
<td></td>
</tr>
<tr>
<td>Unequal</td>
<td>-0.43</td>
<td>71.07</td>
<td>668</td>
<td>0.067</td>
<td>(-0.163; 0.105)</td>
<td></td>
</tr>
</tbody>
</table>
(Cont.) Appendix D - Statistics Support Documents - *Item #37 (page 2)*

<table>
<thead>
<tr>
<th>Variable of Cases</th>
<th>Mean</th>
<th>SD</th>
<th>SE of Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>16-20</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S3ALLM &gt;= 2,06</td>
<td>642</td>
<td>377</td>
<td>058</td>
</tr>
<tr>
<td>S3ALLM &lt; 2,06</td>
<td>1377</td>
<td>346</td>
<td>029</td>
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</table>

Mean Difference = .0290

<table>
<thead>
<tr>
<th>t-test for Equality of Means</th>
<th>95%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variances</td>
<td></td>
</tr>
<tr>
<td>Equal</td>
<td>-</td>
</tr>
<tr>
<td>Unequal</td>
<td>-</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>t-value</th>
<th>df</th>
<th>2-Tail Sig</th>
<th>SE of Diff</th>
<th>CI for Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equal</td>
<td>-</td>
<td>178</td>
<td>062</td>
<td>(-.094; .152)</td>
</tr>
<tr>
<td>Unequal</td>
<td>-</td>
<td>63,42</td>
<td>065</td>
<td>(-.101; .159)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable of Cases</th>
<th>Mean</th>
<th>SD</th>
<th>SE of Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>21-25</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S3ALLM &gt;= 2,06</td>
<td>47</td>
<td>216</td>
<td>033</td>
</tr>
<tr>
<td>S3ALLM &lt; 2,06</td>
<td>1041</td>
<td>303</td>
<td>026</td>
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</tbody>
</table>

Mean Difference = -.0538

<table>
<thead>
<tr>
<th>t-test for Equality of Means</th>
<th>95%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variances</td>
<td></td>
</tr>
<tr>
<td>Equal</td>
<td>-</td>
</tr>
<tr>
<td>Unequal</td>
<td>-</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>t-value</th>
<th>df</th>
<th>2-Tail Sig</th>
<th>SE of Diff</th>
<th>CI for Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equal</td>
<td>-</td>
<td>178</td>
<td>050</td>
<td>(-.153; .045)</td>
</tr>
<tr>
<td>Unequal</td>
<td>-</td>
<td>94,89</td>
<td>042</td>
<td>(-.137; .030)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable of Cases</th>
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<th>SD</th>
<th>SE of Mean</th>
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<tr>
<td><strong>26-30</strong></td>
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<tr>
<td>S3ALLM &gt;= 2,06</td>
<td>0000</td>
<td>000</td>
<td>000</td>
</tr>
<tr>
<td>S3ALLM &lt; 2,06</td>
<td>0290</td>
<td>168</td>
<td>014</td>
</tr>
</tbody>
</table>

Mean Difference = -.0290

<table>
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</tr>
</thead>
<tbody>
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<td></td>
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<tr>
<td>Equal</td>
<td>-</td>
</tr>
<tr>
<td>Unequal</td>
<td>-</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>t-value</th>
<th>df</th>
<th>2-Tail Sig</th>
<th>SE of Diff</th>
<th>CI for Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equal</td>
<td>-</td>
<td>178</td>
<td>026</td>
<td>(-.080; .022)</td>
</tr>
<tr>
<td>Unequal</td>
<td>-</td>
<td>137,00</td>
<td>014</td>
<td>(-.057; -.001)</td>
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</tbody>
</table>
(Cont.) Appendix D - Statistics Support Documents - Item #37 (page 3)

<table>
<thead>
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<th>SD</th>
<th>SE of Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years Teaching 31+</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S3ALLM &gt;= 2.06</td>
<td>42</td>
<td>0.0238</td>
<td>0.154</td>
<td>0.024</td>
</tr>
<tr>
<td>S3ALLM &lt; 2.06</td>
<td>138</td>
<td>0.0072</td>
<td>0.085</td>
<td>0.007</td>
</tr>
</tbody>
</table>

