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Identifying and Working with Elementary Asperger's Students in Rural America

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Abstract

Currently, somewhere in a rural American school sits an elementary-aged student who has been labeled by a teacher and his/her peers as the "Little Professor" according to the Asperger's Syndrome Coalition of the United States. The onset of Asperger's Syndrome is recognized and occurs later than what is typical of autism. A significant number of children are diagnosed after age three, with most diagnosed between the age of five and nine. Children with Asperger's Syndrome generally do not have cognitive or language delay. Social deficits begin at the start of school and they fall just below the typical range. For students with Asperger's Syndrome the result of these deficits is that they never fit in with their classmates. Thus Asperger's Syndrome students slip through the cracks because they tend to be bright and quirky and these traits tend to isolate them from their classmates.

Asperger's Syndrome is a life-long disorder and if it is identified at an early age and appropriate interventions are put in place at home and school, an AS child will have the opportunity to grow and mature and have a productive life as an adult. We as educators should consider the presence of Asperger's Syndrome students in our classrooms as a true gift and not as a burden. These children have gifts, skills, and feelings that need to be nurtured and strengthened in our rural schools.

Identifying and Working with Elementary Asperger's Students in Rural America

Currently somewhere in a rural American school sits an elementary-aged student who has been labeled by school personnel and his/her peers as the "Little professor". Interestingly enough, this label the "Little Professor" emanates originally from Hans Asperger in 1944. This child who has been labeled the Little Professor may in fact have Asperger's Syndrome. According to the Asperger's Syndrome Coalition of the United States, the onset of Asperger's Syndrome (AS) occurs later than what is typical in Autism or at least recognized later. A large number of children are diagnosed after the age of three, with the most diagnosed between the age of five and nine (Dowshen, 2008). Children with AS generally do not have a cognitive or language delay. Many signs of their social deficits appear around the time they start school. The social deficits they have are just below the typical range, and cause them to never truly fit in. As AS students become older, their lack of social skills becomes more apparent as they are interacting and progressing with classmates in a small rural school setting. Thus AS students can slip between the cracks because they tend to be bright yet quirky and these characteristics tend to isolate them from their peers. No one attempts to understand them, or searches for an answer to why they behave the way

they do. They are pushed to the side by their classmates, and no one really takes the time to get to know them.

We as rural educators want to avoid what happened to Tim Page, music critic at the New York Times. In 1997 he was awarded the Pulitzer Prize for his work as the chief music critic at the Washington Post. Mr. Page grew up in a small town in northeastern Connecticut. According to Page (2009), "from early childhood, my memory was so acute and my wit so bleak that I was described as a genius by my parents, by neighbors, even, on occasion by the same teachers who handed me failing grades." (p.2). For most of his life Page felt like an outcast. He was over-stimulated with selective topics of interest, and he was unsure socially amongst classmates and people. Finally, after a lifetime search, he was diagnosed at the age of 45 with AS, a syndrome that falls in the realm of autism spectrum disorders.

One must distinguish between autism and AS. In the New Yorker some years ago Oliver Sachs (1993) states that "people with AS can tell us of their experiences, their inner feelings and states, whereas those with classical autism cannot. With classical autism there is no "window" and we can only infer. With AS there is self-consciousness and at least some ability to be introspect and report".

We need to identify and work with these children at an early age so that they may be at peace with themselves and understand what they face in life. Most educators agree that understanding and acceptance of one's self is a powerful tool that enables students to move forward and succeed.

What is Asperger's Syndrome?

"Asperger's Syndrome (AS) is a type of pervasive disorder characterized by autistic social dysfunction; focused interests; and subtle communication deficits occurring in the presence of typical intelligence. There is no history of formal speech delay" (Ghaziuddin, 2005, p. 117). This disorder is named after a Viennese physician, Hans Asperger. In 1940, Hans Asperger described a set of behavior patterns apparent in some of his patients, mostly males. "Asperger noticed that although these boys had typical intelligence and language development, they had severely impaired social skills, were unable to communicate effectively with others, and had poor coordination" (Dowshen, 2008, p.2). In 1944, Asperger published a paper describing his observations with the young boys who exhibited autistic-like behaviors with marked deficiencies in social and communication skills. Though, it was not until 1994 that AS was added to the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV), where it was included as one of the pervasive developmental disorders. Only in the past 15 years has AS been recognized by professional educators and parents.

The most distinctive symptom of AS can be the child's obsessive interest in a single topic or object. Children with AS want to know everything about their topic of interest, and only want to inform others about it. Their conversations become very limited due to their narrow interests, and they also have difficulty switching topics. Other characteristics of AS include repetitive routines; peculiarities in speech and language; problems with non-verbal communication; unusual sensitivity to certain lights, sounds, fabrics; and clumsy and uncoordinated motor movements. Children with AS usually have a history of developmental delays in motor skills such as pedaling

a bike, or catching a ball. They are often awkward and poorly coordinated with a walk that can appear stiff or bouncy (Myles, 2007).

Definition of Asperger's Syndrome (American Psychiatric Association 2000)

The new DSM-4 criteria for a diagnosis of AS, with much of their language carrying over from the diagnostic criteria for Autism include the presence of:

Qualitative impairment in social interaction involving some or all of the following: impaired use of nonverbal behaviors to regulate social interaction, failure to develop age-appropriate peer relationships, lack of spontaneous interest in sharing experiences with others, and lack of social or emotional reciprocity.

Restricted, repetitive, and stereotyped patterns of behavior, interests and activities involving: preoccupation with one or more stereotyped and restricted pattern of interest, inflexible adherence to specific nonfunctional routines or rituals, stereotyped or repetitive motor mannerisms, or preoccupation with parts of objects.

Gillberg (1998), a Swedish physician who has studied AS extensively has proposed six criteria for the diagnosis, elaborating upon the criteria set forth in DSM-4. His six criteria capture the unique style of these children and include:

Social impairment with extreme egocentricity, which may include:
- Inability to interact with peers
- Lack of desire to interact with peers
- Poor appreciation of social clues
- Socially and emotionally inappropriate responses

Limited interests and preoccupations, including:
- More rote than meaning
- Relatively exclusive of other interests
- Repetitive adherence

Repetitive routines or rituals that may be:
- Imposed on self, or
- Imposed on others

Speech and language peculiarities, such as:
- Delayed early development possible but not consistently seen – superficially perfect expressive language
- Odd prosody, peculiar voice characteristics
- Impaired comprehension including misinterpretation of literal and implied meanings.

Nonverbal communication problems, such as:
- Limited use of gesture
- Clumsy body language
- Limited or inappropriate facial expression
- Peculiar "stiff" gaze
- Difficulty adjusting physical proximity

Motor clumsiness
- May not be necessary part of the picture in all cases (p. 631)

These behaviors must interfere significantly with social as well as other areas of functioning. Furthermore, it should be noted that there must be no significant delay associated with general cognitive function, self-help/adaptive skills, interest in the environment, or overall language development.

Strategies to address the needs of AS students in a rural setting should be based on the student's strengths, such as intelligence, interests or memory to help them blend in and function as typically as possible. Teachers need to identify whether or not a special interest of an AS child is a problem or a talent because this interest can either be a roadblock or a pathway to social contact. Certainly this talent or interest can be utilized in the school setting. According to Atwood (2007) we should adhere to the following key points and strategies when dealing with an AS child's special interests:

- One of the characteristics that distinguishes between a hobby and a special interest that is of clinical significance is an abtypicality in the intensity or focus of interest.
- Unusual or special interests can develop as early as age two to three years and may commence with a preoccupation with parts of objects such as spinning the wheels or toys cars, or manipulating electrical switches.
- The next stage may be a fixation on something neither human nor toy, or a fascination with a specific category of objects and the acquisition of as many examples as possible.
- A subsequent stage can be the collection of facts and figures about a specific topic
- Much of the knowledge associated with the interest is self-directed and self-taught.
- In the pre-teenage and teenage years the interests can evolve to include electronics and computers, fantasy literature, science fiction and sometimes a fascination with a particular person.
- There appear to be two main categories of interest: collections, and the acquisition of knowledge on a specific topic or concept.
- Some girls with Asperger's syndrome can develop a special interest in fiction rather than facts.
- Sometimes the special interest is animals but can be to such an intensity that the child acts being the animal.
- The special interest has several functions:
    - To overcome anxiety
    - To provide pleasure
    - To provide relaxation
    - To ensure greater predictability and certainty in life
    - To understand the physical world
    - To create an alternative world
    - To create a sense of identity
    - To occupy time, facilitate conversation and indicate intellectual ability

- Parents have to try to quench the almost insatiable thirst for access to this interest.
- The special interest can provide considerable information for the clinician.

- A change of preoccupation to a morbid or macabre such as death can be indicative of a clinical depression and an interest in weapons, the martial arts and revenge a possible indication of bullying at school.
- The child or adult may collect information on a topic that is causing emotional distress or confusion, as a means of understanding a feeling or situation.
- The inability to control the amount of time devoted to the special interest can be indicative of the development of an Obsessive Compulsive Disorder.
- The problem may not be the activity itself but the duration and dominance over other activities. Some success can be achieved by limiting the time available using a clock or timer.
- Part of the controlled access program can be to allocate specific social or "quality" time to pursue the interest as a social activity.
- If the interest is potentially dangerous, illegal or likely to be misinterpreted, steps can be taken to terminate, or at least modify, the interest; although clinical experience suggests that this is not an easy task.
- Sometimes it is wiser to work *with* rather than *against* the motivation to engage in the special interest.
- The interest can be a source or enjoyment, knowledge, self-identity and self-esteem that can be constructively used by parents, teachers and therapists.
- Parents may consider private tuition to develop, in an adaptive way, those interests that could become a source of income or employment, such as a natural ability with computers.
- The special interest can be integrated within a Cognitive Behavior Therapy program to understand and manage emotions.
- The interest can be used to facilitate friendships with typical peers and people with Asperger's syndrome who share the same interests.
- If a conversation includes talking about the special interest, the child or adult with Asperger's syndrome usually has to learn the relevant cues and responses to ensure the conversation is reciprocal and inclusive.
- When one considers the attributes associated with the special interests, it is important to consider not only the benefits to the person with Asperger's syndrome, but also the benefits to society. (p.199-200)

It is important for AS students to have the right curricular/social environment with the necessary support and understanding for them to succeed. And to help achieve this goal, an AS student's special interests, their routines and play should be part of their school experience.

1. How can the rural educator help harness their special interests in a rural school setting?

One of the prime indicators of AS is an intense obsession with or interest in a particular object or topic that has no real relevance to the rest of the world. These obsessions of interests are solitary pursuits with no interest on the part of the AS student in sharing with others. These interests monopolize their time, thoughts and conversations. Yet these actions may be a strategy that allows the AS student to relax and seek joy and happiness. According to Ashley (2007), teachers who understand that special interests are a symptom of AS will be able to have the patience needed to manage the questions, interruptions, and lectures they are bound to experience.

To help with excessive talk and questions, teachers can:

- Set a specific time, the same day, each day that he can talk about his special interest.
- Interrupt talk about special interests with a reminder of when he can talk about it.
- Prompt the class that each child may ask a designated number of questions.
- Announce that extra questions can be written down to ask during free time.
- Time to talk about, read, or use the Internet to learn about his special interest can be used as reinforcement for completion of other assignments. (p. 151)

The next step is to help the AS student complete his school work. According to Ashley the following strategies can be followed:

- Set the expectation that all assignments, even outside her interest, are to be completed.
- Allow the interest to be incorporated into some assignments (e.g., selecting a book for a book report, choosing a science experiment, writing about the interest on a grammar and punctuation lesson).
- Incorporate the interest into as many lessons as possible (e.g., count the insects, write a story about insects, draw an insect after each spelling word).
- Use his interest to incorporate several subjects at a time. An interest in clocks can include the history of the clock, what was occurring in the world when the clock was invented, how different countries make clocks, which cultures use clocks and which do not, how many more clocks are sold in Japan than the USA. (p.152)

2. Do AS children need routines in their lives?

Many children with AS require the same routine every day, day in day out. It should be noted that with autistic behavior, a problem can occur immediately when a routine has been disturbed (e.g., a fire drill, a change in classroom routine, any disruption in their personal routines). With an AS child, when a change in routine occurs, his or her difficulty with this change may manifest itself in several ways after the change occurs. Although some children with AS can express their unease with change right away, others may internalize their discomfort with the change, and only later will difficulties arise. Routines help an AS child navigate his/her world in a set, highly predictable, yet comfortable way. We are all creatures of habit, yet most of us adapt when are routines are changed. An AS child relies on these routines to survive and finish the day in order to feel comfortable or at peace with him/herself.

3. Do schools need to establish routines that still allow flexibility?

Routines and flexibility can be magical combination for an AS child. One way for both the home and school to work on the flexibility piece would be to put in effect the following tips:

- Provide a consistent daily home and classroom schedule.
- Post a daily schedule on a wall at home and in the classroom
- Use a highlighter to note changes on the home and classroom schedule
- Communicate changes as soon as you know about them
- Indicate these changes on the home and school schedules immediately

- Pre-plan for change in small ways to increase and AS child's flexibility (Ashley, 2007, p. 156)

Routines that are too stringent and never ever change can inhibit an AS child's ability to play with others at home and in the classroom. Here again, balance and compromise must be executed together to provide an environment in which these AS children can grow to their full potential. According to Ashley (2007), the insistence on routine and sameness interferes with the AD child's play. Not all AD children engage in repetitive play patterns, but for those who do, it can be very disruptive in play. Play for most children is free-flowing with a give and take between playmates where they each play off the other's contribution. One of the most enjoyable aspects of play is the unpredictability and uniqueness that playmates bring to the play. The AD child, however, is disturbed by the free flow of play. She has a set routine in her mind and becomes frustrated when someone attempts to disrupt it. The more rigid and insistent the child is that the play goes exactly as she wants it the more social rejection she will experience.

The AD child who sticks to a rigid play routine also misses out on the joy of solitary play. Even when children play by themselves, their play is still free flowing, imaginative, and fun. The AD child's play in contrast tends to be routine and predictable and to the outside observer appears to be more of a task than play (p. 157).

An AS child's specific interest can be the driving force behind his/her play patterns. These play patterns may in fact be rigid and only apply to their specific way of playing. If the AS child plays with others, he will only want to stay with his interest. Parents and teachers should keep the following in mind in determining typical play patterns:
To help determine if your child's play is problematic, it helps to know what the development of typical play looks like. As young as infancy, babies begin to interact with one another. They imitate each other's sounds, and between one and two years they try to engage one another in playful interactions. By age two to two and a half, toddlers use words to initiate other to play. They also engage in complementary play where each one performs a task to help the other, such as when one holds a doll while the other feeds it. Around this same age, toddlers spend much of their time playing alone even if there are other children around. This solitary play is the most frequent type of play for three-to four-year-olds and occupies about one-third of the play of kindergarten children. Parallel play develops next, where toddlers play with the same toys and do not influence one another's play but may interact by exchanging toys and talking about one another's play. Cooperative play develops later, where toddlers and young children play in an interactive manner, playing towards the same goal, such as building a sandcastle or playing make-believe. (Ashley, 2007, p.158)

Parents and teachers will know whether or not their child is having play problems at home and school. The child will want to play alone. It will be easier on parents and teachers if parents and teachers do not force the issue of encouraging the AS child to play with others. However, play dates are important so that the AS child has the opportunity to share the fun of play with others. Play dates for an AS child should be brief, supervised and have a specific activity. These play dates need to be carefully planned to help stimulate the use of social skills at an early age.

4. How can the home environment and the school environment improve an AS child's play skills?

According to Ashley there are certain kinds of activities that can help an AS child's play skills, as well as their social skills. When children are involved in cooperative play, the likelihood of gaining social skills increased. They learn to share, take turns, get along, and empathize. Certain activities absolutely cannot be played unless there is cooperation. Choose games that require interaction. The most important point in choosing a game is that your child is interested in playing it. The following list is a small sample of games which require various levels of cooperation. (p.164)

Cooperative Games for Two	**Cooperative Games for Groups**
Hand-clapping games	Red Rover
Frisbee	Ring around the Rosie
Catch	Pickle
Handball	Ball games: kickball, softball, soccer
Simon Says	Four-square
Card games	Card games
Board games	Board games
Puzzles	Freeze tag
Hide-and-Seek	Duck Duck Goose
Tennis	Tug-of-War
Rock-Paper-Scissors	Team Scavenger Hunt
Badminton	Hot Potato
Hangman	Musical Chairs
Tetherball	Twister
Tic-Tac-Toe	Mystery puzzle
Chess, Checkers, Backgammon	Marco Polo

Children can also develop better social skills when they spend time with children who share their special interest. When AS children socialize with a group, the group tends to ignore and exclude them. This rejection and exclusion can contribute to their social ineptness and deprive AS students the opportunity to improve their social skills. Appropriate social situations for an AS child must be planned, initially, and then, over time, as the AS student becomes acclimated, and somewhat comfortable among his peers, more spontaneous group interaction is possible.

Reflections

John is a twelve year-old student with AS. He attends a small elementary school (44 children) on the east end of Long Island, New York. John has no history of behavioral problems and currently reads and performs math skills at the 4/5th grade level. His AS has been a lifelong disorder, and if it was not identified at an early age and if appropriate interventions were not put in place in the home environment, the likelihood of John succeeding in public schools would not have been possible. In addition, John is now more likely to have a better quality of life for himself as an adult.

John's school experiences are like many other students with AS. Regardless of the location of the school—rural or urban—all AS children should receive the help and guidance necessary to ensure their success in the educational system to help them meet life's challenges. We, as educators, should consider the presence of AS children in our schools a gift, not a burden. That child, labeled the "Little Professor" has certain gifts, skills and feelings that need to be nurtured and strengthened, and we must be there to help these students reach their fullest potential.

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Rise to the Challenge: Examining the Relationship of Swimming & Autism Spectrum Disorders

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Abstract

This study examined the personal interactions and experiences of six Virginia-based YMCA Aquatics Directors and Instructors in regards to the instruction of individuals with an Autism Spectrum Disorder (ASD). Overall, the main purpose of this study was to offer more insight into the rising challenges faced within the area of adapted aquatics specifically in relation to persons who are impacted by an ASD. This purpose included a hope that by heightening awareness, more research would be done and individuals would be assisted with greater ease and readiness when it comes to acquiring swim skills with a disability. Findings included a general feeling from instructors that although each had some exposure and experience in regards to the instruction of individuals with an ASD, more support could be beneficial. The manuscript also noted that the area of aquatics is included in the definition of physical education in the special education legislation and thus more importance can be placed on these finding

Rise to the Challenge: Examining the Relationship of Swimming & Autism Spectrum Disorders

Defining the Issue

Before examining current research and issues which exist involving Autism Spectrum Disorders (ASDs), it is important to define what this disorder is and the possible impacts it could have on acquiring life-saving skills. Autism is a developmental disorder that is diagnosed with varying repercussions due to its range of severity since it is a spectrum disorder. Some of its neurological ramifications include an impact on "communication, social interaction and repetitive and stereotyped behavior" (Autism Advocacy Coalition of Virginia, 2009). The range of this spectrum covers a high-functioning extreme known as Asperger's Syndrome, the most frequently associated Autistic Disorder and, the rarer but typically less severe, Pervasive Personality Disorder – Not Otherwise Specified (Centers for Disease Control and Prevention, 2010). An individual diagnosed with one of these spectrum disorders will likely have difficulty interacting with others in a socially conventional way, but he or she will not necessarily have symptoms or reactions similar to others with the same diagnosis (Centers for Disease Control and Prevention, 2010). As a result, it can be difficult to anticipate the needs of a person with an ASD.

In addition to everyday activities and basic, functional, daily living skills, the ability to swim is an important one for individuals with an ASD to attain. According to the National Autism

Association, teaching individuals to swim is a serious need because "drowning is a leading cause of death for a child or adult who has autism." This can likely be attributed to the fact that people with an ASD tend to "wander from parents and care providers" and "are often attracted to water sources such as pools, ponds, and lakes" (National Autism Association, 2005). Thus, because of the risks involved in association with not knowing how to swim, it is vital for people who have an ASD to address this issue. It is especially important for this population, because of its rising number of diagnoses, to assess the value of learning this potentially life-saving skill of swimming. It should also be noted that the area of aquatics is included in the definition of physical education in the special education legislation and as such is guaranteed to the student receiving special education students as part of physical education if the student is anticipated to benefit (IDEA, 2004).

Examining the Numbers: Autism Spectrum Disorders

Recent years have brought more attention to this range of disorders and, as such, care is now being taken to look at the increase of numbers and assess the prevalence of ASD. One decade ago, in 2000, the Centers for Disease Control and Prevention (CDC) formulated a group entitled the Autism and Developmental Disabilities Monitoring (ADDM) Network in order to track and analyze the numbers of diagnoses in certain areas of the United States and the impacts of the individuals with an ASD in those particular regions (Rice, 2006). This is helping provide an assessment on a national scale regarding ASDs in the United States.

Specifically in Virginia, there are some startling statistics to consider. The Commonwealth Autism Services surmises from available data that because approximately one person out of 100 is diagnosed with Autism Spectrum Disorder, proportionally 75,000 Virginia residents could, in all probability, have this developmental disability to some degree (Commonwealth Autism Services, 2005). While this statistic is staggering, the possibility of it is a valid one to consider. According to the CDC, the current mean estimate is for one in 110 to be diagnosed with an ASD (Center for Disease Control and Prevention, 2010). This approximation is also stated by the Autism Speaks (2010) website. Another statistic mentioned by this site is the frequency of male diagnoses over females; it is approximated "that in the United States alone, one out of 70 boys is diagnosed with autism." It may be difficult to say definitively, but studies suggest that males are more prone to this disorder (Autism Speaks, 2010). While this is an important conjecture to note, it is inconclusive data and should be regarded accordingly.

Autism has exponentially increased in recent years in the state of Virginia causing concern both for those directly impacted by this diagnosis and those who are merely aware of the issue or peripherally involved. In fact, "the disease frequency of autism now surpasses that of all types of cancer combined" which indicates the serious nature of this prevalent diagnosis (Virginia Public Schools Autism Prevalence Report, 2004). In 1992, there were only 571 recorded cases of Autism Spectrum Disorder in individuals between the ages of three and twenty-two years old in the state of Virginia. This number steadily grew at a moderate rate until the year 2000 when it reached a total of 2,228 individuals who were diagnosed with some degree of autism. After that year, the rate has been significantly more prominent, reaching 6,394 by the year 2006 (Autism Advocacy Coalition of Virginia, 2009). The overall population in the state of Virginia was recorded by the United States Census Bureau in 2000 as 7,078,515. By 2006, the Census reported Virginia as having a population of 7,642,884 (U.S. Census Bureau, 2008). Thus, over the span of six years

while the total state population increased by approximately eight percent, the population of individuals with an ASD almost tripled.

Examining the Numbers: Drowning

Because water is not a natural environment in which humans dwell, it makes sense that people need to be taught how to survive in this medium. It should also be a logical conclusion for one to consider that younger children are often the ones who drown. According to national data from the CDC in 2005, children between the ages of one and 14 died from drowning as the second most frequent cause of accidental death (Centers for Disease Control and Prevention, 2008). The Virginia Department of Health fact sheet regarding drowning explains that this makes sense because of children's natural tendencies in water. Consider these reasons for the heightened risk:

> Several factors put young children at high risk for drowning. Young children are physically top-heavy, active, curious and impulsive. They are also too young to understand that pools and standing water can be dangerous. Children under the age of five years do not struggle in the water. They can drown without making a sound. (Virginia Department of Health: Injury & Topics, 2009)

What this does not account for is the fact that children can be *taught* how to respond in the water and preventing opportunities for children to be left unattended near a body of water is also imperative. Regardless, deaths due to drowning are clearly a concern for this age group. According to the Virginia Department of Health, "swimming pools" – which were the second-most common location for these accidental drownings – "had the highest drowning rates with the younger age ranges of 1-4 and 5-9 years old" (Virginia Department of Health: Medical Examiner, 2010). With this in mind, it is imperative that precautions be taken regarding water safety for young individuals.