Mean Difference = 0.0166

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Variances</td>
</tr>
<tr>
<td>Equal</td>
</tr>
<tr>
<td>Unequal</td>
</tr>
</tbody>
</table>
## Variable works with both severe and mild/moderate students

<table>
<thead>
<tr>
<th>Number of Cases</th>
<th>Mean</th>
<th>SD</th>
<th>SE of Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S3ALLM &gt;= 2.06</strong></td>
<td>42</td>
<td>2857</td>
<td>457</td>
</tr>
<tr>
<td><strong>S3ALLM &lt; 2.06</strong></td>
<td>135</td>
<td>1926</td>
<td>396</td>
</tr>
</tbody>
</table>

**Mean Difference = 0.0931**

### t-test for Equality of Means

<table>
<thead>
<tr>
<th>Variances</th>
<th>t-value</th>
<th>df</th>
<th>2-Tail Sig</th>
<th>SE of Diff</th>
<th>CI for Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equal</td>
<td>1.28</td>
<td>175</td>
<td>2.01</td>
<td>0.073</td>
<td>(-0.050; 0.236)</td>
</tr>
<tr>
<td>Unequal</td>
<td>1.19</td>
<td>61.33</td>
<td>2.39</td>
<td>0.078</td>
<td>(-0.064; 0.250)</td>
</tr>
</tbody>
</table>

## Variable works with mild/moderate students

<table>
<thead>
<tr>
<th>Number of Cases</th>
<th>Mean</th>
<th>SD</th>
<th>SE of Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S3ALLM &gt;= 2.06</strong></td>
<td>42</td>
<td>4524</td>
<td>504</td>
</tr>
<tr>
<td><strong>S3ALLM &lt; 2.06</strong></td>
<td>135</td>
<td>6000</td>
<td>492</td>
</tr>
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</table>

**Mean Difference = -0.1476**

### t-test for Equality of Means

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<th>df</th>
<th>2-Tail Sig</th>
<th>SE of Diff</th>
<th>CI for Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equal</td>
<td>-1.69</td>
<td>175</td>
<td>0.093</td>
<td>0.087</td>
<td>(-0.320; 0.025)</td>
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<tr>
<td>Unequal</td>
<td>-1.67</td>
<td>67.10</td>
<td>0.100</td>
<td>0.089</td>
<td>(-0.324; 0.029)</td>
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</tbody>
</table>

## Variable works with other than mild/moderate or severe

<table>
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<th>Number of Cases</th>
<th>Mean</th>
<th>SD</th>
<th>SE of Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S3ALLM &gt;= 2.06</strong></td>
<td>42</td>
<td>0714</td>
<td>261</td>
</tr>
<tr>
<td><strong>S3ALLM &lt; 2.06</strong></td>
<td>135</td>
<td>0148</td>
<td>121</td>
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</table>

**Mean Difference = 0.0566**

### t-test for Equality of Means

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<thead>
<tr>
<th>Variances</th>
<th>t-value</th>
<th>df</th>
<th>2-Tail Sig</th>
<th>SE of Diff</th>
<th>CI for Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equal</td>
<td>1.94</td>
<td>175</td>
<td>0.054</td>
<td>0.029</td>
<td>(-0.001; 0.114)</td>
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<td>Unequal</td>
<td>1.36</td>
<td>46.64</td>
<td>0.180</td>
<td>0.042</td>
<td>(-0.027; 0.140)</td>
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</table>
(Cont.) Appendix D - Statistics Support Documents - **Item #38 (page 2)**

<table>
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<th>Variable</th>
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<th>Mean</th>
<th>SD</th>
<th>SE of Mean</th>
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</thead>
<tbody>
<tr>
<td>S3ALLM &gt;= 2.06</td>
<td>42</td>
<td>1,905</td>
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<tr>
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Mean Difference = -0.021