During the time span of a decade, from 1997 until 2006, there were 973 reported accidental deaths due to drowning in the state of Virginia. This information, reported by Virginia's Department of Health, also notes that of those deaths 82 percent were males (Virginia Department of Health: Medical Examiner, 2010). While there is not more available information as to the circumstances of these accidents, it is still a significant percentage of male victims compared to the remaining 18 percent for the females. The Virginia Department of Health reports that in 2006 males were more than three times as likely to drown as females. This same year listed 110 accidental drownings (Virginia Department of Health: Injury & Topics, 2009). While this information is not causational, the gender correlation is significant nonetheless.

It should be noted that the data presented here suggests an increased male prevalence for both ASD diagnoses and drowning rates; this is not information that should be ignored.

Methods

Participants

This study incorporated criterion sampling which chooses cases meeting established criteria, such as Aquatics Directors and Instructors with experience in terms of instruction of aquatics for individuals with an ASD diagnosis. This method is very strong in quality assurance (Patton, 1990).

Six Virginia-based YMCA Aquatics Directors and Instructors provided the insight into their personal interactions and experiences with individuals who have an ASD.

Data Collection

The process for conducting this research began with the researcher developing a survey and then contacting the nine YMCAs in the Greater Richmond, Virginia Area to procure the survey data. Before immediately speaking with the Aquatics Directors of these facilities, the researcher contacted the overall facility director to inform them of the study and request.

Once acquiring verbal consent from the YMCAs, the researcher proceeded to email a link of an on-line survey (Appendix A: Survey). From that point onward, it was merely a matter of waiting for the responses before reading them and analyzing the data to share the insights which they offered.

Results

There were a variety of responses from YMCAs. There was one facility that did not have a pool and one that did not have a program for children with an ASD because there had been no expressed need. Aside from those, there was only one which the researcher had no success with messages being returned to receive permission to send the survey link. The remaining six YMCA Aquatics Directors and Instructors provided the following insight into their personal interactions and experiences with individuals who have an ASD.

The four responses to the first question regarding, overall, how many swimmers with an ASD had received lessons at the instructor's YMCA were somewhat mixed with one indicating that there were no swimmers with an ASD, another indicating only three, another citing ten within this past year alone, and finally an approximation of about 15 students over the course of an instructor's 40 years spent teaching.

Four of the six swim instructors indicated that they had taught between one and five students with an ASD in the past five years. The remaining two responders each took the extremes of the spectrum options with one who had not taught any students with an ASD and the other who had taught between six and ten.

Only one of the individuals who participated in the survey had any friends or family members with an ASD.

Several individuals listed a lack of availability or awareness of classes with information on ASD, while others had had some exposure through work in the public school or by gathering information through colleagues.

In order to shape swim lesson plans fitting for students with an ASD, the instructors listed a number of responses regarding what research has helped them. One mentioned that he/she "started working with this group of learners before there was any research to go by." All of the four detailed responses cited personal experiences and the importance of recognizing individual differences as factoring into how to handle each lesson. One instructor also pointed out the value of asking for input from the parents in order to benefit from their knowledge of their own child's weaknesses and strengths.

There was a range of responses in terms of the comfort level which the instructors felt while teaching lessons for individuals with an ASD. This was also true for their perceptions of how easily they felt they could adapt their lesson to meet the needs of their individual learners. None, however, considered themselves extremely uncomfortable or as having great difficulty with these two respective personal assessments.

When asked about the main goals of these swim lessons and the order of skills generally taught in these lessons, all of the five instructors who responded cited the comfort level of the student as being a main focus or factor in the learning process.

The penultimate survey question inquired about the tone of voice used to address students with an ASD. The notable repeat phrases among the responses were "energetic" and "short" or "simple" as far as the level of detail involved in the instructions.

Finally, the survey asked for the range of responses from students with an ASD to the general instructions from the teachers. Although there was a variety, most of the responses from students were reported as positive though perhaps slower at progressing than students without an ASD.

In summary, these responses offer some limited insights into the current standings of what services are in place for teaching individuals with ASDs how to swim. While most instructors had some exposure and experience, more support could be beneficial.

Discussion

An overall assessment of the meaning behind the results of the survey indicates some concerns for aquatic instructors regarding their students with ASDs. The fact that there is one facility without a program in place at all seems less than ideal, but perhaps there really is no need for a program in that area. It is more concerning, however, that there seems to be a general pattern of independent discovery of how to handle this specific population of students rather than a guided approach based on research and tested methods.

With the limited needs expressed by most of the responses, it may not be imperative for all aquatic instructors to be experts at teaching students with an ASD, but resources should certainly be available in case the opportunity presents itself and an instructor needs assistance with how to handle a lesson. Since the majority of the instructors who responded did not have personal

relatives or close friends with an ASD, nor were they aware of much available information regarding the disorder or how to help those impacted by it, it makes sense that more of them felt moderately uncomfortable or neutral teaching this group of students than extremely comfortable. It is, however, certainly a positive sign that most of them reflected a personal sense of flexibility and adaptability with the lesson plans when working with a child who has unique needs because of an ASD.

Shared personal experiences are clearly valuable to instructors. One individual responded that he or she had "gained valuable knowledge through colleagues" and was "able to apply" this information. Aside from acquiring firsthand experience oneself, it should be common sense that receiving information from someone else who has gone through certain circumstances will be more valuable than simply reading or hearing abstract ideas and concepts. This is not to say that research in the field of ASDs is not important for those who are teaching, but it would be more beneficial for them to understand what methods have been tried and been successful or not with people who struggle in different ways on the spectrum of autism with learning how to swim.

It could also be beneficial for more publicity to be produced for individuals who have an ASD, or for one of their caregivers, to learn that these lessons are available and important. The relatively low numbers reported from this survey indicate that either there are not many individuals in this area with a diagnosis or they are not receiving swim lessons from the YMCA – or possibly at all.

At this point it is felt important to reiterate the point that the area of aquatics is included in the definition of physical education in the special education legislation and thus more importance can be placed on these findings.

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Preservice General Education Teachers' Attitudes and Knowledge of Special Education

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Abstract

The purpose of this study was to determine the attitudes and knowledge acquired by preservice general education teachers regarding students with disabilities. Participants included fifty-six general education preservice teaches in their student teaching semester at the University of North Dakota. A three part survey (i.e., attitudes, perceived knowledge, and application of knowledge of special education) was conducted. Participants' responses indicated that 1) preservice teachers' attitudes toward inclusion of students with disabilities were highly favorable, 2) preservice teachers' attitudes were least favorable in the area of managing behavior, 3) preservice teachers' attitudes were marginal in managing time and overcoming negative attitudes of others, 4) preservice teachers' perceptions of knowledge in the area of differentiation (e.g., assessment, instruction) were highly favorable, 5) preservice teachers' perceptions of knowledge in the areas of law, procedures, and severe disabilities was marginal, and 6) preservice teachers' application of knowledge in the area of characteristics of and accommodations for students with learning disabilities and attention deficit hyperactivity disorder was extremely favorable.

Preservice General Education Teachers' Attitudes and Knowledge of Special Education

The federal mandates set forth by the Individual with Disabilities Act (IDEA) and No Child Left Behind (U.S. Department of Education, n.d.) have supported the practice of educating students with disabilities in regular education classrooms. In 2002-2003, approximately 6.4 million students had special education individualized education programs (IEPs) and received special education services. According to the U.S. Department of Education (2007) approximately half of all students with disabilities in 2004–2005 spent 80 percent or more of their day in a general education classroom. As more and more students with disabilities are educated in the general education classroom, it is imperative that general educators have a positive attitude toward the education of students with disabilities and the knowledge and skills to effectively meet the needs of all students.

Research suggests that the attitudes and beliefs of general educators and acquisition of knowledge and skills toward educating students with disabilities are concerns that must be addressed in teacher preparation programs (deBettencourt, 1999; Henning & Mitchell, 2002; Silverman, 2007). In a summary of 28 surveys of general educators' perceptions on inclusive practices, Scruggs and Mastropieri (1996) found that two-thirds of general educators believed that inclusion is beneficial for students with disabilities. However, one-third of the 10,560 teachers reported that they did not have training or resources to actually implement inclusion successfully. Cook (2002) discovered that when pre-service teachers had positive feelings toward inclusion the implementation of inclusion practices was more evident.

In a survey of 228 middle school mathematics teachers, it was concluded that many of the respondents lacked an understanding of instructional strategies to strengthen the mathematical learning of students who had learning disabilities (DeSimone & Parmar, 2006). In another survey study (n=59) that measured the use of instructional strategies within the general education classroom and attitudes about inclusion, findings indicated that general educators needed more attitude and awareness training concerning students with disabilities and the number of instructional strategies used by general educators increased with the number of special education courses taken and the number of hours spent with special educators (deBettencourt, 1999). Other issues that have been identified as challenges faced by teachers include having sufficient resources, having adequate planning time and receiving appropriate training (Idol, 2002).

Research suggests that pre-service teacher preparation programs do not provide adequate training to meet the needs of students with disabilities in the inclusive setting (DeSimone & Parmar, 2006; Rao & Lim, 1999; Smith & Smith, 2000). Preparing general education teachers to effectively teach in inclusive classrooms is an issue faced by numerous teacher education programs (Blanton, Griffin, Winn, & Pugach, 1996; Gerent, 2000; Peterson & Beloin, 1998; Smith, Palloway, Patton, & Dowdy, 2007; Villa, Thousand, & Chapple, 1996). Historically, separate general and special education teacher preparation programs have not provided preservice teachers with training and experience to develop the knowledge and skills needed for inclusion of students with disabilities (Villa, Thousand, & Chapple, 1996). However, some teacher training programs have developed innovative training models that have merged general and special education curricula and field-based experiences but few have assessed the effectiveness of the initiative or learning outcomes of their students.

One program, called Project ACCEPT (Achieving Creative and Collaborative Educational Preservice Teams), attempted to determine the effectiveness of student learning (Laarhoven, Munk, Lynch, Wylan, Dorsch, Zurita, Bosma, & Rouse, 2006). The primary goals of the project were to prepare pre-service educators for inclusive education and to encourage collaboration across disciplines through participation in a course entitled "Collaborative Teaching in Inclusive Settings." Eighty-four elementary, secondary and special education pre-service teachers participated in the project. The project was evaluated by comparing the performance of participants (i.e., the experimental group) with that of students enrolled in a section of the traditional course (i.e., control group). Surveys were used to assess student dispositions toward inclusive education and curricular probes were used to assess pre and post-test competencies in implementing strategies. Results of the survey indicated that students participating in the project made more positive ratings than the students in the control group, and the most beneficial aspect of their experience was collaboration with students from other disciplines. Probe scores increased

from pre to post test for all groups, with significantly more growth for students enrolled in the project.

The purpose of this study was to identify the perceptions of pre-service teachers about their attitudes and knowledge regarding students with disabilities, and to find out to what extent the same pre-service teachers could apply their knowledge of students with disabilities. The study was confined to one university teacher education program where a curriculum integration project between general education and special education faculty was about to be implemented. The purpose of the curriculum integration was to prepare pre-service general education teachers in regards to working with students with disabilities in their future classrooms. The results of the current study provided a baseline against which the responses of future pre-service teachers completing the same program.

Method

Participants and Setting

Participants in this study included 56 general education preservice teachers attending a university in the Upper Midwest. All participants were enrolled in their student teaching semester. The general education majors represented in this study included: early childhood education (n = 5), elementary education (n = 30), middle level education, and secondary education (n = 21).

Instrumentation

Participants completed the *Preservice Teacher Survey of Attitudes and Knowledge of Students with Disabilities Survey* (adapted and modified with permission from Dr. Shaila Rao at Western Michigan University). Demographic information was obtained at the beginning of the survey relative to degree majors and minors. The survey included three sections: Section 1 Attitudes, Section 2 Perceived Knowledge, and Section 3 Application of Knowledge. Section 1 of the survey was comprised of 18 items related to attitudes towards students with disabilities, while Section 2 consisted of 20 items that pertained to perceived knowledge students with disabilities and various aspects of special education. Participants rated items in Sections 1 and 2 using a Likert scale delineated as 5 = *Strongly Agree*, 4 = *Agree*, 3 = *Neutral*, 2 = *Disagree*, 1 = *Strongly Disagree*. Section 3 included four open-ended questions relative to application of knowledge about special education. Questions in this section ascertained participants' ability to identify learner characteristics in order to make appropriate accommodations. Coefficient alphas for internal consistency were .75 for Section 1, .93 for Section 2, and .54 for Section 3.

Data Collection and Analysis

A quantitative research design was implemented for this study. Participants anonymously completed the survey instrument during one senior seminar session, which is taken concurrently with their student teaching experience. The survey took approximately 20 minutes to complete, and the overall response rate was 100% which is well above the acceptable response rate of 50% (Babbie, 1990).

Descriptive statistics for Sections 1 (attitudes) and 2 (perceived knowledge) were reported as percentages for participants' ratings of each item. Data were statistically analyzed for the five highest percentage items in both sections, which were rated as *strongly agree* or *agree*. Conversely, the five lowest percentages items (i.e., rated as *strongly disagree* or *disagree*) were also analyzed.

For Section 3, application of knowledge, each open-ended question was evaluated by a minimum of two raters (i.e., special education faculty) using a holistic scoring rubric with a three-point scale for responses present and accuracy of responses (note that the open-ended questions asked the respondent to list three responses for each question) (see Table 1). Reliability of rating scores was achieved with an inter-rater reliability of .98. Descriptive statistics for this section were also reported as percentages for individual survey items. Data were analyzed using the percentage of participants who received a rubric rating of 3 or 2.

Table 1. Holistic Scoring Rubric

3	• 3 responses present • 3 accurate responses
2	• 2-3 responses are present • 2 responses are accurate
1	• 1-3 responses are present • 1 response is accurate
0	• 0 responses are present • 0 responses are accurate

Results

The survey results were categorized into three areas: 1) general education pre-service teachers' attitudes regarding students with disabilities, 2) general education pre-service teachers' perception of their knowledge regarding students with disabilities, and 3) the application of general education pre-service teachers' knowledge regarding students with disabilities.

Attitudes Regarding Students with Disabilities

The five highest (strongly agree/agree) and five lowest (strongly disagree/disagree) rated items in the category of "attitudes regarding students with disabilities" are reported in Figures 1 and 2. A majority of the general education pre-service teachers surveyed (96%) rated their attitudes highest (strongly agree/agree) in the category of *inclusion fosters understanding and acceptance.* Other categories that were rated high included *inappropriate behaviors are not emulated* (93%), *separate settings promote a feeling of exclusion* (93%), *students with disabilities should be in general education* (89%), and *others involved benefit from inclusion* 89%).

Figure 1. Attitude Items Receiving Highest Ratings

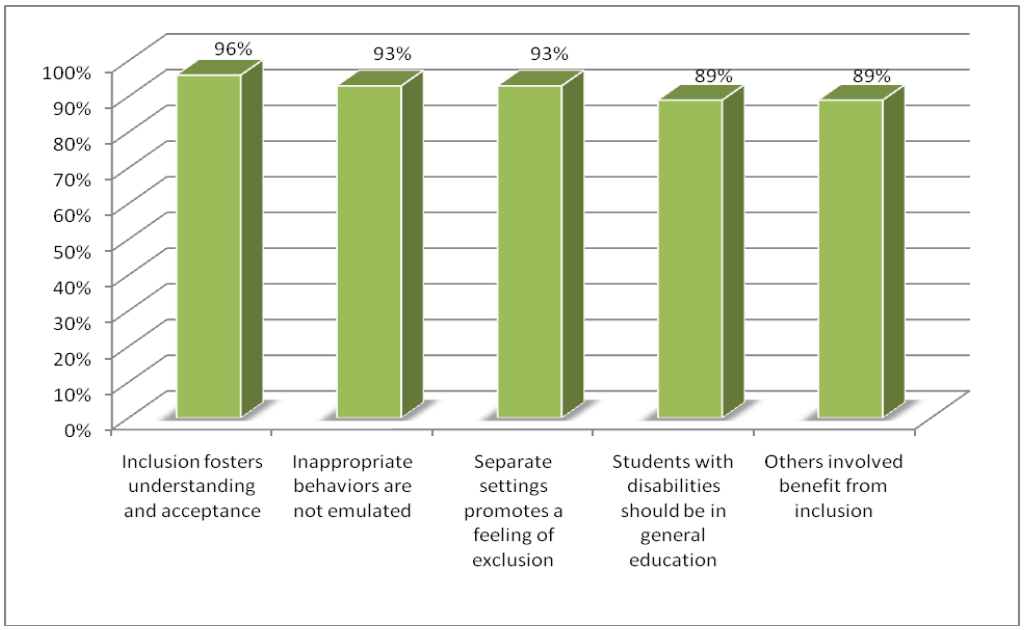
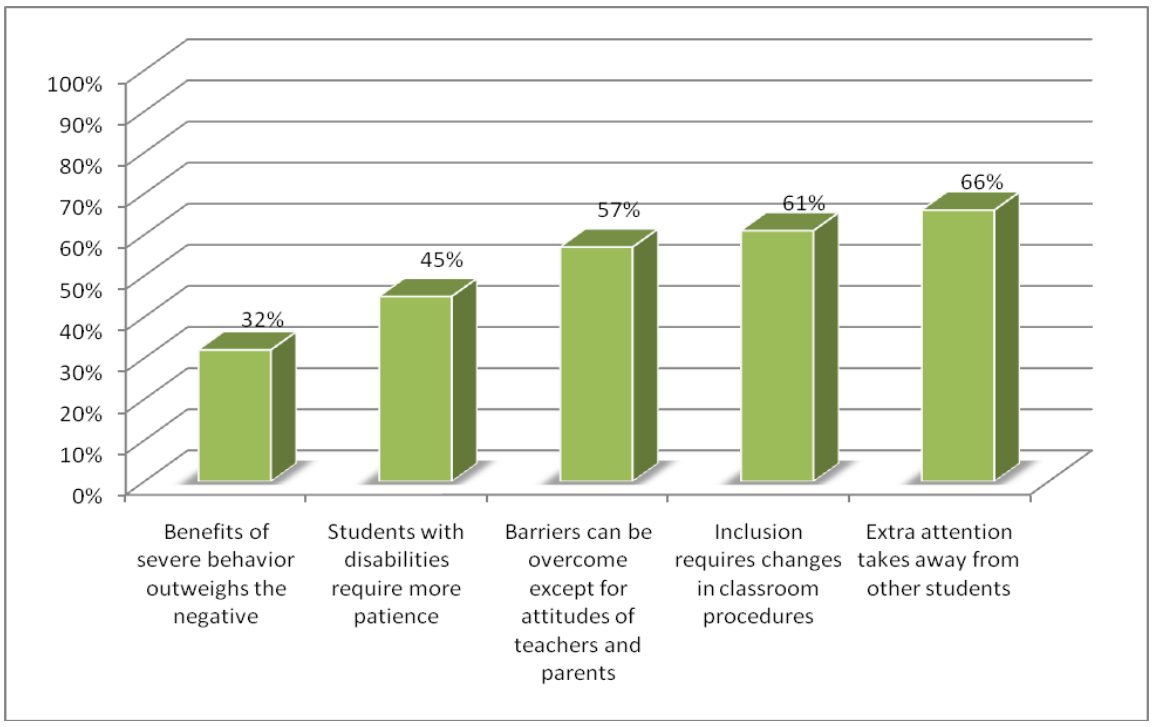


Figure 2. Attitude Items Receiving Lowest Ratings



A majority of the general education pre-service teachers surveyed (32%) rated their attitudes lowest (strongly disagree/disagree) in the category of *the benefits of having a student with severe behaviors in the classroom outweigh the negative*. Other categories that were rated low included *students with disabilities require more patience* (45%), *barriers can be overcome except for the attitudes of teachers and parents* (57%), *inclusion requires changes in classroom procedures* (61%), and *extra attention takes away from other students* (66%).

Perceived Knowledge Regarding Students with Disabilities

The five highest (strongly agree/agree) and five lowest (strongly disagree/disagree) rated items in the category of "perceived knowledge regarding students with disabilities" are reported in Figures 3 and 4. A majority of the general education pre-service teachers surveyed (89%) rated their perceived knowledge highest (strongly agree/agree) in the category of *teacher as model.* Other categories that were rated high included *personal biases and differences affect teaching* (84%), *inclusive practices* (82%), *differentiated instruction* (77%), and *fair assessment practices* (75%).

Figure 3. Perception of Knowledge Items Receiving Highest Rating

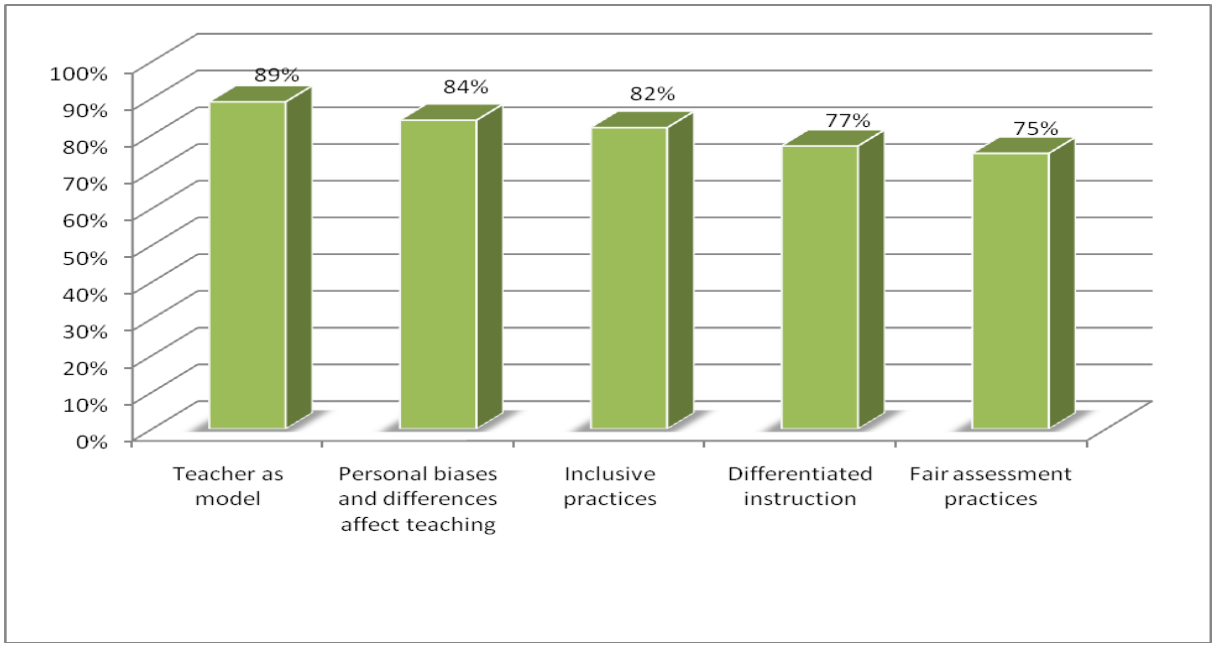
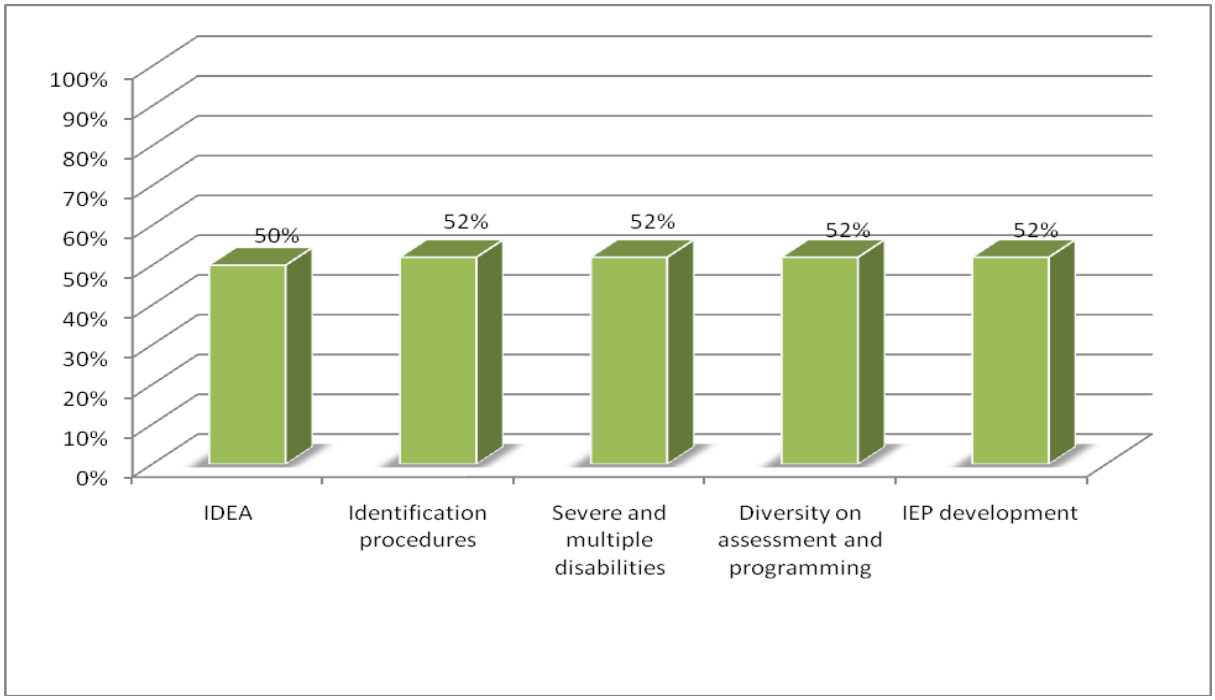


Figure 4. Perception of Knowledge Items Receiving Lowest Ratings

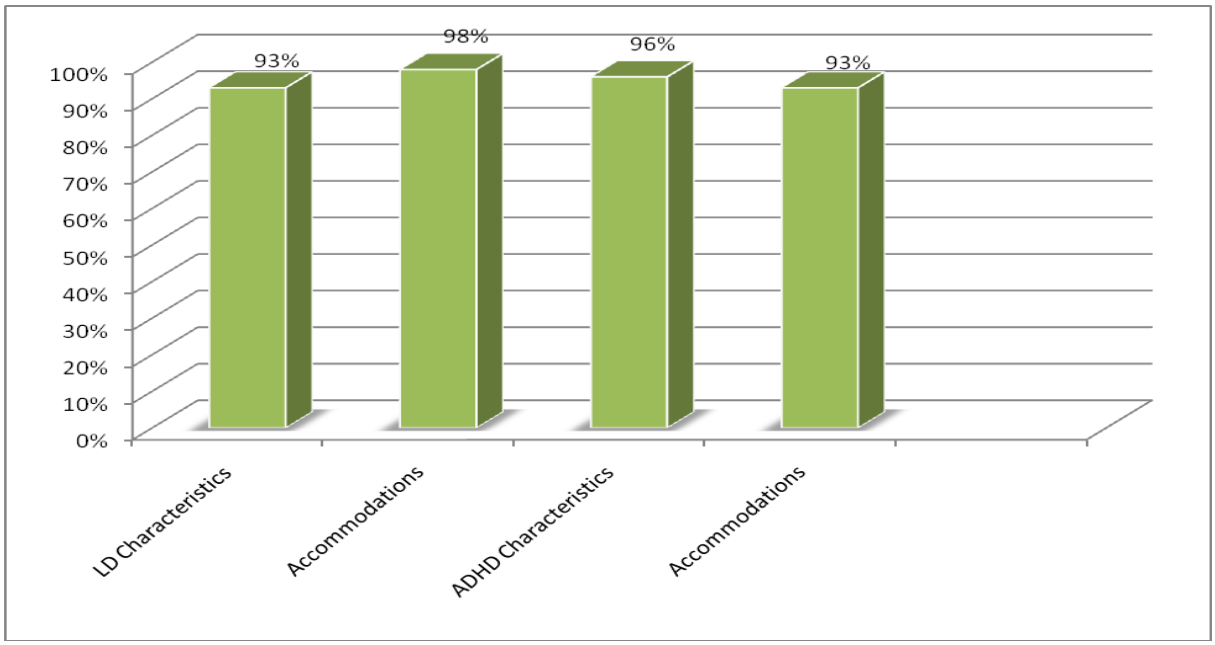


A majority of the general education pre-service teachers surveyed (50%) rated their knowledge lowest (strongly disagree/disagree) in the category of the *Individual with Disabilities Education Act.* Other categories that were rated low included *identification procedures* (52%), *severe and multiple disabilities* (52%), *diversity on assessment and programming* (52%), and *IEP development* (52%).

Application of Knowledge Regarding Students with Disabilities

There was a total of four application questions in an essay format in the last section of the survey. Figure 5 shows the percentage of general education pre-service teachers surveyed who scored a "4" or "3" (an acceptable response) on each of the four questions. Ninety-three percent of those surveyed had an acceptable response for question number one which referred to the characteristics of students with learning disabilities. Question two, regarding accommodations for students with learning disabilities, had 98% of those surveyed earning an acceptable response. In regards to the characteristics of students with ADHD (question number three), 96% of those surveyed earned an acceptable response. Similarly, question number four regarding accommodations for students with ADHD, had 93% of those surveyed earning an acceptable response.

Figure 5. Application of Knowledge Items



Discussion

In the category of "attitudes" the five highest rated items were similar in that they referred to the topic of inclusion. As we looked at the content of these survey items that were rated highest, we concluded that the "theme" of the five items was *inclusion fosters understanding and acceptance*. These findings are similar to the studies by Scruggs and Mastropeiri (1996) and Cook (2002) where they found that the students they surveyed believed that inclusion is beneficial for students with disabilities. Thus, the majority of pre-service candidates rated themselves as having positive attitudes about including students with disabilities in their classrooms.
Likewise, we looked at the five lowest rated items in the category of "attitudes" and found they were similar in that they all referred to the topic of behavior. We identified the theme of the five items as *the benefit of having a student with severe behaviors in the classroom outweighs the negative.* Even though two thirds of the candidates rated themselves as agreeing with this theme, a third of the pre-service candidates indicated that having students with severe behavior problems in their classrooms would have a negative impact.

In the category of "perceived knowledge," the candidates in this study perceived their knowledge strongest in the areas of inclusive practices and differentiated instruction. This is contrary to the studies by Scruggs and Mastropieri (1996) and Cook (2002) where the general education candidates believed they did not have the training or resources to implement inclusion successfully.

The fact that a majority of the candidates surveyed in this study rated their attitudes and perceived knowledge as positive regarding students with disabilities is encouraging. Likewise, high scores in the area of "application of knowledge" are also encouraging. In the third and final category, "application of knowledge," a majority of the pre-service candidates were able to respond to case

study scenarios by 1) describing the characteristics of the student's disability and its impact on the student's classroom functioning, and 2) describing the modifications they, as the classroom teacher, would implement to meet the needs of the student represented in the case study.

As a special education faculty, we continue to explore ways to successfully infuse special education content into a general education curriculum that addresses students with disabilities. Although some positive strides have been made through our efforts at curriculum integration, as was indicated in the results of the survey, we realize that an even greater emphasis on having students with disabilities in general education classrooms is needed. It is our hope that our general education colleagues will not only work side by side with us in this endeavor, but will see the benefits of their participation. Our long range goal is to see increased ownership and participation by general education in the curriculum integration process.

Recommendation for Future Research

There are four program areas in the teacher education department at the University of North Dakota: early childhood, elementary, middle level, and secondary. Of these four program areas, only early childhood and elementary are required to take an introduction to special education course (i.e., Education of the Exceptional Student). The middle level and secondary program areas try to integrate content regarding students with disabilities into coursework, although this is often done in a hit and miss manner. It would be interesting to see if there is a difference between the candidates who are required to take the course in special education and those candidates who are not required to do so. Thus, the survey will continue to be given to pre-service general education candidates during the student teaching semester. Once a sufficient number of candidates have been surveyed, an analysis will be completed to see if there are significant differences among the attitudes, perceived knowledge, and application of knowledge between the early childhood and elementary candidates versus the middle level and secondary candidates.

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Multiple-Choice Tests with Correction Allowed in Autism: An Excel Applet

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Abstract

The valuation of academic achievements in students with severe language impairment is problematic if they also have difficulties in sustaining attention and in praxic skills. In severe autism all of these difficulties may occur together. Multiple-choice tests offer the advantage that simple praxic skills are required, allowing the tasks to be performed without physical support. Even so, attentive and behavioral difficulties may be so disruptive that achievements may be underestimated. Since special needs educators can give immediate feedback on each answer, a strategy might be to permit corrections, allowing further attempts, in order to mitigate these problems and to better capture their knowledge. Here a Microsoft Excel applet is designed to compute the statistical significance and the final grade of multiple-choice tests, if up to two corrections per selection are allowed. The method was used with a nonverbal student with severe autism and Down syndrome in a mainstream secondary school.

Multiple-Choice Tests with Correction Allowed in Autism: An Excel Applet

A conventional multiple-choice (MC) test item consists of a stem (the question) and a list of alternatives (possible answers to the question). The stem may be also an incomplete statement and the alternatives its possible completions. Exactly one alternative is the *correct answer* and the others are *distracters*. Possible weaknesses in a MC test are that it does not measure what it is supposed to, that it contains clues to the correct answer and that it is worded ambiguously (Burton, S.J., Sudweeks, R.R., Merrill, P.F., Wood, B., 1991). A great deal of research on the use of multiple-choice tests in education has been conducted (for a review, see Haladyna, Downing, Rodriguez, 2002). That research has inspired a number of well-known guidelines that describe how to prepare the items for an MC test, taking account of the influence that item format exerts on students' comprehension and outcomes (e.g. Martinez, 1999).

However, psychometric research also reveals the problems that can emerge concerning the reliability and validity of MC test results, highlighting the role that guessing can play in test outcomes alongside a suite of other factors, unrelated to the aim of the test, that can influence students' choices. For instance, when students are not certain of the correct answer, their choices may be influenced by the apparent likelihood of the alternative answers. Since 1919, *formula-scoring* procedures have been used to mitigate these problems (Thurstone 1919). The most popular procedures used at present, are: (S1) simply to compute the percentage of the right answers with respect to number of questions and (S2) give 1 point for each right answer, no point for the unanswered questions, and a penalty of -1/(c-1) points for each failure, where c is the fixed number of alternatives per question. In this latter case, the grade will be the percent ratio of the sum of the points to the number of questions. With the S1 procedure, the test is sensible to guess when the answer is uncertain, because omissions and failures are computed in the same way (zero

score), while, with the S2 procedure, the penalty for errors depends on the probability, 1/*c*, of guessing correctly in response to each question, as we will see later. For instance, S1 is used in the American College Testing (ACT) exam and S2 in the Scholastic Aptitude Test (SAT) exam. Some studies support the first, while others (for different reasons) support the second; given a large number of questions, both approaches yield equivalent reliability (Prieto & Delgado, 1999).

We employ S2 in the material that follows, because it appears to be more reliable for tests involving small numbers of questions (figure 1).

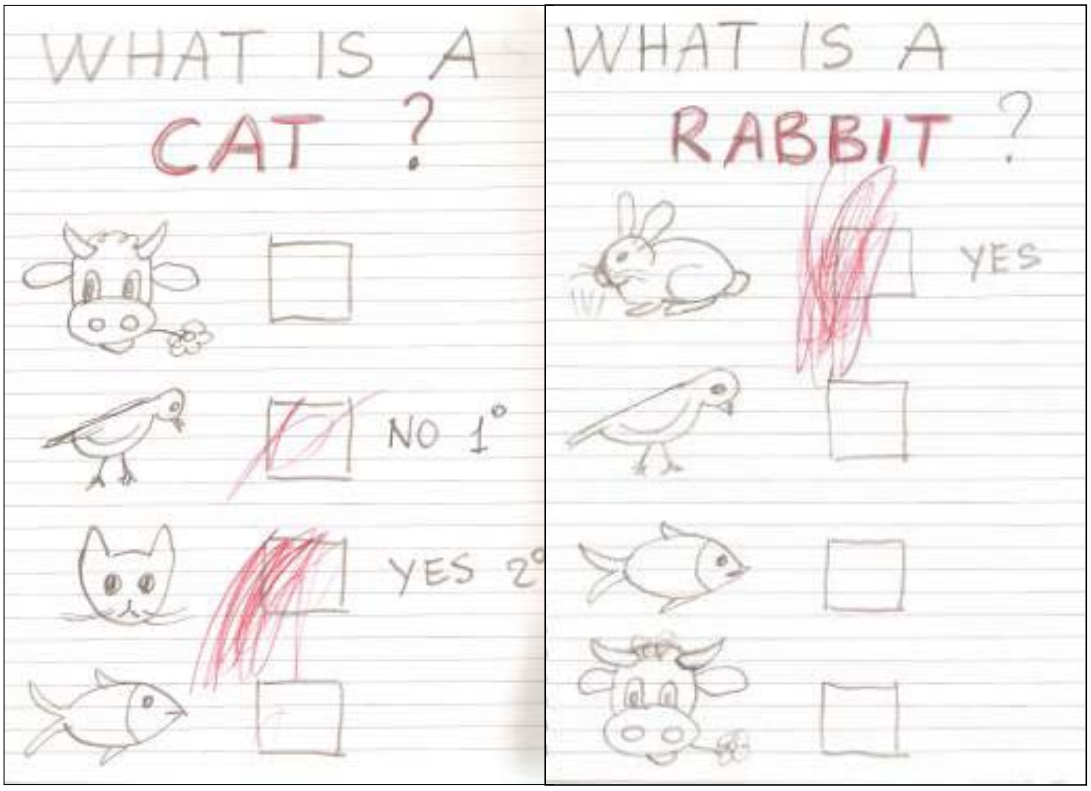


Figure 1. *These are some examples of how to answer the test questions, when some corrections are allowed. To avoid influencing the choice, no physical support is permitted. In the first page, on an A4 sheet, the first answer was wrong - perhaps because that option is spatially close to the correct one – and the second was correct. In the second example, the correct answer was also the first selected, and the selection was relatively certain, as indicated by the breadth and intensity of the student's mark. These examples are taken from a test conducted by a 16-year-old boy with autism with Down syndrome, who studied English as second language.*

Multiple-choice tests are frequently used in special education, to test the performance of nonverbal students, who are difficult to test in other ways. Often, they are employed as components of popular tools like the Peabody test (PPVT™-4: Peabody Picture Vocabulary Test, 2006), used to measure students' vocabulary and word comprehension. There are also studies that describe the influence of particular picture types, employed as alternatives, on performance outcomes (e.g. Heuer & Hallowell, 2007). Here, we propose the use of MC tests to evaluate the

academic achievements of students with autism (Twachtman-Cullen, D., 2006; Volkmar, Paul, Klin, Cohen, 2005; Schopler & Mesibov, 1995), when students exhibit poor or absent speech, and also dyspraxia, which hampers writing (Ming, Brimacombe & Wagner, 2007).

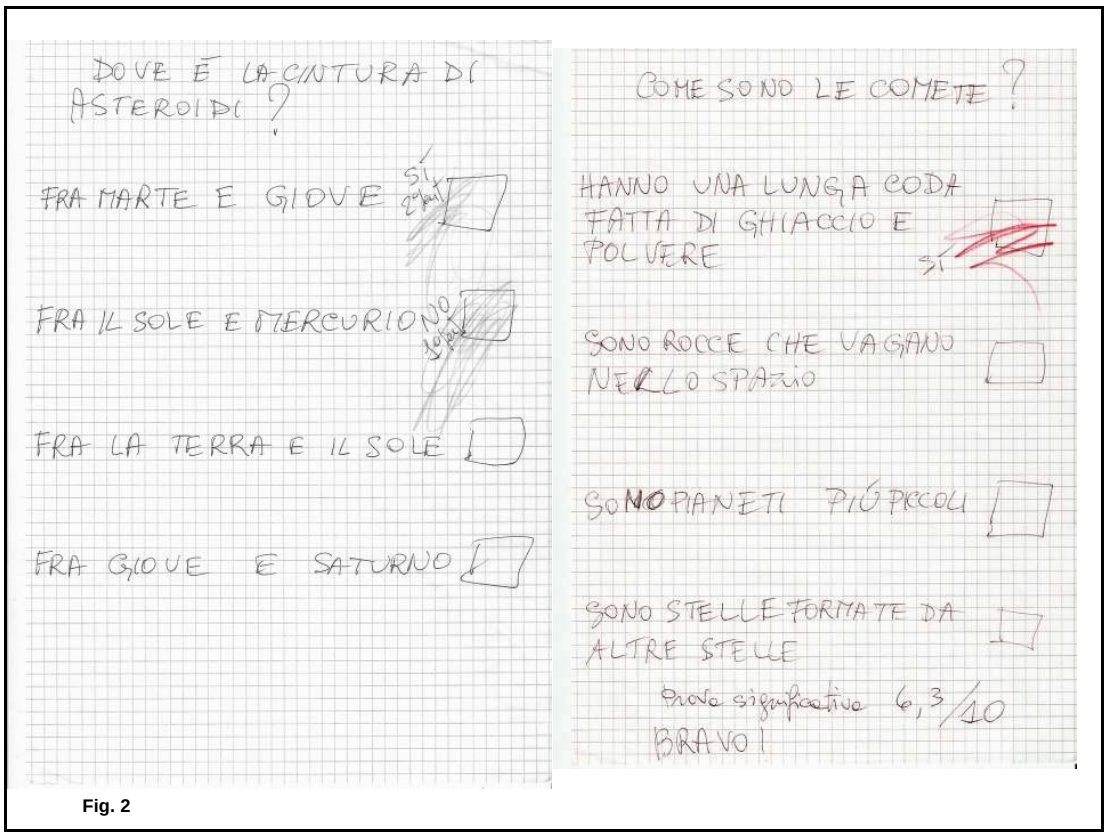


Figure 2. *Test (in Italian) on the solar system, with four alternatives and up to two corrections allowed (i.e. three attempts). The student, with a teacher in attendance, went through each topic and then answered the related questions, each of which was read aloud (both the question and the alternatives) by the teacher. The student was left to mark the answer with no prompt and, if the answer was wrong, was invited to pay more attention and to try once again. On 10 questions, 6 were answered correctly at the first attempt, 2 at the second, and 1 at the third, while one was missed with no attempt (the whole page was doodled). The test was completed by a 16-year-old boy with nonverbal autism and Down syndrome. The test was statistically significant (p=0.01) and the grade was 70/100 (not 6.3/10 as on the picture).*

[Translation: (1st page) WHERE IS THE ASTEROID BELT? A) Between Mars and Jupiter (YES, chosen at the 2nd attempt), B) Between the Sun and Mercury (NO, chosen at the 1st attempt), C) Between Earth and the Sun, D) Between Jupiter and Saturn. (2nd page) WHAT DO COMETS LOOK LIKE? A) They have a long tail, composed of ice and dust (YES), B) They are rocks wandering through the space, C) They are small planets, D) They are stars, composed of other stars. The test is significant 6.3/10. WELL DONE!]

The need for flexible valuation tools in academic testing is evident in Italy, where since 1977 all students with any kind of disadvantage (from challenging behavior to clinical disability) of any severity (from dyslexia to severe autism) must attend, by law, mainstream schools. Where

necessary, support teachers help class teachers to provide an individualized program, and to integrate the student in class activities. In this environment, it is important to be able to evaluate the academic achievements of students with severe disabilities, who might be unable to speak or write in an independent way. Multiple-choice tests seem to be appropriate to this purpose, allowing choices to be made based on objects or pictures (figure 1), written words or sentences (figure 2).
How can we know that a result in a multiple-choice test is statistically significant, i.e. the likelihood that it was wholly obtained by choosing at random is low enough to support strong conclusions? If a student gives a wrong answer, is it possible to allow him/her to try again? If we do allow extra attempts, how does the test's significance change, and how can we mark it? The aim of the following applet is to answer these questions, offering a reliable valuation of MC test scores when extra attempts are allowed. Unfortunately, prevailing attitudes toward people with severe disabilities (such as nonverbal autism) are often rather extreme; either to believe that they understand nothing or to believe that they understand everything but are unable to show it.

Neither of these attitudes is helpful, since particular students might confirm either or both preconceptions when tested in different ways. For this reason, the student has to be prepared on the topic on which he/she is tested, and the teacher has to be sure that each question is intelligible to him/her. In practice, it is important to write the items that have to be read aloud, providing both visual and auditory presentation for each question. For students with severe autism, the task of choosing might not be straightforward and they might need a specific training, using some physical support at the beginning, due to their impairment in learning by imitation (Rogers & Williams, 2006). In fact, choosing by pointing might be a poor method in this case, as these students often touch everything: it may be more effective to ask the student to place the chosen item inside a box or on the hand of the teacher (Schopler & Mesibov, 1995). If the choices are either written or displayed as pictures on paper, a simple tick may be a less reliable response that the coloring of a corresponding box (fig.1 and 2). Unfortunately, these students are often much more stressed than others are by the testing environment, and fail to consistently attend the test items while making their choices (Twachtman-Cullen, 2006). In some studies, visual attention has been described as a key strength (O'Riordan & Plaisted, 2001) of people with autism; that may be so, but impairments in the shifting of attention (deficits in executive functions) can undermine that strength by making it difficult to focus the student's attention towards a new task (South, Ozonoff, McMahon, 2007; Courchesne et al., 1994). For this reason, if the answer is wrong, it can be useful to say and/or to write "no" close to the wrong answer and to immediately invite the student to rethink the question, reading it again with him/her, and inviting the student to answer it once more (see Figures 1 and 2).

With the following applet, up to three attempted answers (i.e. two corrections) are allowed per question. It may be useful to write a note (1^{st}, 2^{nd}, 3^{rd}) indicating the order of the answers, as in Figures 1 and 2, to understand what criteria (if any) were used in making each choice. Note that students are allowed to mark only one alternative at a time and should be able to exclude the alternatives that they have already chosen, because they have access to immediate feedback from their previous mistakes. For this reason, not all MC tests are suitable for corrections. In fact, no correction should be allowed for stems associated with just two alternatives and stems associated with three alternatives should permit at most one correction (i.e. two attempts). At least as currently defined, our method permits at most two corrections (i.e. three attempts) for any stem associated with four or more alternatives.

The aim of this paper is to describe a tool that also permits the reliable evaluation of students with severe disabilities, which is robust to disabilities that implicate the focusing of attention, even when the students exhibit an oppositional defiant behavior during the test. For instance, if all the answers are wrong in a two-alternative test with 6 questions, it is unlikely that the student is choosing at random (p=0.0156), but much more likely that his/her errors are really a form of protest.

Both with typical students and in special education, MC testing may be a useful tool for testing academic achievements, but should never be the only testing method employed. In fact, performance tests allow students greater freedom to produce original ideas and to supply their own information, though they may be more difficult to learn and complete. These tests are therefore at least as important as the MC tests with which we are concerned.

The Multiple Choice Test Valuation Applet.