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### Appendix D - Statistics Support Documents

#### Item #39 (page 1)

<table>
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<th>SE of Mean</th>
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<tr>
<td><strong>main assignment - itinerent</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>S3ALLM &gt;= 2,06</td>
<td>42</td>
<td>1905</td>
<td>397</td>
</tr>
<tr>
<td>S3ALLM &lt; 2,06</td>
<td>136</td>
<td>0588</td>
<td>236</td>
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**Mean Difference = 0.1317**

<table>
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<tbody>
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<td></td>
</tr>
<tr>
<td>Equal</td>
<td></td>
</tr>
<tr>
<td>t-value</td>
<td>2.64</td>
</tr>
<tr>
<td>df</td>
<td>176</td>
</tr>
<tr>
<td>2-Tail Sig</td>
<td>.009</td>
</tr>
<tr>
<td>SE of Diff</td>
<td>.050</td>
</tr>
<tr>
<td>CI for Diff</td>
<td>(-.033; .230)</td>
</tr>
<tr>
<td>Unequal</td>
<td></td>
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<td>t-value</td>
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<td>df</td>
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<td>2-Tail Sig</td>
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<td>.065</td>
</tr>
<tr>
<td>CI for Diff</td>
<td>(-.002; .261)</td>
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</table>

<table>
<thead>
<tr>
<th>Variable of Cases</th>
<th>Mean</th>
<th>SD</th>
<th>SE of Mean</th>
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<tbody>
<tr>
<td><strong>main assignment - other than resource or self-contained</strong></td>
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<td>0476</td>
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**Mean Difference = -0.0186**

<table>
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<tr>
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<tr>
<td>t-value</td>
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<tr>
<td>df</td>
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<tr>
<td>2-Tail Sig</td>
<td>.665</td>
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<tr>
<td>SE of Diff</td>
<td>.043</td>
</tr>
<tr>
<td>CI for Diff</td>
<td>(-.103; .066)</td>
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<tr>
<td>Unequal</td>
<td></td>
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<td>.040</td>
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<tr>
<td>CI for Diff</td>
<td>(-.097; .060)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable of Cases</th>
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<th>SD</th>
<th>SE of Mean</th>
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</tr>
<tr>
<td>S3ALLM &lt; 2,06</td>
<td>136</td>
<td>5368</td>
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**Mean Difference = -0.1082**

<table>
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</thead>
<tbody>
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<tr>
<td>Equal</td>
<td></td>
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<tr>
<td>t-value</td>
<td>-1.22</td>
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<td>df</td>
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<tr>
<td>2-Tail Sig</td>
<td>.222</td>
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<tr>
<td>SE of Diff</td>
<td>.088</td>
</tr>
<tr>
<td>CI for Diff</td>
<td>(-.283; .066)</td>
</tr>
<tr>
<td>Unequal</td>
<td></td>
</tr>
<tr>
<td>t-value</td>
<td>-1.22</td>
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<tr>
<td>df</td>
<td>68.21</td>
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<tr>
<td>2-Tail Sig</td>
<td>.225</td>
</tr>
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<td>.088</td>
</tr>
<tr>
<td>CI for Diff</td>
<td>(-.285; .068)</td>
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</table>
### Variable of Cases - Self Contained

<table>
<thead>
<tr>
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<th>Number</th>
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<th>SD</th>
<th>SE of Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>S3ALLM &gt;= 2.06</td>
<td>42</td>
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<td>4.77</td>
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<td>136</td>
<td>3.382</td>
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Mean Difference = -0.0049