	A	B	C	D	E	F
1	**Table 1. MULTIPLE-CHOICE TEST VALUATION TABLE**					
2	Number c of alternatives per each question (c≥2)	Max number t of answering attempts allowed per question (1≤t≤3 and t<c)	Number n of questions	Number of correct answers given at the first attempt	Probability of a random hit at the first attempt per question	Probability of randomly guessing at most the number of hits obtained at the first attempt
7	10	3	5	0	0,10000	0,59049
8						
9	Probability of randomly guessing at least the number of hits obtained at the first attempt	Number of wrong answers given at the first attempt	Number of correct answers given at the second attempt	Probability of a random hit in the first two attempts per question	Probability of randomly guessing at least the number of hits obtained at the first two attempts	Probability of randomly guessing at most the number of hits obtained at the first two attempts
14	1,00000	5	2	0,20000	0,26272	0,94208
15						
16	Number of wrong answers given at the second	Number of correct answers given at the third attempt	Probability of a random hit in the first three attempts per	Probability of randomly guessing at least the number of	Probability of randomly guessing at most the number of	Binomial probability **p value**

20	attempt		question	hits obtained at the first three attempts	hits obtained at the first three attempts	
21	3	3	0,30000	0,00243	1,00000	0,00243
22						
23 24 25 26 27 28	Number of unanswered questions, with no attempted answers.	Number of unanswered questions at the 2nd attempt, after one failure. If t=1, put 0.	Number of unanswered questions at the 3rd attempt, after two failures. If t=1 or 2, put 0.	Number of wrong answers given at the third attempt	**The test result is statistically SIGNIFICANT (2-tailed stat test with α=0.05)**	**GRADE IN PERCENTAGE POINTS**
29	0	0	0	0	**TRUE**	**79,3**

Table. 1. *Multiple-choice test valuation table of the Excel applet. To use it, replace the actual numbers of all white cells with your numbers and click, with the left key of the mouse, on the "significant" cell and on the "grade" cell. The results, in the golden cells, will appear updated with your data. If "error" appears, this means that your data are not consistent and you have made some mistake when entering them.*

The applet (Table1), programmed in Excel (see appendix), assesses the probability that the overall result of the test was achieved only by random guessing [for the probabilistic terminology, see (Spiegel, Schiller, Srinivasan, 2000)].

The logic of the calculation stems from the following claim:

> *if c is the number of alternatives and t is the (fixed) number of attempts allowed per question, with 0< t <c, then, for each stem, (i) the probability of failure in all the t attempts allowed is 1-(t/c) and (ii) the probability of guessing the correct answer in at most t attempts, is t/c.*

[Proof: The probability that the student fails in all the *t* attempts (i) is

$$\left(1-\frac{1}{c}\right)\left(1-\frac{1}{c-1}\right)\left(1-\frac{1}{c-2}\right)....\left(1-\frac{1}{c-t+2}\right)\left(1-\frac{1}{c-t+1}\right)=$$
$$=\left(\frac{c-1}{c}\right)\left(\frac{c-2}{c-1}\right)\left(\frac{c-3}{c-2}\right)....\left(\frac{c-t+1}{c-t+2}\right)\left(\frac{c-t}{c-t+1}\right)=\frac{c-t}{c}=1-\frac{t}{c}$$

and then the probability of a correct guessing in at most t attempts (ii) is $1-\left(1-\frac{t}{c}\right)=\frac{t}{c}$. In fact, the probability of guessing the correct answer, exactly at the t-th attempt, after t-1 previous failures (conditional probability) is $\frac{1}{c-(t-1)}=\frac{1}{c-t+1}$, because we suppose that the student eliminates the t-1 wrong alternatives he has previously chosen. Hence the probability of failing even the t-th attempt, after t-1 failures, is $1-\frac{1}{c-t+1}$ for t = 1, 2,…, c-1.]

In this claim, we suppose that, at every new attempt, all alternatives are equally likely and that the student excludes all wrong alternatives (if any) that have previously been chosen. If that latter assumption is incorrect – if a student does not exclude options that have been chosen before and confirmed be wrong – his/her probability of random success will be lower, so our calculation of an upper bound on the probability of making correct choices will remain unaffected.

Hence, if *c* is the number of alternatives, then the probability of guessing exactly *h* correct answers out of *n* questions, allowing at most t attempts per question, with $0< t <c$, is

$$p = \frac{n!}{h!(n-h)!}\left(\frac{t}{c}\right)^h\left(1-\frac{t}{c}\right)^{n-h}$$

which is the result of the binomial probability density function, BINOMDIST (non cumulative) in Excel. But the exact probability value is not useful as soon as the number of questions is high: for instance in a two choices test the exact probability of guessing 150 questions out of 300 is 0.0460, which is less than $\alpha = 0.05$ (the usual limit of the statistical significance of a test), while 150 = 300/2 is the expected value of the random guessing. If we use the multinomial probability density formula[1] in a four choices test with 12 questions, the probability of getting exactly 3 correct answers at the first attempt, 3 at the second and 3 at the third, is 0.0220, while these results are exactly the expected values with the random guessing. Another problem with the above formula is that a four choices test with 10 questions, 7 answered correctly at the first attempt and one answered correctly at the third, seems to have the same probability as a similar test in which 8 questions were correctly answered at the third attempt (0.2816), while the probability of getting 7 out of 10 questions at the first attempt is 0.0031. For these reasons, we consider as null hypothesis the claim 'all the hits were achieved by random guessing' and we compute the probability p of erroneously rejecting the null hypothesis (*p-value*). This *p*-value is computed as the smallest of the 2*t* values p_k *and* p'_k, with $k = 1, 2, \ldots, t$, calculated as below:

$$p_k = \sum_{i=0}^{h_k} \frac{n!}{i!(n-i)!}\left(\frac{k}{c}\right)^i \left(1-\frac{k}{c}\right)^{n-i}$$

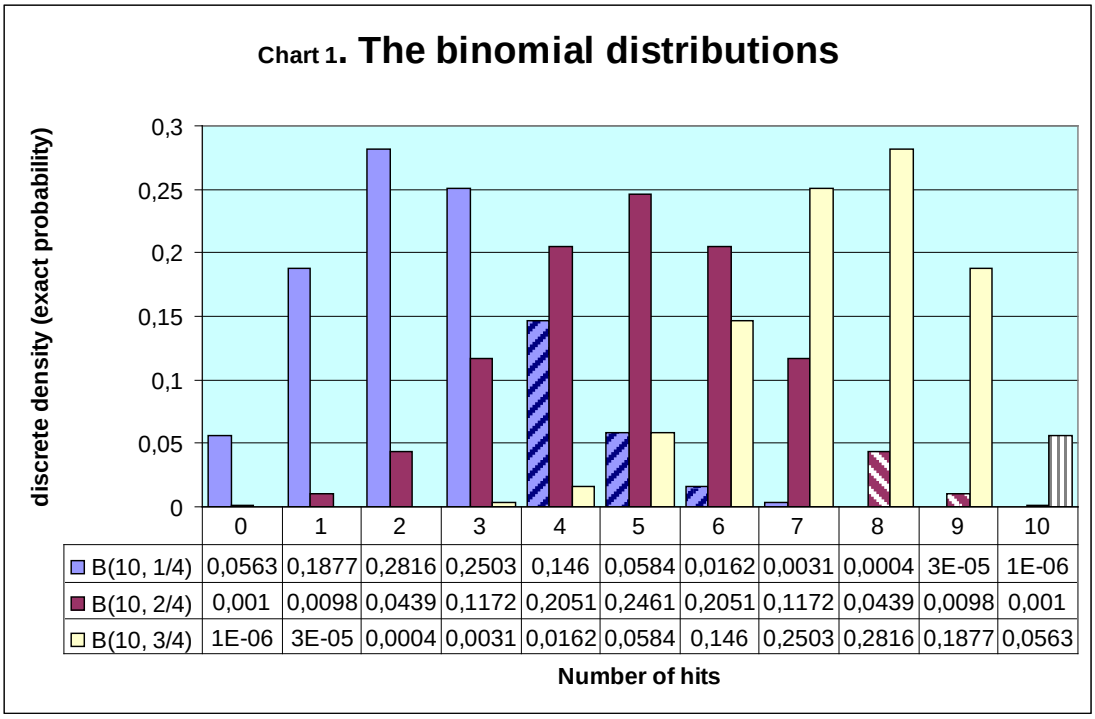
and

$$p'_k = 1 - \sum_{i=0}^{h_k-1} \frac{n!}{i!(n-i)!}\left(\frac{k}{c}\right)^i \left(1-\frac{k}{c}\right)^{n-i}$$

with $k = 1, 2, \ldots, t$, where h_k is the number of hits obtained in at most k attempts and if h_k=0, we suppose p'_k,=1. For each allowed attempt k, these probabilities are, respectively, the probability of having at most h_k hits in at most k attempts and the probability of having at least h_k hits in at most k attempts. The reason for considering both p_k and p'_k, (rather than just the latter) is that these students have been known to express their opposition to a test (or to a teacher) by making deliberate mistakes; that situation can be inferred if we observe performance scores that are significantly below what might be expected from random guessing. Hence, as it is a two tailed test, the significance limit will be $\alpha/2 = 0.025$, if $\alpha = 0.05$ is chosen, as in the applet, and if the number n of questions is greater than 1. If $n = 1$ the significance limit will be α.

In the applet, we suppose $t \leq 3$, because making a request for further corrections could frustrate students with difficulties in focusing. In the computation of the probability, we consider as completely failed the questions, which are unanswered either at the second or at the third attempt after one or two failures. To assess the statistical significance, in the applet, we consider the three binomial distributions *B(n,1/c)*, *B(n,2/c)* and *B(n,3/c)*, respectively of the number of hits given in the first attempt, the number of its hits given in the first two attempts and the number of its given in the first three attempts, and we look for a given result that is too far from the mean to be considered a chance result (Chart 1)

Alongside the number of attempts allowed, the number of questions and the number of choices per question also influence the significance of the test. For instance, the number of questions has to be at least three in a 4-choice test to achieve a significant result when all answers are hits at the first attempt, while in a 2-choice test, the number of questions required is at least six.



	0	1	2	3	4	5	6	7	8	9	10
B(10, 1/4)	0,0563	0,1877	0,2816	0,2503	0,146	0,0584	0,0162	0,0031	0,0004	3E-05	1E-06
B(10, 2/4)	0,001	0,0098	0,0439	0,1172	0,2051	0,2461	0,2051	0,1172	0,0439	0,0098	0,001
B(10, 3/4)	1E-06	3E-05	0,0004	0,0031	0,0162	0,0584	0,146	0,2503	0,2816	0,1877	0,0563

Chart 1. *Suppose that a MC test with 4 choices, up to 3 answering attempts allowed per question, and 10 questions, yielded 4 correct answers at the first attempt, 4 at the second and 2 at the third. The binomial distribution of hits obtained at the first attempt is B(10, ¼), the binomial distribution of hits obtained in at most two attempts is B(10, ½) and the binomial distribution of hits obtained in at most three attempts is B(10, ¾). In B(10, ¼), the probability p'_1 of having at least 4 hits at the first attempt is p'_1 = 0.146+0.0584+0.0162+0.0031+0.0004+0.00003+0.000001=0.22412, which the sum of the values of the striped columns in that distribution. In B(10, ½), the probability p'_2 of having at least 8 hits in at most two attempts, is p'_2 = 0.0439 + 0.0098 + 0,001 = 0.0547 (sum of the striped columns in that distribution). In B(10, ¾), the probability p'_3 of having 10 hits in at most three attempts, is p'_3 = 0.0563 (striped column). As in each distribution, the probabilities p_1, p_2, p_3 of having respectively at most 4, 8 and 10 hits are much greater than p'_1, p'_2, p'_3 , the p value is p'_2 = 0.0547, which is not less than 0.025. Hence the test result is not statistically significant.*

How are the Grades Computed?

In the final score, measured in percentage points, errors are computed negatively, and that negative score is added to a positive score if there is a later correction. A test can be split and answered at different times, for instance on different days, if the student is tired.

Let c be the fixed number of answering alternatives per question (with $c>1$) and t be the maximum number of answering attempts, allowed per question, with $1 \leq t \leq 3$. Choosing at random at the first attempt, the probability of a hit, in each question, is $1/c$, and of an error is $1-(1/c)$ (Spiegel et al., 2000). Hence we decide, following (Culwick, 2002), that, at the first attempt, $-1/c$ is the score for each error, and $1-(1/c)$ is the score for each hit (this removes the advantage $1/c$ given by guessing), while zero is the score for unanswered questions. At the second attempt, with

c>2, the score for each error is –(1/c) –(1/(c-1)), the score for each hit it is 1-(1/c)-(1/(c-1)) and the score for each unanswered question is (-1/c), adding a penalty (-1/c), which refers to the error that was previously made, and changing the guessing penalty to (-1/(c-1)), since there are now just c-1 alternatives. At the third attempt, with c>3, the scores are -1/c-(1/(c-1))-(1/(c-2)) for each error, 1-(1/c)-(1/(c-1))-(1/(c-2)) for each hit, and -1/c-(1/(c-1)) for each unanswered question, because there are now two previous errors and the number of the alternatives is reduced to c-2. Finally, following (Culwick, 2002), we divide the average score of the questions by 1-(1/c), which is the highest score, and multiply it by 100, defining 100 as the maximum score that can be achieved for each hit at the first attempt. The formula 100s/(1-(1/c)) converts each question score s, computed as above, into a percentage grade (Table2). Hence, the grade for each error at the first attempt is calculated as –100(1/c)/(1-(1/c)), which is equal to 100(1/(c-1) that is the formula employed by the S2 method cited previously, when the maximum score is 100 instead of 1.

The rationale of this scoring procedure is that, in the same test, hits obtained in choosing among a certain number of alternatives are given more weight than hits obtained from choices among fewer alternatives, but conversely errors obtained in choosing among fewer alternatives are given more negative weight than errors obtained in choosing among more alternatives; in fact, guessing probabilities depend on the number of alternatives available.

Finally, the result of a test is considered credible if it yields significant divergence from a "guessing distribution", i.e. $p < 0.025$ if n>1 and $p<0.05$ if n=1, and if the student achieves a global score of at least 60%. Other criteria can also be used to define a "passing" score.

Number of alternatives	**Table 2. SCORES FOR EACH ANSWER IN PERCENTAGE POINTS**						
	Scores for each **hit** at the **1**rs attempt	Scores for each **hit** at the **2**nd attempt	Scores for each **hit** at the **3**rd attempt	Scores for each **fail** at the **1**st attempt	Scores for each **fail** at the **2**nd attempt	Scores for each **fail** at the **3**rd attempt	Scores for **not replied** questions
2	100	-	-	-100	-	-	0
3	100	25	-	-50	-125	-	0
4	100	55,56	-11,11	-33,33	-77,78	-144,44	0
5	100	68,75	27,08	-25,00	-56,25	-97,92	0
6	100	76,00	46,00	-20,00	-44,00	-74,00	0
10	100	87,65	73,77	-11,11	-23,46	-37,35	0
26	100	95,84	91,51	-4,00	-8,16	-12,49	0

Table. 2. *The grade of the whole work is obtained by dividing the sum of the scores for each question by the number of questions (mean score). The 10 alternatives might be the Arabic digits in a math task and the 26 alternatives might be the alphabet letters in a spelling task.*

The applet can also be used to evaluate writing tasks (figure 4 and 5), if they are done by choosing the letters or digits in a fixed pool. To simplify the choosing task, we suggest an arrangement in which the positions of the letter and digit stamps are fixed, as in figure 3. In general, the display of the alternatives in all tasks that require a selection among a fixed set (such as true-false tasks, colors tasks and so on) should be kept constant to avoid adding unneeded complexity to the task. The writing task can be organized incrementally, beginning with only a few letters or digits on a keyboard and adding others in further sessions. Instead of stamps, letter cards can be used, or a computer keyboard, hiding the keys that currently play no part.

Figure 3. *The "keyboard", with rubber (worn-out) stamps displaying letters of the alphabet and Arabic digits, has a wooden grid that can be taken off to allow for changing and cleaning of the background; this background is printed with letters and numbers and is covered with a transparent slide. Letters and numbers are displayed as for the English computer keyboard (QWERTY), to aid the student in selecting. In math tasks, the letters can be removed and the digits can be removed in spelling tasks.*

As we can see in Figures 4 and 5, the selection of the letters was corrected by crossing out the wrong letter and writing a small "1" or "2" or "3" close by (or by using three different color ink pens), to indicate if it was the first, the second or the third error. After the third error, a third correction is not allowed and the selection is counted as an error at the third attempt. These tasks are often statistically significant, because there are many alternatives (26 and 10) for each selection, and they can also help us to understand what these students really know, going beyond any initial prejudices.

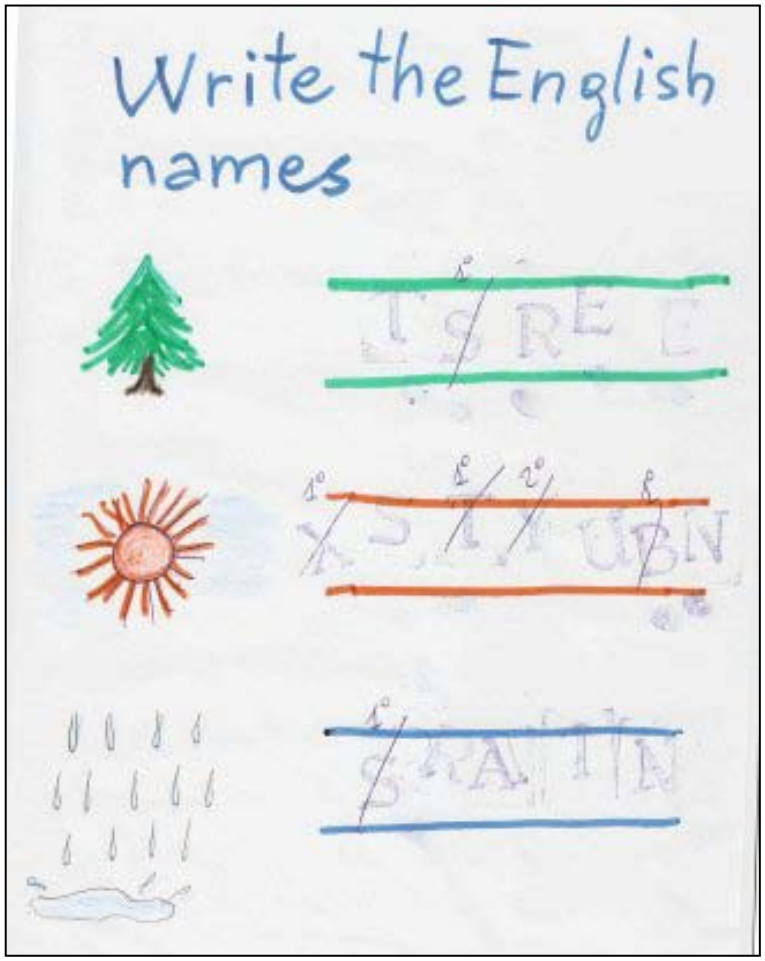


Figure 4. *This is an example of a spelling task, where up to two corrections are allowed per letter selection. When the selection was wrong, the student was informed and the wrong letter was crossed out, indicating if it was the first, the second, or the third error for that selection (three different colored pencils could be used to distinguish the order of the errors). The corrected new letter was printed on the left. In this exercise, the words TREE, SUN and RAIN should be written. The student, a 17-year old boy with Down syndrome and autism, educated in Italian mainstream schools, was not helped in the selection, but was helped in stamping – in deference to his severe dyspraxia. Out of 11 letters, he selected 6 of them correctly at the first attempt (T, E, E, A, I, N), 4 at the second attempt (R, S, N, R) and 1 at the third attempt (U). Hence, using the applet, we find that the test was significant ($p<0.0001$) and the grade was 97.7%. This grade is high, because the penalty for the errors is low, i.e.$(1/26)=0.038$. Observe that the mistaken letter stamps were close to the correct ones on the keyboard, and the selection of "U" was achieved in three steps.*

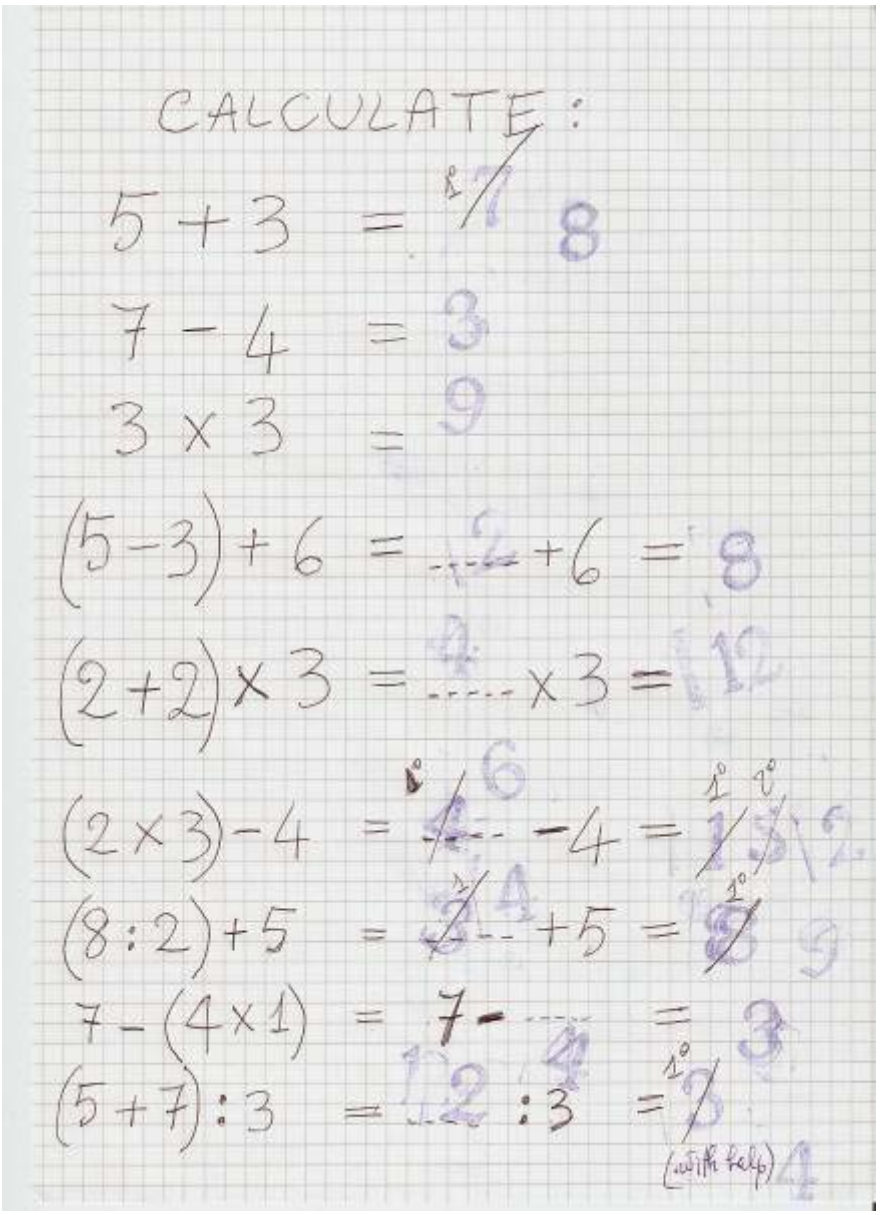


Figure 5. *This math task was carried out by the same student and up to two corrections are allowed per selection, as in the previous example. Out of 17 digits that should be printed, 11 were selected correctly at the first attempt, 4 were selected correctly after one correction, 1 was selected correctly after two corrections, and 1 was wrong (in fact, it was selected with help - so is not counted). In this case the number of alternatives is 10 and the grade was 87.5% - a significant result ($p<0.0001$). This test could also certainly be repeated with other grading criteria.*

For instance, in the example of figure 4, if task were completed without allowing corrections, the result would be "TSEE" for TREE, "*XTB*" for SUN and "SAIN" for RAIN, which is not very promising. In the same condition, the example of figure 5 would be 5+3=*7*, 7−4=3, 3×3=9, (5−3)+6=2+6=8, (2+2)×3=4×3=12, (2×3)−4=*4*−4=*1*, (8:2)+5=*3*+5=8, 7−(4×1)=7−4=3, (5+7):3=12:3=*3*. In the spelling task, no word was correctly written at the first attempt, and the percentage of correct letters was 54.5%. The math task was better and the percentage of correct

digits was 64.7% at the first attempt. With our grading criterion, which penalizes the errors, the grades should be 52.7% and 60.8%, respectively, if no correction was allowed. If we observe the errors, we see that almost all the mistaken letters and digits were close to the correct ones on the keyboard. Allowing corrections helps the student to be more confident in his/her own ability - despite his/her impairments - and to rethink the task, as well as helping the teacher to better understand the cause of the errors. Using the grading criteria described above for multiple-choice tests, we employed the applet to compute the grades in the two tasks, with two corrections allowed, as 97.7% and 87.5% respectively. Our grading choice does not exclude further grading criteria that are more frequently used for these tasks. The high statistical significance, with $p<0.0001$ in both tasks, confirms that the choices were not usually guessed. The capacities and difficulties of a particular student cannot be generalized to other students with the same pathology; each student might have gone through different learning experiences, and in any case, apparently similar disorders can emerge from damages to very different brain areas. Recognizing this, we suggest that task structures should be flexible, and adapted individually to each student.