<table>
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</thead>
<tbody>
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</tr>
<tr>
<td>Equal</td>
<td></td>
</tr>
<tr>
<td>t-value</td>
<td>176</td>
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<tr>
<td>df</td>
<td></td>
</tr>
<tr>
<td>2-Tail Sig</td>
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<tr>
<td>SE of Diff</td>
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<tr>
<td>CI for Diff</td>
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<tr>
<td>Unequal</td>
<td></td>
</tr>
<tr>
<td>t-value</td>
<td>67.99</td>
</tr>
<tr>
<td>df</td>
<td></td>
</tr>
<tr>
<td>2-Tail Sig</td>
<td>954</td>
</tr>
<tr>
<td>SE of Diff</td>
<td>0.084</td>
</tr>
<tr>
<td>CI for Diff</td>
<td>{(-1.173; 1.163)}</td>
</tr>
</tbody>
</table>
(Cont.) Appendix D - Statistics Support Documents - **Item #40 (page 1)**

<table>
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<tr>
<th>Variable</th>
<th>Number of Cases</th>
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<th>SD</th>
<th>SE of Mean</th>
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<tr>
<td>Grade Level 1-6</td>
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<tr>
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<td>3571</td>
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<td>S3ALLM &lt; 2,06</td>
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<td>4203</td>
<td>495</td>
<td>042</td>
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</tbody>
</table>

Mean Difference = -0.0631

| t-test for Equality of Means | | | | |
|-----------------------------|----------------|----------------|----------------|
| Variances | t-value | df | 2-Tail Sig | SE of Diff | CI for Diff |
| Equal | -0.73 | 178 | 468 | 0.087 | (-2.35; 1.08) |
| Unequal | -0.74 | 59.09 | 465 | 0.086 | (-2.35; 1.08) |

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number of Cases</th>
<th>Mean</th>
<th>SD</th>
<th>SE of Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade Level K-12</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S3ALLM ≥ 2,06</td>
<td>42</td>
<td>0952</td>
<td>297</td>
<td>046</td>
</tr>
<tr>
<td>S3ALLM &lt; 2,06</td>
<td>138</td>
<td>0580</td>
<td>235</td>
<td>020</td>
</tr>
</tbody>
</table>

Mean Difference = 0.0373

| t-test for Equality of Means | | | | |
|-----------------------------|----------------|----------------|----------------|
| Variances | t-value | df | 2-Tail Sig | SE of Diff | CI for Diff |
| Equal | 0.84 | 178 | 399 | 0.044 | (-0.05; 0.124) |
| Unequal | 0.75 | 57.41 | 459 | 0.050 | (-0.063; 0.137) |

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number of Cases</th>
<th>Mean</th>
<th>SD</th>
<th>SE of Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade Level -other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S3ALLM ≥ 2,06</td>
<td>42</td>
<td>0714</td>
<td>261</td>
<td>040</td>
</tr>
<tr>
<td>S3ALLM &lt; 2,06</td>
<td>138</td>
<td>0362</td>
<td>188</td>
<td>016</td>
</tr>
</tbody>
</table>

Mean Difference = 0.0352

| t-test for Equality of Means | | | | |
|-----------------------------|----------------|----------------|----------------|
| Variances | t-value | df | 2-Tail Sig | SE of Diff | CI for Diff |
| Equal | 0.97 | 178 | 335 | 0.036 | (-0.037; 0.107) |
| Unequal | 0.81 | 54.53 | 420 | 0.043 | (-0.052; 0.122) |
### Appendix D - Statistics Support Documents - Item #40 (page 2)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number of Cases</th>
<th>Mean</th>
<th>SD</th>
<th>SE of Mean</th>
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</thead>
<tbody>
<tr>
<td>Grade Level Pre-K</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S3ALLM &gt;= 2,06</td>
<td>42</td>
<td>0,0238</td>
<td>0,154</td>
<td>0,024</td>
</tr>
<tr>
<td>S3ALLM &lt; 2,06</td>
<td>138</td>
<td>0,0435</td>
<td>0,205</td>
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</tr>
</tbody>
</table>