About Grading and Significance

As we have seen, negative grades are a useful way to counterbalance any benefits that accrue from random guessing (Culwick, 2002); they should, however, not be exposed to students directly, who should simply be told that they have not passed the test.

Even a test that is not statistically significant can yield useful information, because it may be significant from other points of view. For instance, if a student with autism's behavior improves while dealing with a new topic (e.g. displaying a reduced tendency toward head banging), we can conclude that the student might be interested in that topic. If, moreover, he accepts to participate in a test, this is truly a positive signal of pleasure and then it does not matter if his test 'p value' exceeds 0.025, because the statistical significance will improve later, when the topic will be more familiar.

Here we want to emphasize the role of chance in a multiple-choice test, and how arbitrary some judgments (either positive or negative), which are made after only a few observations with few alternatives per question, may be. A 'quick check', with either one or two questions, and with two or three alternatives per question, tell us virtually nothing (either positive or negative) about students' achievements. In fact, even correct responses may tell us nothing reliably positive, because, for instance in the case of a two-alternative test, at least six correct answers must be observed, with no previous error, before we can believe that the student has learned and is really making deliberate choices. On the other hand, consistently incorrect answers may tell us nothing reliably negative, because students with attention deficit and behavioral problems are likely, even in an informal testing situation, to reply initially by choosing at random; for this reason, here we propose to give them the chance to make corrections. The policy suggested is to be more patient and respectful with these students, giving them more opportunities to show their knowledge.

We can observe that even a single positive answer, without previous errors, is statistically significant if the alternatives are 26, as when students select from among the letters of the English alphabet. For example, if the question is "What is the initial letter of the capital of the U.K.?", and the answer is "L", the probability of guessing with 26 letters is 0.038, which is lower than 0.05 and therefore significant, according to our criteria. On the other hand, in the same kind of task

with 26 alternatives, the student can fail the first 4 letters at the first attempt, but the test is still statistically significant if there are two further correct letters at the first attempt (p=0.020). For instance, if the task is "Write on the computer the names of the animals in the pictures" and the student, instead of writing CAT and DOG, writes *PEN* and *R*OG, without corrections, then the test is statistically significant (p=0.020), even if the grade is too low to pass (30.7%). This does not mean that the student did not guess, because much more improbable events may happen, such as winning the lottery or having Down syndrome and autism (less than 1 out of 6000, i.e. p=0.000167). Since we cannot know for certain if the student is simply guessing, judgments of this sort are best made by following a fixed criterion.

The Use of the Applet with a Nonverbal Student with Autism and Down Syndrome

The applet was used to evaluate some of the knowledge of a 16-year-old nonverbal student with severe autism spectrum disorder and Down syndrome, attending a secondary school in Italy. He seemed to understand and to remember some topics in science, history, history of arts, Italian literature and English. In particular, he liked to read (with the help of his support teacher) the same novels that his classmates were set, and seemed to understand them well, as tested through his responses to multiple-choice tests allowing up to two corrections per question. These tests usually employed four alternatives per question (Figures 1 and 2). Applying the method reported here, the teachers were able to grade his progress in most of the courses that he attended.

Conclusion

The Excel applet and the method of allowing some possibilities of correction in multiple-choice tests, which are proposed here, need to be verified in further practical trials before we can be sure of their real utility. Regardless of the results of that work, the applet might play a more general role in helping testers to assess the role of guessing in students' scores for multiple-choice tests (with or without corrections) and true/false tests. The applet also computes percentage grades, employing a formula that penalizes errors (if c is the number of alternatives, the penalty is $-100/(c-1)$, for questions replied at the first attempt) and balances the value of any subsequent hits and errors against the number of residual alternatives. An extension of the use of the applet is proposed both for spelling and mathematics tests (with or without corrections) that are carried out printing the words and the numbers with stamps displayed on a keyboard or with the computer or composing them with letter/digit cards selected from a fixed set. Employing this method, we were able to test a 16-year-old nonverbal student, with autism spectrum disorder and Down syndrome, effectively, identifying his strengths and weaknesses, as well as some of his preferences, and discovering that he was both able and eager to share the learning culture of his peers in a mainstream secondary school, in spite of his limits.

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Appendix

The applet in table1 was programmed in Excel with the following formulas:

E7 =1/A7

F7 =BINOMDIST(D7;C7-A29;E7;TRUE)

A14 =IF(D7>0;1-BINOMDIST(D7-1;C7-A29;E7;TRUE);1)

B14 =C7-A29-D7

D14 =IF(B7>1;2/A7;E7)

E14 =IF(D7+C14>0;1-BINOMDIST(C14+D7-1;C7-A29;D14;TRUE);1)

F14 =BINOMDIST(D7+C14;C7-A29;D14;TRUE)

A21 =IF(B7>1;B14-C14-B29;0)

C21 =IF(B7>2;3/A7;D14)

D21 =IF(D7+C14+B21>0;1-BINOMDIST(D7+C14+B21-1;C7-A29;C21;TRUE);1)

E21 =BINOMDIST(D7+C14+B21;C7-A29;C21;TRUE)

F21 =IF(AND(B7>0;B7<=(A7-1);B7<4;D7<=(C7-A29);C14<=B14-B29;B21<=A21-C29);MIN(F7;F14;E21;A14;E14;D21);"ERROR")

D29 =IF(B7=3;A21-C29-B21;0)

E29 =IF(C7>1;IF(F21<0,025;TRUE;FALSE);IF(F21<0,05;TRUE;FALSE))

F29=IF(OR(AND(B7=1;A7>1;C14=0;B21=0;B29=0;C29=0;C7>=(D7+A29));AND(B7=2;A7>2;B21=0;C29=0;C7>=(D7+C14+A29+B29));AND(B7=3;A7>3;C7>=(D7+C14+B21+A29+B29+C29)));(((1-(1/A7))*D7)+((1-(1/A7)-(1/(A7-1)))*C14)+(IF(A7>2;1-(1/A7)-(1/(A7-1))-(1/(A7-2));0)*B21)+IF(B7=1;(-(1/A7))*B14;IF(B7=2;(-(1/A7)-(1/(A7-1)))*A21;IF(A7>2;(-1/A7-(1/(A7-1))-(1/(A7-2)))*D29;0)))+(A29*0)+(B29*(-1/A7))+(C29*(-(1/A7)-(1/(A7-1)))))*100/((C7)*(1-(1/A7)));"ERROR")

The Use of Assistive Technology for People with Special Needs in the UAE

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Abstract

Today, technology has become an essential part of the everyday educational setting. Its use has proven to facilitate learning and communication of many students with and without disabilities. Assuredly, assistive technology (AT) has transformed education and empowered students with disabilities. However, research studies investigating AT for students with special needs in the United Arab Emirates (UAE) are limited, if any. Quantitative and qualitative data collection methodology were used to explore the AT tools, services, barriers, and professional development available in the UAE special needs centers. Results showed that different AT devices existed according to the types of disabilities. In addition, results revealed different types of barriers hindering the use of AT. Results may shed light on the use of AT in the UAE, teachers' perceptions towards this use and barriers impeding such use. Recommendations and suggestions to improve the use of AT wherever and whenever needed in the UAE are discussed.

The Use of Assistive Technology for People with Special Needs in the UAE

Today, technology has become an integral part of our lives. Advances in technologies have revolutionized our conception of teaching and learning. Indeed, technology has enabled huge access to education and increased the learning opportunities for all learners. A more diverse group of learners can now access a wealth of educational materials and other resources with the help of technology. Undoubtedly, available adequate technology has maximized the learning and employment opportunities for people with disabilities. AT enables students with special needs to become more efficient and independent in completing their tasks and their overall performance. Nowadays, many students with disabilities use a variety of assistive technologies to help them become more functional.

The term assistive technology was first introduced in the Technology-Related Assistance for Individuals with Disabilities Act of I988 (P.L. 100-407, better known as "Tech Act,". The term is broken into two branches: assistive technology services and assistive technology devices. The term "AT device" is historically defined as equipment that is used to enhance or maintain the functional capability of an individual with a disability (Edyburn, 2003). An assistive technology service is any service that assists a child with disabilities and their family members in the

selection and use of the assistive device. Subsequently, the appropriate selection and use of AT enables individuals to complete tasks and perform more efficiently and independently than otherwise possible (Edyburn, 2000).

The AT services also includes providing technical training services for professionals who work with persons with disabilities. As for the term assistive technology devices, the Individuals with Disabilities Education Improvement Act of 2004 (IDEA, 2004) defines AT devices as "any item, piece of equipment or product system whether acquired commercially or off the shelf, modified, or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities" [20 U.S. Congress (1988) 1401$602 (1) (A)]. AT varies from low-to high-technology devices. Examples of AT tools include, but are not limited to, audiotapes, compact discs, videos, electronic-based reference books, amplification devices, Braille note-taking devices, and electronic alternative and augmentative communication (AAC) systems such as speech synthesizers and augmentative communication boards (Bryant & Bryant, 2003; Friend & Bursuck, 2002). AT can address many types of disabilities. Students with autism, hearing impairment, and visual impairment are a few examples of those special needs people who can benefit from the huge opportunities the AT may provide.

In spite of the dramatic advances in AT, one of the most prominent difficulties that special needs people still face is the availability of the AT tools. Unfortunately, many people with disabilities are still deprived of access to the suitable type of technology that will help them to be more empowered themselves. Without access to high-tech tools, like computers and other AT devices, students with disabilities will be unable to pursue postsecondary education and career options like their peers without disabilities, they must have access to the high-tech tools. These tools include computers, websites, telecommunications products, instructional software, and scientific equipment (Burgstahler, 2003). In order for students to have full access, all physical barriers to tools as well as facilities to be removed and appropriate AT be made readily available (National Center for Education Statistics, 2000; Schmetzke, 2001).

Although the benefits of technology may be even greater for people with disabilities than for people without disabilities (Goldberg & O'Neill, 2000; Hasselbring & Glaser, 2000), individuals with disabilities are less than half as likely as their non-disabled counterparts to own computers, and they are about one-quarter as likely to use the Internet (Kaye, 2000). In addition, the design of many Web pages, instructional software programs, productivity tools, telecommunications products, and other electronic and information technologies do not take into consideration the limitations of some individuals with disabilities (Burgstahler, 2002; Opitz, Savenye, & Rowland, 2003; Schmetzke, 2001). For example, Web pages that do not include text alternatives that can be read by speech and Braille output systems limit information access by a student who is blind or has a reading disability; a videotape that does not have captions does not allow access for deaf viewers; software with a high reading level may not be accessible to people with learning disabilities or developmental disabilities; and devices which are not modified to meet the needs of a physically impaired individual are inaccessible.

Having stated the above, one must note that access to AT is not enough. Special education teachers of today face serious challenges regarding their knowledge and skills of AT. Special education teachers and administrators need to be educated on the availability of the latest advances in technological tools and their use (Edyburn, 2005). Similarly, special needs students

and their care-givers need to be assisted in the selection of a variety of AT that best meets their needs, trained in how to use the adequate AT, and supported to maximize the benefit.

Unfortunately, many special educators and administrators are not aware of the varied types of technology and how it can benefit their students, nor are they prepared to implement AT devices effectively (Edyburn, 2006; Parette, Peterson-Karlan, Wojcik, Watts & Stoner, 2007). What is the use of having access to a tool if it is not used effectively? The IDEA law of 2004 mandates training special needs students, their families and their teachers on how to use such technological tools (IDEA, 2004). In order for desired outcomes to be achieved, technological tools must be adequately matched to students' needs. Otherwise, students will not be able to benefit from such access (MacArthur, Ferretti, Okolo & Cavalier, 2001; Wong, 2001).

Unfortunately, many AT workshops rely heavily on the expert rather than training the special education teachers to have long-term knowledge and efficient skills in choosing and implementing the AT services. Most of the time, such expert-based workshops spread awareness among participants at a surface level rather than building or upgrading the participants' knowledge and advanced skills (Parette, Peterson-Karlan, Smith, Gray & Silver-Pacuilla, 2006). Teachers attending AT workshops must be provided with ample opportunities to try a device and receive feedback instantly. Indeed, Edyburn (2005) stated that "learning by doing is essential to the task of building knowledge" (p. 69). Lack of developing a broad-based team of AT skilled teachers will lead to continuing reliance on experts for consultation.

Research related to teachers' training and their use of technology indicates that several barriers have hindered technology integration into teacher education. Those barriers include lack of teacher training, administration support, time for teachers to familiarize themselves with the use of the equipment and software, , technical support, funds and budget constraints, and appropriate materials, Still other barriers are limited time for teacher planning, limited availability of equipment and computer placement in remote locations, no clear expectation that faculty will incorporate technology in academic activities, doubt about the validity of using some of the newer technologies, and resistance to change by many educators (Shelly, Cashman, Gunter, & Gunter, 2002). Finally, Kian and Chee (2002) reported that teachers who owned computers and had more computing experience were found to have lower anxiety and more positive attitudes than teachers who had less computer experience.

Statement of the Problem

In spite of the rapid evolution and continued advancement of technology nowadays, many people with disabilities are still deprived of access to technology including necessary assistive technology devices. In addition, many special education teachers and administrators lack the training and knowledge needed to help them choose the adequate tools that match their special needs students' needs in order to maximize their students' long term success. This is particularly the case in the United Arab Emirates where AT is still in its emerging stage. According to the literature reviewed by the researchers, it seems there is a scarcity in studies conducted on the utility of AT in the UAE. Therefore, a study of this nature becomes crucial to the context of UAE and the population of special needs students.

This study aimed at investigating the reality of AT use in the special needs centers in the United Arab Emirates. Although the area of AT integration is still in its infancy, the researchers feel it is an area of utmost importance to the Emirati individuals with special needs in particular, and to the UAE community in general. Therefore, it is worth researching the status of AT because results might shed light on the current practices of AT and its impact on the lives of special needs students.

Research Methodology

Participants

The participants in the present study were special education teachers from special needs centers in the United Arab Emirates. These participants were randomly selected from special needs centers around the country representing five out of the seven UAE Emirates (Ajman, Ras-Al khaimah, Sharjah, Dubai & Fujairah) . Fifty six special education teachers participated in the study. In addition, 8 female special education teachers and 2 male speech therapists were randomly selected for the focus group interviews. Six of the eight special education teachers work in special needs centers and were specialized in teaching students with hearing impairment and students with mental retardation. The other two special education teachers teach students with learning disabilities in special classrooms in the public schools.

Research Questions:

The research questions we explored in this study were:

1. What do teachers consider to be the most used assistive technologies by students with physical disabilities??
2. What do teachers consider to be the most used assistive technologies by students with learning disabilities?
3. What are the barriers that impede effective use of assistive technology as reported by special education teachers?
4. What are special education teachers' perceptions of assistive technology?
5. What are special education teachers' perceptions of the use of assistive technology by special needs students?
6. What are special education teachers' perceptions of parents' attitude towards assistive technology?

Data Collection

To answer the study questions, data were collected from two different sources: Focus group interviews (qualitative) and a questionnaire (quantitative).

1. Focus group interviews with special education teachers and specialists from special needs centers in different Emirates were conducted. The aim of these interviews was to collect detailed data on assistive technology tools and services, and problems hindering their use and implementation.
2. A questionnaire was administered focusing on various types of AT and their impact on special needs students' academic progress, functional skills and communication skills. The

themes of the questionnaire included AT barriers, special education teachers' perceptions of AT and their perspectives on parent attitudes towards the use of AT.

Data Analysis

The current study utilized a mixed research method where quantitative and qualitative data were collected. Descriptive statistics were used for quantitative data analysis (questionnaire) and qualitative data (focus group), utilized a grounded theory method. Grounded theory is one that "is inductively derived from the phenomenon it represents" (Strauss and Corbin, 1990, p23).

Results and Discussion

The first research question was "what do teachers consider to be the most used assistive technologies by students with physical disabilities?" Results showed that there were different types of assistive technologies (AT) being used (see Tables 1, 2, and 3). These technologies can be categorized based on the following types of disabilities: Hearing impairment, visual impairment, physical impairment and learning disability. When we investigated the AT used for helping individuals with hearing impairment, participants reported high percentages for hearing aids, FM systems, and improved classroom sound systems. The percentages of usage were 71.1, 67.5, and 40.5 respectively.

Similarly, when we investigated the percentages for AT for visual disabilities (Table 2), we found that participants reported a number of technologies used for visual disabilities. The most used of the AT devices were auditory materials (58.3%), large print materials (47.2%), Braille typewriter (37.1%), optical aids / magnifiers (28.9%), and Screen magnification software (27.8%).

Results from the focus group interviews indicated that hearing aids, FM systems and sound system improvement are the most commonly used AT devices. This is in accordance with results obtained from the questionnaire. This may be explained by the fact that the category of hearing impairment in the UAE has received more attention compared to other types of disabilities. Over the past decade, more audiologists and speech therapists were recruited in the UAE. As a result, the hearing impaired population has received some more attention. Subsequently, amplification devices have become more available than others for individuals with hearing impairment, particularly the FM system (Easterbrooks, 1999).

Table 1
The use of assistive technologies for individuals with hearing impairment

Variable	%	
	YES	NO
Hearing Aids	71.1	28.9
FM system	67.5	32.5
Classroom environment sound system improvement	40.5	59.5
Infrared system	11.1	88.9

Table 2
The use of assistive technologies for individuals with visual disabilities

Variable	%	
	YES	NO
Auditory materials	58.3	41.7
Large print materials	47.2	52.8
Braille typewriter	37.1	62.9
Optical aids / magnifiers	28.9	71.1
Screen magnification software	27.8	72.2
Screen magnifier (mounted over screen)	22.2	77.8
Closed Circuit Television (CCTV)	19.4	80.6
Alternative papers (e.g. raised line, highlighted lines)	18.2	81.8
Braille note-taker	17.6	82.4
Screen reader, text reader	16.7	83.3
Screen color contrast	15.8	84.2
Keyboard using accessibility options	15.8	84.2
Braille embosser	15.2	84.8
Braille translation software	11.8	88.2
Touch screen	10.3	89.7
Dictation software (voice input)	8.6	91.4
Screen color contrast	8.3	91.7
Large letter keyboard	6.1	93.9
Braille/tactile keyboard	6.1	93.9
Scanner w/OCR and text to speech software	5.9	94.1
Slate and Stylus	5.9	94.1
Whiteboard / Writing devices for hard of vision students	5.9	94.1
Special lighting	3.0	97.0
Color contrast screens	2.9	97.1

Table 3
The use of assistive technologies for individuals with physical disabilities

Variable	%	
	YES	NO
Adapted chair, sidelyer, stander	66.7	33.3
Non-slip surface on chair to prevent slipping	63.9	36.1
Assistive devices to facilitate mobility inside the classroom	54.5	45.5
Switch with Morse code	28.2	71.8
Pencil/pen with adaptive grip	23.5	76.5
Keyboard using accessibility options	15.8	84.2
Touch screen	10.3	89.7
Arm support	8.1	91.9
Mouth stick/head mouse with on-screen keyboard	5.9	94.1
Book adapted for page turning (e.g. page fluffers, 3-ring binder	5.9	94.1

The second research question was "what do teachers consider to be the most used assistive technologies by students with learning disabilities?" Respondents indicated that ATs most often used to help students with learning abilities were the abacus/math line (67.5%), software for concept development (42.5%), and marker pens (25.0%) (See Table 4).

As for the focus group interviews, results showed that some computer programs (multimedia software) related to the alphabet are the most used AT devices for children with learning disabilities. However, we need to caution that there is a shortage in the quality and quantity of such software. For example, when quality literacy software is available it is usually more commercial and not educational type. In addition, many of these software programs are limited to teaching the alphabet and vocabulary, while the researchers have not come across software programs dealing with phonological awareness.

Table 4
The use of assistive technologies for individuals with learning disabilities

Variable	YES %	NO %
Abacus/Math Line	67.5	32.5
Software for concept development/manipulation of objects	42.5	57.5
Marker pen	25.0	75.0
Calculator with large keys	17.5	82.5
Software to read websites and emails	15.4	84.6
Voice recognition software	15.0	85
Talking calculator	14.3	85.7
Voice output device w/speech synthesis	13.5	86.5
Electronic portable dictionary	11.1	88.9
Communication board/book with pictures/objects/ letters/words	10.0	90
Word prediction, abbreviation/expansion to reduce keystrokes	7.7	92.3
Tactile/voice output measuring devices	7.5	92.5
Portable word processor to keyboard instead of writing	7.5	92.5
Electronic portable thesaurus	5.1	94.9
Software with cueing for math computation (may use adapted input methods)	5.0	95.0
Single word scanners	2.6	97.4

The third research question was "what are the barriers that impede effective use of assistive technology as reported by special education teachers?" Participants reported a number of barriers spreading over four categories: Professional development, equipment availability, administration, and support (see Table 5). This conforms to several findings in the English literature. For example, Edyburn (2004) has clearly emphasized the need to support teachers, parents and administrators when they are making decisions regarding the choice of appropriate tools for struggling students. Similarly, Edyburn (2003; 2005) has repeatedly highlighted the importance of special education teachers and AT specialists to be equipped with up-to-date knowledge and skills when choosing and using AT products. Heyburn stated that in order for special education teachers to be fully competent, they need to move beyond awareness levels of knowledge towards "working knowledge." He listed a number of expectations associated with this "working

knowledge." Some of these expectations are: commitment to learning about AT, instructional applications of AT, decision-making, and advocacy for accessibility.

Results from focus group interviews were in accordance with Edyburn's findings. For example, all participants stated that lack of initial training and sustained professional developments were amongst the most common barriers in addition to the high cost of AT in general.

According to Michaels, Prezanti, Morabito & Jackson (2002) the cost of technology was perceived by the disabled student service providers as the greatest barrier. In addition, Parette et al. (2007) have clearly made the distinction between providing professional development to teachers at a surface level, and sustaining professional development of teachers by exposing them to ample opportunities as well as providing them with feedback.

Table 5
Barriers impeding the use of assistive technology as reported by special education teachers

Variable	M	SD
Professional Development		
There is no in service training on the use of AT.	3.7	1.3
I did not receive enough training to use AT	3.1	1.4
Equipment Availability		
AT is expensive and difficult to obtain	4.1	0.9
AT is not available in the school / center	3.5	1.3
Mobility issues: Difficult to move around equipment and tools	3.3	1.3
Administration		
The current curricula do not include outcomes for AT	3.5	1.2
Administration regulations do not mandate the use of AT	3.1	1.3
Administrators do not support the use of AT	3.0	1.3
Support		
Lack of technical assistance	4.2	1.0
School environment is not technically prepared for the use of AT	4.0	1.0
AT available now is often damaged and needs maintenance	3.7	1.2

The fourth research question was, "what are special education teachers' perceptions of assistive technology?" Our results showed that special education teachers had positive attitudes regarding the AT used to help students with special needs. Results revealed high mean scores of items that support the use of AT with students to improve their learning. Teachers in this study support the use of AT in the classroom, and recognize the importance and utility of using AT to help them teach as well as its motivational impact on student achievement (See Table 6). The mean scores for these items on the survey were 4.6 and above on a 5-point scale extending from extremely low (1) to extremely high (5). In a study by Kian and Chee (2002), positive attitudes were found with professionals who own and use computers. There is no doubt that positive attitudes when coupled with adequate professional training and support will lead to better results in the utilization of AT.