Mean Difference = -0,0197

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<th>95%</th>
</tr>
</thead>
<tbody>
<tr>
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<td>t-value</td>
</tr>
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</tr>
<tr>
<td>Unequal</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number of Cases</th>
<th>Mean</th>
<th>SD</th>
<th>SE of Mean</th>
</tr>
</thead>
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<td></td>
</tr>
<tr>
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<td>0,2857</td>
<td>0,457</td>
<td>0,071</td>
</tr>
<tr>
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<td>0,2319</td>
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<td>0,036</td>
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Mean Difference = 0,0538

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<td>t-value</td>
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<tr>
<td>Unequal</td>
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<table>
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<th>Variable</th>
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<th>Mean</th>
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<td>grade level 10-12</td>
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<td>S3ALLM &lt; 2,06</td>
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Mean Difference = -0,0280

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<tr>
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(Cont.) Appendix D - Statistics Support Documents - **Item #40 (page 3)**

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<th>Variable</th>
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Mean Difference = -0.0155

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</table>
VITA

Martell Menlove
Center for Persons with Disabilities
UMC 6855
Utah State University
Logan, Utah 84322-6855
Work: (801) 797-2153
(Home)

135 Abbey Lane
Providence, Utah 84332
Home: (801) 755-0584

Education:

A.S. Snow College, Ephraim, Utah
General Education; 1975.

B.A. Utah State University, Logan, Utah; magna cum laude,
Elementary Education--Spanish/Portuguese; 1976

M.Ed. University of Utah, Salt Lake City, Utah;
Educational Psychology--Educational Administration; 1979

Ph.D. Utah State University, Logan, Utah
Special Education; 1996

Certificate University of Utah, Salt Lake City, Utah;
School Administrative/Supervisory; 1982

Professional Experience:

Co-Director, Utah Assistive Technology Program, P.L. 100-407 Grant, Center
for Persons with Disabilities, Utah State University, 1990-present.

General management and administration of Utah's federally funded Tech
Act Grant under P.L. 100-407. Development of a state-wide program to
provide assistive devices and services to individuals of all ages with
disabilities.

Doctoral Student, Utah State University, Logan Utah, Special Education, 1989-
present.
Professional Experience cont:

Superintendent of Schools, Rich County School District, Randolph, Utah; 1987-89.
Responsible for educational program for 525 students, grades K-12, in four schools. As the only district level administrator, administered all facets of the district operation including all financial planning and budgeting, hiring of certificated and classified employees, development and implementation of curriculum programs, and other items as directed by the Board of Education.

Director of Elementary Education, Tooele County School District, Tooele, Utah; 1986-87.
Responsibilities included the educational program for 3,800 elementary students in 9 schools.

Principal, Oquirrh Hills School/Director of Self-Contained Special Education Programs, Tooele County School District, Tooele, Utah; 1985-87.
Responsibilities included the educational program for all students with Severe and Multiple disabilities in Tooele County from birth to 22 years of age. Also administered adult day-treatment program. Coordinated all federal, state, and local programs for this population.

Principal, Dugway High School, Tooele County School District, Tooele, Utah; 1984-85.
Responsibilities included the educational program for 325 students in grades 7-12.

Principal, Stansbury Park Elementary, Tooele County School District, Tooele, Utah; 1982-84.
Responsibilities included the educational program for 425 students in grades K-6.

Co-Director, Utah Productivity Study, Tooele County School District/Utah State University; 1983-84.
As principal of Stansbury Park Elementary I was responsible for the implementation of a comprehensive productivity model developed by Utah State University.
**Professional Experience cont:**

Guidance Specialist/School Counselor, Jordan School District, Sandy, Utah; 1979-82.
*Responsibilities included providing individual and group counseling and guidance services for students in grades 6-8 at Oquirrh Hills Middle School and West Jordan Middle School.*

Classroom Teacher/Team Leader, Jordan School District, Sandy, Utah; 1976-79.
*Responsibilities included teaching and providing leadership to fellow teachers in team-teaching situations. Served as team leader in sixth grade at Mount Jordan Middle School and taught grades three and five at Oakdale Elementary.*