Results from the survey of teachers' perceptions and AT use are in alignment with results collected from the focus group interviews where participants collectively supported the use of AT. All interviewed participants stated that the use of AT, when it is available, facilitates their work and enhances learning for the special needs students.

Table 6
Special education teachers' perceptions of assistive technologies

Variable	M	SD
I support the use of AT in the classroom	4.7	0.7
AT is important and useful for students with special needs	4.7	0.7
AT assists me when teaching students with special needs.	4.7	0.7
At has a positive impact on students motivation and achievement	4.6	0.7
Knowledge about AT will improve my practice	4.6	0.7
AT assists the students with special needs to overcome their disability or weakness.	4.0	1.1
AT is safe to use	3.9	1.0
AT is easy to use.	3.7	1.0
AT requires a lot of time	3.0	1.3
The use of AT is demanding	2.9	1.3
Available AT is appropriate to the type of the disability students with special needs have.	2.8	1.4
Students with special needs have other priorities that are more important than AT	2.7	1.1
The use of AT is additional work for the teacher and needs additional time which is not available to the teacher.	2.2	1.2
Using AT disturbs other classroom peers	2.1	1.1
Using AT delays the completion of the curriculum on time	1.8	0.9
It is not my duty as a teacher to use AT in teaching students with special needs.	1.7	0.9
AT does not help students in their academic achievement	1.7	1.0
I'm not convinced that assistive technology is important in teaching students with special needs	1.5	0.8

The fifth research question was, "what are special education teachers' perceptions of special needs students' use of assistive technology?" Results showed that teachers' perceptions are not positive pertaining to the use of AT by special needs students (see Table 7). This is due to several factors. Mainly, students with special needs are not fully trained to use or maintain their AT devices. This issue is of high importance if an AT device was to be used to maximize its benefit. In fact, in a study by Michaels, Prezant, Morabito and Jackson (2002), the researchers underscored the need for students with special needs to be fully knowledgeable about AT devices and their usage if they want to become lifelong learners who can use and manipulate information now and in the future. Providing access to AT alone is not the resolution. Expertise in its usage must be aligned closely with its importance. This may be of a more pressing issue considering the rapid continuous changes taking place in the field of AT.

In addition, special needs students seem to experience negative emotions when using AT, which can be attributed to the lack of awareness and stigma associated with disability. Indeed, the stigma associated with disabilities can have an adverse effect on the social well being of the person with disability (McLaughlin, Bell & Stringer, 2004; Tibi, 2005).

The speech therapists interviewed in this study clearly stated that the hearing impaired students felt ashamed when having to use hearing aids or other hearing devices. This is because it makes them look different from the others. This may be attributed to the lack of awareness and negative attitudes towards individuals with disabilities in general. Furthermore, 80% of the interviewed participants stated that students do not receive enough training as to the appropriate use and maintenance of AT. These findings conform to results obtained from the questionnaire items (see Table 7).

Table 7
Special education teachers' perceptions of special needs students' use of assistive technology.

Variable	M	SD
Students are not fully trained to use AT	3.4	1.1
Students often misuse AT devices which lead to damaging equipments	3.8	1.0
Students feel shy about using AT because it makes them look different	2.9	1.1
Classroom peers often make fun of students who use AT	2.6	1.0

The sixth research question was, "what are special education teachers' perceptions of parents' attitudes towards assistive technology?" Results showed that teachers have very low perceptions of parents' attitudes towards AT. Mean scores on all items of teachers' perceptions were 2.5 or lower (Table 8). This indicates that parents may lack awareness as to the use of AT, its types, value, and the impact it leaves on enhancing their children's performance when using it appropriately. The implication of this finding is that parents must be educated about the availability of AT products and their benefits. This can be accomplished by inviting parents to an open-day at the center/school where such AT tools can be shown to them. Moreover, parents can be informed as to what types of support services that exist to promote their children's performance across tasks that may be otherwise impossible. Many parents of special needs children are not experts in using assistive technology. According to Edyburn (2003), "Parents are in desperate need of easy-to-use decision-making tools that help them identify categories of products that may be useful for individuals or groups of struggling students"(p. 22).

Of the 10 interviewed professionals (100%) stated that parents of students with special needs lack the basic knowledge and skills of AT and its impact on their children. This qualitative result confirms the above quantitative results obtained by the questionnaire.

Table 8
Special education teachers' perceptions of parents' attitude towards assistive technology.

Variable	M	SD
Parents' expectations about the use of AT are realistic	2.5	1.0
Parents seeking information about AT needed for their sons / daughters.	2.4	1.3
Parents are aware of the importance of using AT	2.3	1.1
Parents request information on the benefit of AT	2.3	1.2
Parents are up to date on the advances in of AT used by their child	2.2	1.1
Parents are fully aware of how, when and where AT can be used	2.2	1.0
Parents propose solutions to the difficulties faced by the teacher or student on the use of AT in the classroom.	2.1	1.0
Parents contribute to pay for their child's AT	2.1	1.0
Parents trained in the use of AT and provide assistance to their children	1.9	.9
Parents can maintain AT and can identify malfunctions	1.9	.9

Conclusion

Findings of the current study shed some light on the status of AT devices in the UAE, and the perceptions of special education teachers and specialists towards these devices and their usage. In addition, some barriers hindering the use of AT were identified. The most prominent barriers revolved around issues of professional development, availability of devices, administration support and technical support. In addition, there were some barriers identified as the causes of the negative perceptions held by special needs teachers towards their special needs students and their parents. These barriers were mainly related to issues of awareness of AT devices and their impact on students' performance. Furthermore, Students' lack of knowledge and expertise in using the devices and maintaining them was perceived by teachers as a hindrance in the effective and efficient use of the AT devices.

Subsequently, adequate selection and use of AT when accompanied with professional training and administrative and technical support allow individuals who use AT to enhance their performance. Ultimately, the aim behind using AT is to overcome performance problems as much as possible. A large body of research has documented success stories for learning, enjoyment, communication, and the enhancement of other life skills when individuals with disabilities use AT efficiently.

Based on the findings from the study and the reviewed literature, the researchers suggest the following recommendations for optimal use of AT devices in the future. The following recommendations are directed towards all concerned members in the community, particularly, stakeholders, special needs advocates, parents of special needs students, professionals and paraprofessionals.

1- Increase public awareness to AT devices and its impact on people's lives.
2- Advocate for the right of individuals with special needs to use AT
3- Draft laws specific to the right of individuals to be provided with AT devices and services.
4- Provide professional training for students using AT devices.
5- Provide professional development and follow-up for service providers in the area of AT.

6- Educate parents as to the importance of AT to their children's performance, and provide opportunities for parents to seek help when facing difficulties or queries regarding AT.
7- Design specifically for the Arabic context (language and culture).

The current study focused on the status of AT devices in the UAE, barriers in using them, and the perceptions of some professionals working with special needs individuals towards AT in general. Future research in this area in the UAE is warranted. For example, more research is needed to investigate:

1- Differences between male and female special needs students' usage of AT
2- The availability and usage of AT devices in the special education classroom in the regular public schools.
3- The status of AT usage through real-time classroom observations.
4- The role of professional Development in teacher's awareness of AT.
5- The special needs students' attitudes towards the use of AT devices.
6- The attitudes of the parents towards AT devices and services available to their children.
7- The area of alternative and augmentative communication (AAC).

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Punishment Strategies: First Choice or Last Resort

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Abstract

Is it appropriate to implement punishment strategies in the home and school settings when children display disrespectful and inappropriate behaviors? This article depicts the advantages and disadvantages of teachers and parents utilizing an array of punishment strategies including: (a) reprimands, (b) response cost, (c) timeout, and (d) corporal punishment. It is critical that educators and parents know the advantages and disadvantages of each of the punishment strategies so that they can make well informed, knowledgeable decisions.

Punishment Strategies: First Choice or Last Resort

Should teachers and parents dare utter the "p" word in regard to behavioral strategies for students who repeatedly display an array of inappropriate behaviors? The "p" word in this article referring to the often criticized and denounced word "punishment." According to Bos and Vaughn (2006), the definition of punishment is when a teacher or parent follows a "behavior with a consequence that decreases the strength of the behavior or reduces the likelihood that the behavior will continue to occur" (41). What do teachers or parents do when students are making minimal behavioral improvements with the utilization of positive behavioral strategies? Is it appropriate to consider implementing punishment type behavioral strategies when severe tantrums or aggressive behaviors occur on a continuous basis? This article examines information that all educators and parents should know so that they can weigh the positive and negative attributes of the following selected behavioral strategies: (a) reprimands, (b) response cost, (c) timeout, and (d) corporal punishment.

Aspects of Punishment

There are many aspects of punishment that teachers and parents should be conscientious of before deciding if they want to implement punishment techniques with their students. According to researchers the following are negative aspects of punishment that should be considered:

(1) Aversive feelings towards school or home can develop in students who receive punishment frequently. These students may demonstrate negative feelings toward the adults administering the punishment and develop resentment. They may also exhibit fear towards school, possible aggression, and increased anxiety (Bos & Vaugh, 2006; Martens & Meller, 1990; Taylor, Smiley, & Richards, 2009).

(2) Punishment strategies may often rapidly decrease undesired behaviors; however, over time punishment is ineffective and does not eliminate the behavior (Bos & Vaugh, 2006; Martens & Meller, 1990; Taylor, Smiley, & Richards, 2009).

(3) Punishment strategies often do not generalize across settings. For example, a student who receives timeout for having a tantrum in reading class may then display tantrum behaviors in math class one hour later. Therefore, the student does not comprehend the concept that tantrum behaviors result in timeout across all settings, not just in reading class (Bos & Vaugh, 2006).

(4) Punishment strategies do not teach students appropriate behaviors. The student only learns which behaviors should be avoided in front of the person delivering the punishment (Bos & Vaugh, 2006).

Guidelines for Punishment

According to Mather and Goldstein (2001), the following are guidelines that teachers and parents should consider when implementing punishment strategies:

(1) Teachers and parents should provide clear guidelines depicting which behaviors are considered inappropriate and the consequences or punishments for each of those behaviors. For example, if a student refuses to complete his or her chores at home or assignments at school, he or she may lose a certain privilege such as playing outside. The student must understand which inappropriate behaviors result in which specific punishments.

(2) Students should be provided with models of appropriate behaviors. They need to see and practice which behaviors they are expected to perform.

(3) In order for punishment strategies to be at all effective they must be fair, consistent, and given immediately after the student performs the inappropriate behavior.

(4) It is vital that students be given natural and logical consequences for inappropriate behaviors. For example, if a student destroys school property, a natural and logical consequence would be that he or she completes jobs at school to pay to replace the damaged property.

Reprimands

Definition. According to Houton (1980), a reprimand is a form of punishment that may be used when a child exhibits inappropriate behavior that causes harm to others, himself, or property. Although reprimands are appropriate to use with some behaviors, Bacon (1990) recommends that they be used infrequently, and with a statement indicating to the child an appropriate behavioral alternative.

Redirection vs. reprimand. The terms reprimand and redirection should not be utilized interchangeable because the words definitely do not communicate the same meaning. When a teacher uses the behavior strategy, redirection, he or she explains to a student that a behavior is inappropriate. The educator teaches the student the appropriate behavior. He or she then allows the student to correct the inappropriate behavior and when the student appropriately performs the behavior, a reward is provided, such as praise. According to Bryant, Smith, and Bryant (2008), "Redirection is an effective way to help a student stop a problem behavior and receive further instruction on appropriate behavior in a relatively short amount of time" (358).

For example, James is a third grader who receives special education services in a behavioral classroom because he has the eligibility of emotional disturbance. His teacher, Mrs. Holder has a classroom expectation that all students must raise their hand and wait to be called on if they would like to answer a question. One day, James shouts out an answer in class without raising his hand or waiting for the teacher to acknowledge him. Mrs. Holder utilizes the strategy of redirection by privately reminding James of the classroom rule. She encourages him to raise his hand if he knows the answer and patiently await her to call on him. The next time James raises his hand and waits to be called upon, Mrs. Holder deliberately chooses him to answer the question. She then praises him for abiding by the expectation.

On the other hand, while redirection is considered a positive behavioral strategy, a reprimand is considered as negative. When a reprimand is utilized, the student is only informed that the behavior is inappropriate. According to Bryant, Smith, and Bryant (2008), reprimands should be avoided and do not "provide the student with the opportunity to practice the correct behavior and receive reinforcement" (358). For example, Timmy pushes a student one day when the class is lining up to go to lunch. His teacher, Mrs. Tooke, utilizing a reprimand as a behavioral strategy, raises her voice and says, "Timmy, how many times do I have to tell you that we do not push other students in my class? Since you cannot line up appropriately without pushing other students, you can just walk with me down the hall."

Suggestions for implementation. Walker, Ramsey, and Gresham (2004) suggest that, in order for reprimands to be effective, the following guidelines should be applied:

(1) The child should be told specifically what behavior he or she performed that was inappropriate.

(2) The child must not be humiliated or shamed.

(3) The reprimand should occur immediately following the inappropriate behavior.

(4) The adult issuing the reprimand should remain calm and not display anger.

(5) The adult should use a firm voice when reprimanding.

(6) If the child's behavior was causing harm to others, the child should be removed from the situation quickly.

(7) A reprimand may be paired with loss of privileges.

(8) The child should not be embarrassed in front of peers and when the reprimand is over, the adult should not keep chastising the child.

Ineffectiveness of reprimands. Over the past forty years many studies have been conducted concerning the ineffectiveness of reprimands. A research study conducted by Thomas, Becker, and Armstrong (1968) suggested that reprimands were ineffective. In this study even though twenty-eight elementary student participants received reprimands and disapproving comments for inappropriate behaviors three times the typical rate, their behaviors did not improve. A study conducted by Madsen et al. (1968), proved similar results when increased reprimands were given to students who did not stay seated during class. The results of this study showed that as the number of reprimands increased so did the frequency of the students getting up from their seats. According to research by Iwata et al. (1994), reprimands given by caregivers (parents / guardians) often had the opposite of their intended effect. Even though the purpose of the caregivers was to curtail inappropriate behaviors, issuing reprimands to their children often increased the undesired behaviors by serving as a positive reinforcement.

Effectiveness of reprimands. Salend, Jantzen, and Giek (1992) conclude that the research pertaining to reprimands varies, and numerous conditions exist to determine if the implementations of reprimands are successful. According to Jones and Miller (1974), reprimands had a higher success rate when the teacher paired the reprimand with a facial expression that displayed disapproval. Research conducted by Houten et al. (1982) concluded that reprimands were more effective when the teachers were in close proximity to the students at the time the reprimands were delivered. The research by Houten et al. (1982) also indicated that inappropriate behaviors of the student participants decreased when the teachers utilized a combination of reprimands, eye contact, and firmly grasping the students' upper arms.

Summary of reprimands. The research surrounding the implementation of reprimands yields mixed results. Certain research studies (Salend, Jantzen, & Giek, 1992; Jones & Miller, 1974; Houten et al., 1982) produced positive results if certain conditions existed. Whereas, other studies (Thomas, Becker, & Armstrong, 1968; Madsen et al., 1968; Iwata et al., 1994) concluded that the use of reprimands were virtually an ineffective behavioral strategy. It is crucial not to confuse the negative behavioral strategy, reprimands, with the positive behavioral strategy, redirection. Whereas the behavioral strategy, redirection, provides the student with guidance on appropriate alternative behaviors and allows the student to demonstrate the replacement behaviors, the strategy, reprimand does not.

Response Cost

Definition. Response cost is a punishment strategy used when a student displays certain targeted inappropriate behaviors. According to Bos and Vaughn (2006), response cost is a "procedure in which a specified amount of a reinforcer is removed after each occurrence of the target behavior" (41). Kazdin (2001) describes response cost as a mild punishment strategy that does not cause the undesirable effects of other more severe punishment strategies such as corporal punishment. Walker et al., (2004) writes that the use of response cost as a punishment strategy is much easier to implement than timeout.

Suggestions for implementation. When implementing the punishment strategy, response cost, Walker, Shea, and Bauer (2004) recommend that the following procedures be used in order to increase the success of the strategy:

(1) The child must fully be aware of the behavior he displayed which caused the punishment to occur.

(2) The correlation between response cost and the inappropriate behavior demonstrated should be understood by the child. For example, if a child throws toys during playtime, he should be unable to play with the toys during the following recreational time.

(3) Threatening the child or using excessive warnings should not be employed by the adult.

(4) Once the rules have been established and response cost has been deemed the appropriate consequence, the punishment should be executed.

(5) When issuing punishment, the adult needs to be calm and unemotional.

(6) Consistency should always be maintained by the individual issuing response cost.

(7) Consequences should be enforced that are both fair and reasonable. If a child throws toys during playtime, stating that the child cannot play with the toys for six months is unreasonable and unfair.

(8) Inappropriate behaviors must not be the only behaviors emphasized. Positive, appropriate behaviors must also be reinforced by adults.

Thibadeau (1998) recommends these additional guidelines when implementing response cost as a punishment strategy:

(1) The parent or teacher must collect data to determine how many times an inappropriate targeted behavior occurs. This data is also referred to as a baseline.

(2) Once response cost is implemented, the parent or guardian should continue to collect data to depict if this targeted behavior has decreased over time.

(3) Evaluation is needed on a regular basis so that alterations can be made if needed.

(4) The student must completely understand the rules of the response cost system and the adult must carry out the system consistently.

Timeout

Definition. Powell and Powell (1982) define timeout as "time away from positive reinforcement" (p. 19). Research by Zabel (1986), Ruhl (1985), and Shapiro and Lentz (1985) indicated that general education teachers, special education teachers, and school psychologists commonly used

timeout as a behavioral management technique. According to Lane, Gresham, and O' Shaughnessy (2002) timeout is utilized in the classroom setting only for students who demonstrate unacceptable behaviors. This strategy is also employed to deter other students from displaying inappropriate behaviors.

Criteria for timeout. According to researchers (Alberto & Troutman, 2005; Cuenin and Harris, 1986; Kerr & Nelson, 2006) in order for timeout to be an effective behavioral management technique, certain criterion must be considered.

(1) There must be a distinct difference between the timeout and time-in environments. The student must desire to be included in the time-in environment.

(2) Targeted behaviors are identified and the use of timeout is initiated consistently when those behaviors occur.

(3) The child must understand why he is being sent to the timeout environment.

(4) The timeout area must contain no stimulus that the child would find appealing or pleasing.

(5) The duration of the timeout must be appropriate for the child's age.

Seclusion timeout. According to Bryant, Smith, and Bryant (2008), seclusion timeout is a behavior strategy used for students who demonstrate out of control behaviors and has "gained popularity because it offers the student a chance to calm down, think about what happened, and rejoin the group in a short time period" (366). Whereas traditional timeout may involve that the student be removed to a certain designated area within the classroom, such as a certain desk, carpeted area, etc.; seclusion timeout involves that the student be removed to a small, separate, isolated room (Alberto & Troutman, 2005).

Smith and Rivera (1995) offer certain guidelines that are important to consider when implementing seclusion timeout.

(1) Before a teacher implements seclusion timeout, he or she should provide the student with ample opportunity to correct inappropriate behaviors.

(2) A student's behavior should be carefully evaluated before a teacher utilizes seclusion timeout. The behaviors that the student is demonstrating must be severe enough to justify this behavioral strategy since a period of instructional time will be temporarily missed for the student.

(3) If the student is struggling academically or socially, he or she may desire to be removed to seclusion timeout as an avoidance technique. It is crucial that the teacher be aware of the student's academic and social circumstances to insure that the student is not attempting to escape a difficult assignment or unpleasant social situation.

(4) The student must be monitored while in seclusion timeout to prevent self-injurious behaviors.

(5) Parents must be notified that seclusion timeout was utilized with their child. This notification includes that the teacher complete certain

documentation describing the specifics of the situation (duration of timeout, incident preceding the teacher's decision to use seclusion timeout, efforts on teacher's behalf to use other behavior strategies first such as positive reinforcements.)

Comparison of timeout and reprimands. Jones, Sloane, and Roberts (1992) conducted a study with three preschool children, comparing the effectiveness of verbal reprimands and timeout; these three children were markedly aggressive and oppositional. The mothers of the three children implemented the two behavioral strategies - verbal reprimands and timeout, in the home after being properly trained. The findings of the study concluded that, when used correctly, timeout was more effective than verbal reprimands.

Advantages to timeout. According to Taylor (1997) there are many advantages to using timeout as a behavioral management technique.

(1) The effects from timeout are typically quick and produced long-lasting effects.

(2) Positive reinforcements are easily integrated with timeout procedures in order to increase desired, appropriate behaviors.

(3) Timeout provides the child with an opportunity to regain control of his behaviors.

(4) The child does not have to be removed from the learning environment in order for timeout to transpire (except in seclusion timeout).

(5) Timeout is not an intrusive behavioral management technique.

Disadvantages of timeout. Walker et al. (2004) caution educators that timeout should only be used as a last resort and after other behavioral strategies have been unsuccessful with the student. According to Zirpoli (2005), timeout has several potential disadvantages.

(1) Teachers or parents may abuse the duration.

(2) Some teachers may place students in timeout in order to take a break themselves.

(3) Some students may find the time-in environment unappealing and desire to use timeout as an escape from academic tasks.

(4) Timeout may be used too frequently and learning time is potentially lost.

(5) Timeout could infuriate the student and cause other inappropriate behaviors to occur.

Evaluation necessary. It is important to evaluate the effectiveness of timeout frequently. According to Costenbader and Reading-Brown (1995), teachers must consider the idea that timeout is not effective if a student is repeatedly given the punishment. However, when timeout is an effective behavioral technique for students, inordinate amounts of learning time is not lost in order to correct for behavior. According to Skiba and Raison (1990), "considerably less instructional time was lost to timeout than to other sources of classroom absence, such as suspension or truancy" (p. 36).

Corporal Punishment

Definition. Corporal punishment, which is still practiced in many American schools today, takes on varying forms. Corporal punishment, by far the most severe of the punishment strategies, is physical pain inflicted upon students who have participated in various rule infractions ranging from fighting a classmate to skipping school. According to the Society for Adolescent Medicine (2003) and the U.S. Department of Education (2001a), the various forms of corporal punishment include the following:

(1) spanking

(2) hitting

(3) paddling

(4) shaking

(5) using electric shock

(6) forcing the student to partake in certain body postures for extended periods of time

(7) preventing the student from using the restroom

The use of corporal punishment can be administered by school personnel and parents / guardians.

Negative effects. Research has demonstrated that many negative side effects can result from school personnel or parents administering corporal punishment to students. According to Hyman (1995), the following are possible negative outcomes to corporal punishment:

(1) Serious injuries can and do result from the use of corporal punishment, such as bruising, blood clots, discoloration of skin, and welts.

(2) Corporal punishment can cause life-long, detrimental psychological outcomes, such as conduct disorder, for the students who have endeared this type of punishment.

(3) Students may become more aggressive and have feelings of incompetence.

(4) Continual use of corporal punishment can affect the ability of students to utilize adequate problem solving skills.

Why is Corporal Punishment Used in Some States?

Twenty-one states in America still use corporal punishment as a means of punishment for students in schools (Kennedy, 1995). Why do some states favor this form of discipline? Corporal punishment in many instances is used as a deterrent to prevent students from committing repeated behavioral wrongdoings. According to the U.S. Department of Education (2001a), the utilization of corporal punishment in schools may reduce serious behavioral offenses. Research by Yancy (2001) supports the concept that when a student receives corporal punishment for a behavioral offense; that student may remember the pain and humiliation of the corporal punishment and be less likely to repeat the same offense in the future.

Summary

Educators and parents must be knowledgeable about varying types of behavioral strategies and decide individually which ones they choose to implement with their students. Of course, there is no real surprise that when educators and parents use physical means (grabbing students by the upper arms as in the Houten et al. study) or humiliation tactics (using reprimands in front of students' peers) to subdue the undesired behaviors of students that some type of results will be evitable. However, are these results that educators are looking for? According to Taylor, Smiley, and Richards (2009), punishment techniques may control the behaviors temporarily; however, the behaviors many times are not eradicated. Conversely, sometimes it is necessary to implement punishment strategies to assist a student in improving his or her behaviors. However, it is essential that educators and parents know the advantages and disadvantages of each of the punishment strategies so that they can make informed, educated decisions.

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Picture Exchange Communication System for Individuals with Autism Spectrum Disorder

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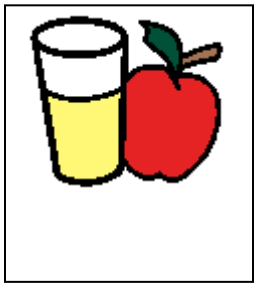
Autism spectrum disorder (ASD) is a neurological disorder that manifests itself within an individual through cognitive, social, and academic deficits. As is true for all spectrum disorders, each individual may experience a range of deficits with varying severity. Many students with autism spectrum disorder experience difficulty in some area of communication. The Picture Exchange Communication System (PECS) was developed in an effort to remedy the communication difficulties between individuals with severe ASD and their peers. The main goal of PECS is to enable students with communication deficits to spontaneously communicate with their peers. The system is composed of six different phases in which a student may progress with increasing independency. While many individuals with ASD are able to communicate effectively with PECS, such a system is not suitable for all individuals on the spectrum; therefore, it is imperative for professionals, parents, and peers to be knowledgeable of the implementation, utilization, and culmination of the Picture Exchange Communication System.

Many students with ASD who experience communication difficulties need an alternative way to interact with those who surround them. "The picture exchange communication system (PECS) was developed by Bondy and Frost to teach children with autism independent, self-initiated functional communication" (Lund & Troha, 2008). PECS is an example of augmentative and alternative communication (AAC). AAC is described by the International Society of Augmentative and Alternative Communication (ISAAC) as any additional method that helps an individual to communicate. Methods such as physical gestures or cues are referred to as unaided systems of AAC, as they enable an individual to communicate without additional equipment, while other methods such a picture book or a special computer are considered aided systems. AAC classifies PECS as an aided system of communication, as it relies on a student's use of an individualized communication book (Zaccak, 2010).

The main goal of PECS is to enable children and adults with communication difficulties to spontaneously initiate communication exchanges through the use of small picture cards. In order to successfully reap the benefits of PECS, an individual should progress through six phases. The six phases of PECS are as follows:

In phase one, students are taught to initiate communication. The second phase expands the use of pictures. In the third phase, students make specific choices between available pictures. During the fourth phase, the student learns to build simple sentences. The fifth phase involves helping the student answer the question, "What do you want?" and in the sixth phase, students learn to comment about items and activities (Kluth, 2003).
While progressing through each of the phases in successive order results in the most desirable outcomes, students with ASD have celebrated successes in communicating with their peers within each of the individual steps. Because PECS is a hierarchical system, students will progress through each phase at their own rate as they master each successive goal.

Each phase of PECS involves preparation and procedure. Before introducing PECS to students with ASD, parents and professionals must first agree that the picture exchange system is the right alternative communication method for the student. Once parents and teachers agree, much preparation must be done before the student is actually subjected to any materials. Preparing to implement PECS necessitates much brainstorming. Initially, family members, professionals, and peers must collaborate to identify objects, activities, foods, or locations that strongly interest the child who will soon be introduced to PECS. Then, the collaborative team must decide on the representational model that the individual will use to communicate. This may consist of actual photographs, clip-art inspired graphics, or pictures from computer programs such as Boardmaker© that will be used for picture cards. After a representational model is chosen, the picture cards may be created. Typically, picture cards are pictures or graphics printed onto a square piece of paper which is then laminated. Every picture has the word of the object that is represented above or below the object. The size of the picture cards may vary depending on the phase of PECS that the individual is currently in or a specialized PECS program. The following is an example of a picture card from the Boardmaker© program that serves as the representational model for apple juice:



Apple juice

Velcro is taped onto the back of each picture card so that it may be secured into a child's communication book. A communication book is a binder or book with Velcro that contains all of the student's vocabulary or picture cards. After these picture cards are created, a professional should choose about 4 cards that will be of great interest to the child to begin the first phase of the PECS training.

Perhaps the most important element in the PECS introductory phase is maintaining the child's interest. To begin, the student should be seated with one adult behind him, the physical prompter who will assist the child, and a second adult directly in front of him, who is the communicative partner. First, the communicative partner should have the desired object in actual form (the physical object) and have the picture card on the table in between her and the student. Once the child reaches for the object, the physical prompter will assist the child in picking up the representational model or the picture card and hand it to the communicative partner. After the communicative partner receives the card, she should say a statement that reiterates the action and give the child the desired object. These steps are exemplified within the following scenario: the communicative partner has a toy in her hand. When the child attempts to grab the desired toy from her hand, the physical prompter takes the child's hand, guides his hand, has him pick up the picture card of "toy" and put it in the communicative partner's hands. When the communicative partner receives the card, she reiterates the action by saying "Oh, you want the toy!" and immediately hands him the toy. It is important to allow the child to enjoy his reward for some

time before immediately repeating the procedure. After numerous repetitions of the procedure, the physical prompter should diminish the physical assistance he provides to the student. Only when the student has mastered the ability to exchange the picture card with the associated object to his communicative partner should he move onto phase two (BBB Autism Support Network, 2010).

Phase two of PECS synthesizes the ability to exchange a picture for an object with the use of a communication book. As for preparation, a communication book is necessary to successfully train the student in phase two of PECS. The communicative partner should place one picture card in the communication book. When the child with ASD independently lifts the picture card out of his communication book, the communicative partner will provide him with his reward as in the first phase, but the distance between herself and the child will be increased for this exchange. It is important to change the picture cards that are used between these exchanges so the student generalizes the action, not the specific picture card. It is recommended that other individuals besides the educator or speech and language pathologist perform these exchanges and at different locations so the child may understand that such an exchange is made with a variety of communicative partners at various locations. Once the child is able to successfully go to his communication book, pick up the picture card, walk over to his communicative partner and hand her the card to receive the desired object, the child is ready to move on to phase three of PECS (BBB Autism Support Network, 2010).

Phase three of PECS is more challenging than phase one or two because it necessitates the child's discrimination between pictures. In phase three, the communicative partner will prepare the child's communication book with two or more picture cards. The number of picture cards that should be in the communication book at this time will vary from child to child depending on how well he/she is able to discriminate between pictures. If, for example, the child does not often discriminate pictures, the communicative partner should only put two different picture cues in the child's communication book at this time. Once the preparation is completed, the communicative partner will sit across from the child and ask "What do you want?" The child will then reach for one of the picture cards and place it in the communicative partner's hand, who will then reiterate the action and provide the child with the object that was requested. If the child is initially unable to discriminate the picture cards from each other, he will eventually learn to discriminate the picture cards based on the object he receives as a result of exchanging each picture. To progress the child through this phase, the communicative partner should add more picture cards to the communication book as the child successfully exchanges pictures for objects. Once the child is able to search through his communication book, discriminate the picture cards, and request a variety of objects, he is prepared to move onto phase four of the picture exchange system (BBB Autism Support Network, 2010).

Phase four capitalizes on the child's ability to discriminate picture cards by introducing a sentence strip. To prepare for this phase, the child must be given a new picture card with the words "I want" on it. Typically, these words may be depicted in picture form of the American Sign Language physical gesture of two hands with curved fingers spread out and palms facing the body. A sentence strip with Velcro also must be created, which should be long enough to fit two picture cards next to each other. The communicative partner will introduce the sentence strip with the "I want" card to the far left of the strip. Once the student chooses a picture card, the physical prompter may assist the child in putting his chosen card next to the "I want" card if necessary.

The physical prompter should help the child then hand the entire sentence strip to the communicative partner. The communicative partner will then reiterate the action but this time, she will read the sentence strip aloud with space between each word. As the child seems more comfortable using the "I want" card, the communicative partner may remove the card from the sentence strip into the child's communication book and prompt him to put it onto the sentence strip with another picture. Once the child has mastered the ability to spontaneously choose the "I want" and utilize it to request a desired item, he is ready to move onto phase five of the augmented communication system (Wallin, 2010).

Phase five of PECS is a simple extension of vocabulary within the child's communication book. The phase capitalizes on the mastered skill of phase four by having the child request an object using the "I want" card by incorporating adjectives. To prepare to teach the child this phase, the communicative partner should create new picture cards of numbers, colors, or descriptive words. It is important for the communicative partner to first introduce these cards to the child before expecting him to spontaneously request objects using these adjectives. Once the child has learned these new adjective cards using the procedure in phase one, these new descriptive words can help refine the child's requests. Once the child is able to refine his requests for objects spontaneously, he is able to move onto the sixth and final stage of PECS (Wallin, 2010).

The sixth and final phase of PECS enables a student to comment on his environment. In order to begin the phase, the child must have new picture cards such as "I smell," "I hear," and "I feel." It is important for the communicate partner to allow opportunities for the student to comment spontaneously using these new cards. The communicative partner might say "I feel happy. How do you feel?" Since the child has proven mastery within the former phases of PECS, the child should understand that a correct response should come in the form of a picture card. These questions that the communicative partner asks should be in the form of social questions, while the questions in phases 1-5 consisted of communication for reinforcers or desired objects. Ultimately, this phase will be mastered when the child is able to adequately express his social views with the use of appropriate picture cards on his sentence strip and spontaneously hand it to the communicative partner (BBB Autism Support Network, 2010).

While many students with ASD are successfully able to progress through each of the phases of PECS, such an evolution from start to finish may take years to accomplish. It is important to understand that students at any phase in the picture exchange system are able to communicate and express their needs and desires. While each of the six phases of PECS contains specific goals to be mastered, many professionals have implemented strategies or techniques within each of these six phases. Michael Grupp (2009), a speech and language pathologist (SLP) at the Groden Center in Providence, Rhode Island, implements his own technique within phase four of PECS. After a child spontaneously requests an object using the "I want" card and the desired object on a sentence strip, he has trained the communicative partner to take the child's index finger and have the child touch each picture card as they read the child's request aloud. If the child is not looking at the cards or pulls his hand away from the communicative partner's, the communicative partner is to take the child's index finger again and read the entire sentence over. Only after the communicative partner reads the sentence strip aloud with the child's finger touching each picture card is the child provided the desired object. Another technique that Grupp has employed for one particular student using the PECS system is the utilization of a red "STOP" card with a picture of a hand. Before the child is given a desired food item that he successfully requested, the child

must wait as the communicative partner counts for five seconds in her head before given a few bite sized pieces of that food item. It is important to note that this "STOP" card is larger than the rest of the child's picture cards, is stored in the pocket of his communication book binder, and is only used during snack-time and lunchtime (Grupp, 2009). The SLP designed this technique to compliment the PECS system in an effort to have the child eat his food much slower. Professionals may use their creative minds to implement techniques that build on or incorporate the skills mastered within PECS.

PECS has proved to be a successful augmented communication for many students who have ASD. In one study, researchers tested students with intellectual disabilities and visual impairments in reading comprehension after a researcher read a book aloud while asking questions and providing the students with physical objects applicable to the story. Compared to baseline data, the two students tested both experienced a large increase as to the number of comprehension questions they were able to answer correctly after they were exposed to the objects during the intervention. Researchers believe that "by attaching the object to the page, the student gained understanding that the page of the book itself contained the information. The student then used the same object as a means to communicate understanding of a comprehension picture" (Mims, Diane, Baker, Lee, & Spooner, 2009). As proved in the study, by providing students with a visual and physical representation of an object, students are able to better comprehend knowledge. The picture exchange system capitalizes on this fact and provides students with a physical and visual representational model in which they can gather information from.

In another study, students who were deaf, hearing impaired or intellectually disabled were able to improve their rate of success in following instructions when they used a picture dictionary compared to following written directions alone. In fact, four of the seven students who participated in the study rated the helpfulness of the picture/word dictionary as a four or a five, with five being the most helpful. "The results of this study indicate that picture dictionaries can be successfully used to promote expressive communication of students with deafness and intellectual impairments" (Allgood, Allgood, Heller, Easterbrooks, & Fredrick, 2009). Therefore, the research confirms that the notion of picture-based communication that PECS is centered around is beneficial to students with ASD or other disabilities because it enables them to understand what they are asked to do and allows them to successfully follow directions.

Finally, much information about the effectiveness of PECS was discovered in the study entitled "The Effect of Teaching PECS to a Child with Autism With Verbal Behavior, Play, and Social Functioning" by Anderson, Jurgens, and Moore (2009). Researchers found that as a result of using PECS, one case study student increased his initiation of verbal behavior, play, and social functioning over the five years that he was trained in the communication system. At the beginning of the study the focus child was able to verbalize 14 words. Yet by the conclusion of the study, the same child was able to verbalize 77 words. As for the effective acquisition of PECS, researchers believe that:

> The use of highly preferred, individually motivating items, the teaching of self-initiated communication, the highly structured training format, and the use of concrete visual representations, may be more easily understood by children with autism than systems that use abstract manual signs (Anderson, Jurgens, & Moore, 2009)

With scientific research supporting its effectiveness, it appears that many students with ASD have encountered success with the picture exchange communication system.

While PECS may be the solution to many students' communication problems, it may not be as suitable for others. One drawback of the picture communication system is vocabulary: students are limited to using the vocabulary that is in their communication book. Amy Rice (2010), a supervisor of three special education teachers at the Groden Center in Providence, Rhode Island, reiterates this notion: "The system [PECS] can be a little bulky. A student could bring the book out to the playground but would probably have to leave it on the picnic table if they wanted to play on the equipment and need both hands. Also if it is left behind somewhere the child does not have their words with them to express themselves." Another disadvantage of PECS is that communication is limited. If a student does not have a specific card for a specific object, they are unable to request that object using the PECS system (Kluth, 2003). Rice (2010) further explained that sometimes, students may become distracted by the Velcro or pictures and the communication book becomes a toy to them. In her experiences she has seen many students try to eat the picture cards. In addition to discussing the disadvantages of PECS for students with autism, the system is difficult for people who have limited mobility. "PECS requires fine motor skills, as an individual needs to pick up a picture and grasp it. Students with other disabilities such as Cerebral Palsy would have a much more difficult time with PECS" (Rice, 2010).

Research has also proven that the PECS system should not be the sole augmented communication system that families of a child with special needs should consider. When pressed to make such an important decision, parents should be aware of the potential negative effects of PECS or any other augmented communication system. A study that analyzed and compared a control group to an experimental group that was trained with PECS found that "in the groups receiving PECS training/consultation there were significant post-treatment increases in the rate of their initiations and rate of PECS use in the classroom. However, the positive effects were not maintained once classroom consultations ceased" (Howlin, Gordron, Pasco, Wade, & Charman, 2007). Another disadvantage of using the PECS system is that it requires a child to be able to discriminate and interpret pictures. While there exists a large population of students who find interpreting pictures to be *easier* than reading basic language, there is also a large number of individuals who cannot adequately associate representational model pictures with realistic objects. For those students who are blind or visually impaired and also have communication difficulties, the PECS system is inappropriate without adaptation. Therefore, while PECS may be the best communication option for one child with ASD, the belief that PECS is simply the most suitable option should not be extended to all students with ASD with communication impairments.

For parents of students with ASD who feel that their child may not be the best candidate for the PECS system, there still remains a variety of alternative communication methods. Perhaps the most popular alternative to PECS is American Sign Language (ASL). ASL is ideal for students who are deaf or have a hearing impairment, as no verbal prompting is necessary as in the picture exchange system. Many families believe that ASL is preferable to PECS because it allows for more fluid and natural communication. Yet ASL also necessitates the communicative partner's understanding of signs in ASL. According to Amy Rice (2010), the Groden Center prefers PECS for a few reasons. One of them is because of the fact that anybody can understand what the picture means when it is handed to them. "In order for a child to build the vocabulary in ASL that

they have with PECS it would require that staff also know all of their signs. While that is not too difficult when the child has 10-20 signs, it becomes much more difficult when their vocabulary increases" (Rice, 2010). The possibility of a family's choosing for their child to learn ASL exists largely in their own knowledge of ASL or their willingness to learn it.

Furthermore, Facilitated Communication (FC) also exists as an alternative way of communication for students with ASD who have communication problems. Facilitated communication is a method whereby a person with autism is able to point to letters or type out letters on a keyboard or electronic device while the person with autism receives the support of the touch of another person or "facilitator" on wrist, elbow or shoulder. The elements of facilitated communication are: physical support; progressing from initial training to practice and finally to fluency; maintaining focus; emotional support; and fading physical support (Himelman, 2010). While FC is easy to understand and the vocabulary may be unlimited with the use of assistive technology, the disadvantages of the system may outweight the advantages. With FC, an individual *always* requires a communication assistant, or someone who provides physical support to enable the individual to communicate. Because of this, there exists the possible influence of the communication assistant on the individual he is aiding. For example, if an individual is using a computer to type and his communication assistant, who is providing physical support believes that he knows what the individual is typing, he might consciously or subconsciously influence the individual's typing through his physical assistance or his own beliefs of what the individual is about to communicate. In addition, the most efficient type of FC may also be the priciest: FC often utilizes equipment including expensive computers or other costly devices. Despite the drawbacks, many families of children with communication difficulties have found great success with facilitated communication.

Augmented and alternative communication systems exist to enable individuals with disabilities to express themselves. PECS is one of many communication systems that allows students to request specific items and upon completion of all six phases, comment on the world around them. With support and accolade from both professionals and researchers, many individuals with ASD encounter great success with PECS. Yet a variety of other communication systems such as ASL and FC also exist as alternatives to verbal communication. In order to successfully implement any alternative communication system, it is critical for professionals, parents, and peers to be knowledgeable of the utilization of the system and to adequately assess which system is suitable for each individualized child. Through the successful implementation of PECS, students with ASD or other communication disabilities have the ability to communicate with their peers and experience the fullest life possible.

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Special Education is Broken

Lacie Rader

When I first came to Berkeley High School, having been hired as a non-credentialed special education teacher, my goals as an educator were soon to be recognized as unrealistic. It became increasingly obvious to me that a general education classroom, at a school that inhabits over three thousand students, would not be the breeding ground for authentic education. Classroom sizes ranging from thirty to forty students per teacher, in an urban well diversified school, make differentiation and personal attention a near impossibility. The diversity of any large urban school has its benefits, but the size itself will always be the downfall when the school focuses on lofty dreams of cultivating Ivy League students while developing the national reputation for academic rigor.

Without fail, students who are on the lower end of the socio-economic spectrum will fall behind because the school's focus does not take into account the diversity it encourages. Ten percent of Berkeley High School students have IEPs because they cannot keep up with the overall demands of high school. Having worked closely with these students, I can say that the reasons for this varied greatly from the student reading at a first grade level to the student maintaining a lack of motivation due to a disinterest in going to a four-year college.

Even though ten percent of BHS students cannot cope with the standards of the school, few changes have been made in the curriculum, vocational skills classes have not been added (though there is an interest coming from some of these students), the graduation standards remain the same and teachers are encouraged to keep moving quickly through materials in order to accommodate and challenge students on the other end of this spectrum. When teachers complain about the predicament this puts us in, the D word is used as if it is the end all answer: Differentiation. Differentiation, however, is like a complicated machine. It requires many parts working together. Most notably it needs time and personal relationships to churn its gears, both of which are next to nil at BHS. Instead of making fundamental changes in school philosophy to accommodate these students, these students are referred to special education where they can receive an IEP to get the support they need.

I didn’t realize when I accepted the position for special education resource specialist that a) my pedagogy would not fit in with the overall curriculum of a college prep high school and b) that I was working mostly with the exact type of students I had become interested in working with. I knew I would soon be doing a nice service by working with learning disabled teenagers, but I had no idea that the population was at least ninety percent poverty stricken, broken-homed., emotionally distressed minority students. I was only three days into my job when I began to ask myself, “How is it possible that only poor black males have learning disabilities?” This is to say, it was in this role that I began to question the way our school defines disability.

The special education program, by creating a side program for underachieving students, seals the administration's gold frame for the college prep school image that would otherwise fall apart. But even this isn't quite working so in recent months it has been whispered around the school that Berkeley Tech School (a school down the street for students with extremely negative behavior patterns) will be expanding. Right now BTECH is populated with almost one hundred percent

Latino and African-American Students. Like most diversified schools, Berkeley High School has an academic gap it seems too certain that BTECH's lack of diversity will remain pertinent regardless of how many students are admitted.

Special education seemed to be housing all of the students who could not get an "A" in overcrowded high level English classes taught by teachers who are far more interested in finishing up their PhD than teaching at high school. Despite the unfairness of it all, I still had hope that at least here these students could receive the proper support they would need in order to get something from their high school years.

Recent neurological studies attempt to explain the large minority population in special education. The following idea was summarized by Clive Cookson in a Boston newspaper regarding research presented at the American Association for the Advancement of Science. "Many children growing up in very poor families with low social status experience unhealthy levels of stress hormones, which impair their neural development… The effect is to impair language development and memory and hence the ability to escape poverty for the rest of the child's life." Because minority students make up the lower socio-economic population of our students, the demographics of the special education program are not startling. While insightful, Cook's fatalistic analysis does not hold water.

If you take some of these very same students and put them into a healthier environment, with more support, giving them one-on-one teaching opportunities, these students can flourish. I have personal experience with this as I took one student under my wing that had been expelled as a freshman. Because he was a special education student, exceptions were made to have him re-enrolled the following fall. Nico was assigned to me carrying fifteen tons of attitude on his shoulders and reading at a third grade level. Just last week he came to me to show me a report card full of A's and B's. He's even taking an AP class. Nico came into Berkeley High School his freshmen year being disadvantage, not disabled. We know students such as Nico succeed in alternative high schools throughout the country when the schools are equipped with a new design and teachers trained specifically to work with these types of students. Nico will be graduating in two months.

So, why not address the situation for what it is; the students that make up the lower socioeconomic end of our schools are not able to get their needs met within the college prep structure? The special education program makes this face-to-face with the facts confrontation a less pressing need. Yet the special education department, accompanied with paperwork, psychologists and insufficient funding is not a solution to the problem. Within this structure or process really, a child's needs are calculated in such a way so that the student is only eligible for particular resources. The process therefore must be precise and the field full of experts, but as I am no expert myself, I can promise you the determination of eligibility is as hit or miss as a game of horseshoes, played by yours truly.

Filling out the IEP is the most dreaded aspect of being a special education teacher. It can be up to thirty pages long filled with obscure language, arbitrary test results, observations and teacher input. Ideally the goals, accommodations and services written within will accurately reflect a student's individualized needs, however often times the IEP is shy of any individuation because the resource specialist is given a workload which makes personalization impossible on top of a

deadline for each IEP which brings about a very hurried process (described further in the essay). Even some of the best reports I've seen are not successful in supporting the student. A completely accurate summary of the student's ability, needs and suggested tools for support can be drawn up, a meeting held and still at the end of the day the implementation of the IEP by teacher, administration, student and parents rarely occurs. Yet, I spent more time writing IEPs and having IEP meetings than I did meeting with students and actually supporting them. So, Why the emphasis on paperwork?

The number one priority of leaders in the special education field should be to engender separation between special education and state/federal policy. This means rather than spending ninety percent of our energy trying to stay in compliance with regulations and miscellaneous paperwork, the department's efforts should be redirected toward the students who are being largely neglected because of the misdirected and overemphasis of district mandates.

However inspired I was by having these students was becoming less and less relevant, for the type of education I had always thought I would give them was somehow not an option, it is not listed on the list of resources we can offer them. What we can offer our students (if it's added to the IEP) seems to be as follows. This is not a comprehensive list, but it should help to represent the special education resource spectrum as I understand it early in my career.

At Berkeley High School we offer math and literacy classes at levels appropriate for those who are below grade level once having entered high school. We do not have history, science, second languages, art or music at the levels which would be required in order for any of these subjects' content to be accessible to a student who is reading, writing and/or comprehending at any level lower than seventh grade. Essentially this means that our students with the lowest skill levels are only advancing in two subjects a day. This also means they are sitting in classes which are mostly alienating them for the other three-fourths of the day.