**University Courses Taught**


**Publications:**


**Publications Cont.:**


**Consultant Experience:**

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<th>Subject or Area</th>
<th>Dates</th>
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<tr>
<td>Arkansas Increasing Capabilities Access Network</td>
<td>State AT Plan</td>
<td>4/94</td>
<td>Little Rock, AR</td>
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<tr>
<td>Idaho Assistive Technology Project</td>
<td>State-wide AT System</td>
<td>7/94</td>
<td>Moscow, ID</td>
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</table>
Conference Presentations:

The Development of a Mobile Fabrication Laboratory for Assistive Technology. Regional Assistive Technology Conference--Unlocking the Environment; Denver, Colorado; April 1990.


Interagency Coordination in Developing State-Wide Assistive Technology Programs. Yearly Meeting of State Technology Grantees; Washington D.C.; October 1990.

Technology and How It's Helping Aging People. Utah Governor's Conference on Aging--Living Well in the 90's: An Era of Activity; Salt Lake City, Utah; October, 1990.


Defining Issues Within the Context of Assistive Technology Training. California State University, Northridge--Technology and Persons with Disabilities; Los Angeles, California; March, 1991.


Public Awareness/Marketing Activities. RESNA TA 2nd Annual Meeting of All States on Assistive Technology; Kansas City, Missouri; June 23, 1991.

Developing Videotapes on Assistive Technology. RESNA TA 3rd Annual Meeting of All States on Assistive Technology; Arlington, Virginia; August 21, 1992.

Reasonable Accommodations on a Small Business Budget. ADA Small Business Symposium; Salt Lake City, Utah; May 5, 1993.
Conference Presentations cont.


Assistive Technology and Environmental Design for Seniors. Aging and Disabilities: At the Crossroads; Salt Lake City, Utah; October 21, 1993.

Assistive Technology Applications for Individuals with Traumatic Brain Injury. 5th Annual Utah Head Injury Family Conference; Salt Lake City, Utah; November 5-6, 1993.

Protection and Advocacy and Assistive Technology. Executive Directors Summit Meeting - National Association of Protection and Advocacy Systems; Bethesda Maryland, December 1, 1993.


An Overview of Assistive Technology. 5th Annual Utah Mentor Teachers Conference; Salt Lake City, Utah; January 20, 1994.

Incorporating Assistive Technology Goals into the Individualized Education Program. The Joint Utah Augmentative Communication and Western Assistive Technology Conference; Salt Lake City, Utah; February 11, 1994.

Assistive Technology as a Tool to Transition. The Utah Annual Transition Conference; Provo, Utah; April 27, 1994.

Assistive Technology for Persons with Head Injuries. Western Regional Head Injury Conference; Park City, Utah, September 23, 1994.
**Professional Activities:**


**Professional Membership:**

PDK - 1990 - present - Program Committee Co-Chair - present
Council for Exceptional Children, 1986 - present
RESNA, 1991 - present
Utah School Superintendents Association, 1987-89
Utah Association of Secondary School Principals, 1984-85
Utah Association of Elementary School Principals, 1982-84
Utah Systems Approach to Individualized Learning (U-SAIL), Program Committee Member, 1984-87
Professional and Community Service:

Co-Director Utah State Productivity Study, 1983-84
State of Utah Health Textbook Adoption Committee, 1984-87
Utah Principal's Academy Fellow, 1985-86
State of Utah Elementary Accreditation Committee, 1985-88
University Advisory Council for Individuals with Disabilities, Utah State University, 1991-1993
State of Utah Special Education Textbook Adoption Committee, 1990-1993
Graduate Student Representative - SpEd Faculty 1991-92
USU Graduate Student Senator for SpEd Dept.- 1991-92
Utah State University Americans with Disabilities Act Special Task Force - 1992-present
Access Utah Information and Referral Network – Advisory Board - 1993-present
Utah Statewide Independent Living Council - Member - 1994-present

Little League Flag Football Coach
Youth Soccer League Coach
Boy Scout/Cub Scout Leader