We also offer a CLC class. CLC stands for consultive learning center and ultimately serves as a study hall in which teacher assistance is offered when needed. Only, when you put fifteen low leveled students in one classroom, who have been alienated for the larger percent of the day from the activities and lectures in which the majority of their peers have been engaged in, classroom management is where most of the teacher's energy is directed. If you look around this room you'll see that there are only two girls and two Latino students among everyone else who are inevitably eleven black males. When the class is quiet, we're still dealing with fifteen students who are each behind in all of their classes, all low skilled and all in need of one on one tutoring. CLC is a waste of time for over ninety-percent of students with IEPs at Berkeley High School.

Aside from special classes, BHS students with IEPs all have resource specialists (the new lingo for special education teacher). Resource specialists have many different responsibilities. First and foremost is that we make sure that general education teachers understand our student's IEPs and grade them based on their current levels and the IEP team's goals for that student. In some ways it's a matter of convincing the general education teacher to be more compassionate in grading, but also a matter based on logistics. If the reason we give for putting our students into classes above their skill levels is that we are working on social competence development, then it seems logical that our students should be graded based on the criteria that they are socially acceptable within these classes. Similarly, if the reason we give for having an illiterate student in the classroom is

that he or she should also have access to Shakespeare, then we must be sure the lessons are accessible (even if they need to be modified) to the student. Otherwise, we cannot fail her. This is something that seems very difficult for general education teachers. Ideally the resource specialist would have time to support the students and teachers that are put into these trying situations, but with the emphasis on paperwork and meetings, it is safe to say that both general education teacher and student are left deserted.

The other complication with mainstreaming is that any good teacher with admirable standards concerning education is going to question whether or not it is in fact acceptable to pass a student who has accessed hardly five percent of the curriculum's content. This leads to a discussion between general education teacher and special education teacher. It becomes a battle of philosophies intertwined with personal experiences, idealism and of course the law. Because people are passionate about education, there are a lot of defensive behaviors that come into play during these meetings and oftentimes the special education teacher's expertise and authority are completely undermined. The administration should recognize this authority and support the special education teachers if an inclusive model is going to run smoothly, yet any special education teacher knows that our department is the black sheep of the school and rarely are we seen as authority on our student's as much as we are seen as naïve overly compassionate upholders of the IEP.

As touched upon earlier, the resource specialist is responsible for creating an IEP for each student on his or her caseload. IEP stands for individualized education plan. Once a student's disability is recognized the student goes through academic testing. If discrepancies are present, the student is approved for special education resources. An IEP is created to specify which resources the student will have access to. The IEP is renewed annually serving as a legal document allowing the student special services until a transition out of special education seems possible.

The student should have academic testing (a two hour process), the IEP has to be written (about 15 pages of information to fill out based on research gathered past IEPs which is oftentimes missing), teachers and parents need to be invited and an agreed time and date needs to be set. At these meetings everyone touches base to see how it is we can best serve the student. Teachers (almost never present) discuss the student’s behaviors in the classroom which are contributing to or taking away from the student's overall ability to succeed in a classroom setting. Parent express their concerns, counselors talk about graduation and future career options and the student vocalizes his/her concerns. A lot of great ideas come from these meetings and the student sits with a number of people interested in their education, but most of what is discussed at the meetings is lost only a few days later due to a lack of resources, time or motivation on the student's part.

When the IEP is sealed and stamped, the idea is that all of the information enclosed and the list of accommodations will serve as a student's support as they participate in general education classes. As much as we don't enjoy writing them, I sometimes feel that without the IEP some of our students would have next to no support at all. The tricky part is trying to have the students advocate for themselves in order to get the accommodations written within the document, but most of our students are not mature or willing enough to deal with the humiliation involved with communicating about their learning differences. They are quite honest about not wanting the extra help if that's what it will take to get it. Also, teachers who do not attend the meetings are resistant to comply to the individual plan and students end up losing faith in the entire process.

The good thing about the IEP is that it serves as a legal cushion for students; If teachers are not meeting the accommodations written within the IEP, it's near impossible to fail the student. Despite the fact that the obvious relationship between general education teacher and special education teacher should be positive and centered on student achievement, oftentimes the meeting of these accommodations gets passed right back to the resource specialist who is actually already busy preparing for another IEP meeting.

We are given up to twenty-five students who each have six teachers. This means resources specialists need to facilitate well over one-hundred personalized connections in order to ensure that our shared student both passes the class and has an experience worth his/her time. The focus should be on supporting the student well enough that we can honestly justify the student's placement within the classes. Yet the consensus around schools is that the outcome is not so positive.

Some general education teachers are entirely misguided about how much time special education teacher have on their hands. They think the special education can come to their classroom and sit with our less behaved students or intensely struggling students. Even if we were not in meetings or meeting with discipline officers randomly throughout the week, this could mean being in twenty-five different places at once (remember that is the caseload size), but it doesn't even mean that. Resource specialists at Berkeley High School teach two classes a day. For these classes we must prepare curriculum, deal with behavior issues, balance the different skill levels and implement fair assessment and grading guidelines.

I share all of this not as a way of complaining, but rather as way to dispel the way too popular view that the resource specialist is an efficient resource for our students. Until we get away from paperwork and meetings which take up at least fifty percent of our work day, we will remain mostly ineffective as educators to students with special needs. One student told me today that he always feel bad asking for help with a question on a test because it is all too evident that everyone in the special education central area is already busy.

Our students are not getting enough support. Not only are they failing classes that we have put them in with the claim to support them, but they are also having the development of their basic skills all but put last. In some cases when they are in our special education classes, their basic skills are being developed. Still, it is an understatement to assert that one or two hours a day of skill-appropriate classes is inadequate. Especially if you can imagine that these classes look like the CLC class I described earlier. I feel as if our special education classes act as a safe place for our kids to vent and relax. Then off they go into the sea again, without a life jacket. Despite every effort by concerned people to resolve achievement gap, over three hundred of our students at Berkeley High School are given the educational experience I have just described.

"The Civil Rights Movement and the 1954 Brown v. Board of Education decision which extended equal protection under the law to minorities, paved the way for similar gains for those with disabilities. Parents, who had begun forming special education advocacy groups as early as 1933, became the prime movers in the struggle to improve educational opportunities for their children.

Public Law 94-142 proved to be landmark legislation, requiring public schools to provide students with a broad range of disabilities - including physical handicaps, mental retardation, speech, vision and language problems, emotional and behavioral problems, and other learning disorders - with a "free appropriate public education." Moreover, it called for school districts to provide such schooling in the "least restrictive environment" possible.

Reauthorized in 1990 and 1997, the law was renamed the Individuals with Disabilities Education Act (IDEA) and spawned the delivery of services to millions of students previously denied access to an appropriate education. Thanks to IDEA, these students were not only in school, but also, at least in the best case scenarios, assigned to small classes where specially trained teachers tailored their lessons to each student's individual needs. Schools also were required to provide any additional services - such as interpreters for the deaf or computer-assisted technology for the physically impaired - that students needed in order to reach their full potential. And, in more and more cases, special education students began spending time every day in regular classroom settings with their non-special education peers." (Rethinking Schools Prisilla Pardini Spring 2002)

Despite compulsory education laws, students with learning differences were being neglected of an equal opportunity for education hence the birth of full inclusion in schools but in actuality, full inclusion is whispered about with negative connotations in most schools that deal with this method. Full inclusion in and of itself is not a problem, but the lack of funding to finance FI is.

In order for our students to be have their needs met, at the bare minimum, we must be able to offer them more one on one time. This means more open positions or less busy resource specialists. The student I mentioned earlier who feels as though his RSP is too busy for him suggested that we have a place in the special education office where there is always one or two people whose sole job is to assist incoming students with their work and tests. The sad thing about this is that it sounds like a position that would probably pay no more than ten dollars an hour.

In the same article, Prisilla Pardini continues, "According to the Department of Education, approximately 6 million children (roughly 10 percent of all school-aged children) receive special education services. Educating those children was expected to cost nearly $51 billion last year, according to the Department of Education's Center for Special Education Finance, with the yeoman's share - more than $44 billion - coming from states and local school districts. That, despite the promise made by the federal government in 1975 to cover 40 percent of the additional costs incurred by districts to educate students with disabilities. Even though federal spending for special education continues to rise (from $3.1 billion in 1997 to $6.3 billion in 2001), the federal government has never paid more than 15 percent of the total costs."

This is in no way a criticism of administration, resource specialists, gen-ed teachers or schools. I do believe that given the history of special education and the resources allocated to us, that we're doing the best we can. There have been limited feasible models proposed. What I'm suggesting is that we simply acknowledge that the current model is not working. It is one thing for these students to be victims of a failing model, but it reaches a point of being detrimental when we pretend that we are helping our students. Our students know that they are not getting adequate help. If they are being put into a program whose sole purpose should be to support its students, and it fails at this, what sort of message are we sending our students about seeking out resources as they move into their adult years?

People do not tend to change systems that claim to be functional. We're practically giving our students parachutes and asking them to jump off the plane but we're the only one that knows the parachute doesn't work. It's craziness. I'm not suggesting taking kids out of their harder classes or assigning them someone to follow them all day long. I'm not suggesting giving them half days where they start job training for the other half of the day (though this might be best for some of them). I'm not even suggesting that school necessarily has to be the place where we are dealing with all of these issues.

What I am suggesting is that as long as we are responsible for these children we must admit why it is that they are not succeeding and take action to better serve them. 1) The student comes from a home where he/she is not being supported. 2) The student is unmotivated or lazy 3) The student is not getting enough help at school. 4) The student has a low self-esteem. 5) The student sees no merit in public education. 6) The student has a biological learning difference. 7) The student's placement was not considered well enough. 8) The student is dealing with emotional disturbance. In every one of these situations, the child needs more support therefore we should be primarily concerned with the student on a personal level.

Contrary to popular belief, our failing students are more stressed out about school than their fellow 'A' student peers. They are not lazy so we certainly can't point a finger at them for not thriving with their "resources." When progress reports come out and I sit down with my students to inquire about their low grades they explain to me that the class is too difficult for them. When I ask them what ideas they have for improving the grade they respond, over and over again, "I need help." One-on-one help is by far the most beneficial resource we can offer failing students, yet they do not receive this easily accessible guidance. If special education teachers cannot be freed from paper work to do this more important work then let us tap into the community's volunteer programs, university programs and youth oriented organizations. When a student has a low self-esteem, he deserves a mentor. When a student hates all academics, she deserves vocational opportunities.

I watch Leon Small (a sixteen year old boy who cannot read) walk from classroom to classroom dreading the possibility of another excruciatingly humiliating moment when a teacher asks him to read and he has to decline in front of his peers. For our well adjusted students, this is externally smooth. For our least adjusted, they end up getting sent to discipline for reacting aggressively. Leon has somehow gotten through all of these years without learning to read. He said to me once, "you have no idea what it has been like to get this far and not be able to read." Another student said to me once, "they just don't understand. They think we can do it, but they don't know what it's like, how hard it is to get it done." They're right, I have no idea. What I am sure of is that this is a boy that needs to be offered more resources. If the state will not pay for it, the special education program should make it its priority to undergo major structural changes that redefine the role of SPED employees.

While our hearts in the right place, our work is deceiving. Because the work we do greatly determines these young people's futures, we must stop getting caught up in the language, laws and intentions of the special education program. This should be a field, above all others, that has student/teacher relationships directly in the center. If we can somehow redirect our program's goals to reflect the necessary personal approach to educating special education students away

from a legal documentation framework, then one would think the resources would be there for a new framework; a framework that actually works.

Locus of Control, Interest in Schooling and Science Achievement of Some Deaf and Typical Secondary School Students in Nigeria

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Abstract

This study compared locus of control, interest in school and science achievement of typical and deaf secondary school students. The study also investigated influence of students' locus of control and interest in school on general science achievement. Seventy two (72) deaf and 235 typical children were purposively selected from eight secondary schools from Oyo and Ogun States in Nigeria. Three instruments were used to collect data. They are: Locus of control questionnaire, Interest in schooling questionnaire and Science achievement test. Interest in school and locus of control when taken together accounted for 25.6% of the total variance in science achievement (R^2= 0.256, $p < 0.05$). There was significant difference in locus of control and interest in school between deaf and typical children. Typical children significantly tended towards external locus of control ($t = 4.416$, $p < 0.05$) and also had more interest in schooling ($t = 5.747$, $p < 0.05$) than their deaf counterparts. Typical children also performed significantly better than their deaf counterparts ($t = 7.294$, $p < 0.05$). Teachers should make schooling more interesting especially to deaf students. Necessary facilities should be provided for the deaf students to enhance their teaching so that their achievement in science will be at par with their hearing counterparts.

Locus of Control, Interest in Schooling and Science Achievement of Some Deaf and Typical Secondary School Students in Nigeria

Generally deaf children tend to be difficult to train because of language problem faced in the cause of teaching them. However, this does not mean they are less intelligent than typical children. Language is a major key to whatever else the deaf children may wish to learn in and outside the school. This set of children cannot hear simple language thereby causing their being neglected in the society. Ysseldyke and Algozzine (1991) observed that hearing impairment adversely affects a child's educational performance. Aloba (1992) explained that language is a

means by which experience is crystallized and structured, hence a lack of or limitation of it will lead to a reciprocal restriction in the ability to integrate experiences.

Loss of hearing apparently affects deaf children learning style so that they often depend on visual learning modalities. Most of the time, the deaf children have distorted access to the flow of language and information in the environment, hence they quite reasonably demonstrate under achievement in language, conceptual knowledge and abstract concepts. Mba (1995) noted that defective hearing creates barriers to developments and brings about disorganization of the individuals. This is because language is involved in the cognitive processes of thinking, memory, reasoning, planning and problem-solving while it is used in directing different activities. However, Moore (1982) and Abang (1988) explained that the condition of deafness imposes no limitation on the cognitive capabilities of individuals since deaf people have been found to function within the typical range of intelligence. It is therefore imperative that social and academic facilities that can improve their well-being be extended to them. More so, the National Policy on Education stresses the need to give equal opportunity to all children, their physical, mental and emotional disabilities not withstanding (FGN, 1981).

Locus of control is conceptualized on a dynamic dipolar continuum spanning from internal to external. Internal locus of control is characterized by the belief that consequences are failures resulting from one's own behavior. Thus, individual who believe that their successes or failures result from their own behaviors possess an internal locus of control while external locus of control is characterized by the belief that consequences are a result of fate or luck.

Chapman and Beersman (1997) defined locus of control as individually perceived sources of control over certain behaviors or events. The concept of internal and external locus of control has important consequences for children's academic development. Students who take responsibility for their academic achievement perform better on standardized achievement tests and in overall grade point average (Dweck & Licht, 1980; Stipek & Weisz, 1981; Ogunkola, 2003). On gender and locus of control, Okeke (1992) found out that males and females differ in their pattern of attribution of success and failure. In academic situation, girls are more likely to see success as caused by ability than are boys. In failure situation, girls are more likely than boys to attribute their failure to lack of ability than lack of effort. Though, Ogunkola (2003) also reported that internal locus of control students performed significantly better than their external locus of control counterparts, however, there was significant difference between the performances of male and female students with internal locus of the performance of male and female with external locus of control.

Interest is an affection state which appears to be a reflection of central feature of relationship between value of system individual and the environment (Busari, 1999). Olusi (2005) reported that students' achievement in science is high and students' interest generally affects academic achievement. He further explained that though interest in education alone does not bring about success in science, it however increases the probability of success. For example, Olatoye and Oloyede (2004) reported positive significant relationship between interest in schooling and study habit. A student who is not interested in schooling is likely to have poor study habit and also be frequently absent from school.

Most studies on locus of control and interest in schooling have been carried out only on hearing students. There is a need for a study like this that compares hearing and deaf students. Abang (1988) asserted that deafness imposes no limitation for cognitive capabilities. In the search for technological and scientific development, there is need to consider factors that can enhance science achievement. Some of the students offering science now, deaf or hearing will eventually become future scientists and engineers. If deaf students are neglected in science education studies, the outcomes of research may be biased. Scientific development in a nation gives birth to economic and political freedom. All the nations that are advanced economically today are also those that have advanced in science and technology (Olatoye, 2008). In the quest for scientific advancement and economics independence, developing countries like Nigeria need to take conscious efforts at lifting up the standard of science achievement. This study therefore investigated combined and relative influences of locus of control and interest in schooling on science achievement of deaf and hearing students in Oyo and Ogun States, Nigeria.

Research Questions

The following research questions were raised to guide the study:

1. To what extent will locus of control and interest in schooling taken together predict student science achievement?

2. To what extent will locus of control alone predict student science achievement?

3. To what extent will interest in schooling alone predict students' science achievement?

4. Is there any significant difference in deaf and hearing students' (i) Locus of control (ii.) Interest in schooling (iii.) Science achievement?

Methodology

Research Design

This study adopted an ex-post facto research design. In such design, the dependent and independent variables have already occurred, the researcher cannot manipulate them.

Sampling Technique and Sample

The target population for this study comprised all the deaf and hearing students in junior secondary three levels in Oyo and Ogun States. From each state, two Local Government Areas (LGAs) were judgmentally selected for the study. The reason for using judgmental sampling technique was because of the deliberate attempt to include schools with deaf students in an inclusive setting. Only few schools admit deaf students. Eight schools were therefore judgmentally selected from the Local Government Areas chosen from the two states. Selection of students for participation was based on student willingness and interest. In all the eight schools (two schools from each LGA), all the deaf students were encouraged to participate because they were fewer in number than the hearing students. However, a sample of about forty hearing students was selected from each school. A total of 72 deaf students and 235 hearing students

participated in the study. The average age of the students is 13.2 while the age range is 12-17 years.

Instrumentation
Three research instruments were used to collect data. They are:

(i) Locus of Control Questionnaire (LCQ)

(ii) Interest in Schooling Questionnaire (TSQ)

(iii) Student Achievement Test (SAT)

i. Locus of Control Questionnaire LCQ
LCQ was constructed by the investigators to assess students' attribution style. Locus of control has to with how students rate the source(s) or cause (s) of events that happen to them. LCQ contains Section A which elicits information on some background characteristics such as age, name of school, and gender. There are 14 items on the LCQ.

Examples are:
'Most of the things that happen to me are due to ill luck'
'I know I can make it if I work hard'.

The students are to, 'Strongly Agree', 'Agree', 'Disagree' or 'Strongly Disagree' with each statement. A student who strongly agrees with the first example above is likely to belong to external locus of control. On the other hand, a student who strongly agrees to the second example is likely to belong to internal locus of control. When a student attributes whatever happens to his or her own behavior or attitude, he or she belongs to internal locus of control. Those who attribute what happen to them to external factors such as fate or ill luck belong to external locus of control. The initial version of the questionnaire was given to expert for suggestions and modification. The Cronbach alpha reliability co-efficient is 0.712.

Interest in Schooling Questionnaire (ISQ)
This is a twelve-item questionnaire designed to elicit information on students' interest in schooling. The students are to 'Strongly Agree', 'Agree', Disagree' or 'Strongly Disagree' with each statement on ISQ. Examples of items on ISQ are:
'I enjoy activities carried out in school'
'I attend classes regularly'

The initial version of the questionnaire was given to experts for suggestions and modification. The Cronbach alpha reliability co-efficient is 0.733.

Science Achievement Test (SAT)
SAT was constructed by the researcher to determine the level of students' achievement in science. SAT is a 30-item multiple-choice objective test items. To ensure content validity, the researchers went to the various schools to collect their schemes of work and also to know how much content

had been covered. The test covered the various topics already taught in all the schools. Some experienced secondary school teachers went through the items before coming up with the final version after corrections had been made based on expert suggestion.

Each item is followed by four options A to E. Examples of items on SAT are:

1. Hydra is able to perform the following functions except
   a. feeding b. movement c. photosynthesis d. ingestion
2. Excessive bleeding from an injury may be due to lack of vitamin _____
   (a) A (b) B (c) D (d) K

Procedure of Data Collection

It is important to state here that because of the peculiarity of the deaf students involved in this study, the study required some extra planning. The teachers of deaf were already informed before the test and questionnaires were administered. The teachers of the deaf students were on ground throughout the period of data collection to assist the researcher explain the purpose of the study to the deaf students and to solicit their co-operation. Teachers of the deaf students used sign language to communicate with their students. It was also noted that deaf students are more restless and have short attention span compared to their hearing counterparts. With patience and encouragement they participated actively in the study. The same instruments were administered on the deaf and hearing students. It was also observed that hearing students completed the questionnaires and answered the achievement test questions faster than their hearing counterparts.

Method of Data Analysis

Data analysis was done using regression and t-test statistics. The research questions were answered using a two-tailed test at 0.05 level of confidence.

Results of Data Analysis

Researcher Question 1: To what extent will locus of control and interest in schooling taken together predict student science achievement?

Table 1: Locus of control and interest in schooling as predictors of science achievement

R = 0.506 R square = 0.256 Adjusted R square = 0.251 Standard Error = 4.512						
Analysis of Variance						
	Sum of Squares	**df**	**Mean Square**	**F**	**P**	**Remark**
Regression	**212.436**	**2**	**1060.218**	**52.070**	**0.000**	**Significant ($p < 0.05$)**
Residual	**6169.572**	**303**	**20.361**			
Total	**8289.948**	**305**				

In Table 1 above, locus of control and interest in schooling when taken together account for 25.6% of the total variance in student science achievement (R square= 0.256, $p < 0.05$). The percentage is statistically significant. These two variables (locus of control and interest in schooling) are very important factors to take into consideration in order to enhance science achievement both of hearing and deaf students.

Research Question 2: To what extent will locus of control alone predict student science achievement?

Table 2: Locus of control as a predictor of science achievement

R = 0.351 R square = 0.123 Adjusted R square = 0.120 Standard Error = 4.889						
Analysis of Variance						
	Sum of Squares	**df**	**Mean Square**	**F**	**P**	**Remark**
Regression	**10211.791**	**1**	**1021.791**	**42.738**	**0.000**	**Significant ($p < 0.05$)**
Residual	**7268.156**	**304**	**23.908**			
Total	**8289.948**	**305**				

In Table 2 above, locus of control singularly accounts for 12.5% of the total variance in student science achievement (R square = 0.123, $p < 0.05$). This percentage contribution is statistically significant. Locus of control is therefore very relevant in predicting student science achievement.

Research Question 3: To what extent will interest in schooling predict student science achievement?

Table 3: Interest in schooling as a predictor of science achievement

R = 0.502 R square = 0.252 Adjusted R square = 0.249 Standard Error = 4.518						
Analysis of Variance						
	Sum of Squares	**df**	**Mean Square**	**F**	**P**	**Remark**
Regression	**2085.762**	**1**	**2085.762**	**102.201**	**0.000**	**Significant ($p < 0.05$)**
Residual	**6204.186**	**304**	**20.409**			
Total	**8289.948**	**305**				

In Table 3, interest in schooling alone accounts for 25.2% of the total variance in science achievement (R square = 0.252, $p < 0.05$). This percentage contribution is statistically significant. Interest in schooling is a good predictor of student science achievement. It should be noted that though each of the independent variables (locus of control and interest in schooling) accounts for significant variance in students' science achievement, however, interest in schooling accounts for a greater percentage.

Research Question 4: Is there any significant difference in deaf and hearing students'
(i) Locus of control (ii) interest in schooling and (iii) science achievement

Table 4: Locus of control, interest in schooling and science achievement of hearing and deaf students

Variables	Student type	N	Mean	Standard deviation	Standard Error	df	t	p	Remark
Locus of control	Hearing	235	44.202	5.754	0.375	305	4.416	0.000	*
	Deaf	72	40.986	4.629	0.478				
Interest in Schooling	Hearing	235	47.214	6.638	0.433	305	5.747	0.000	*
	Deaf	72	42.632	4.624	0.545				
Science Achievement	Hearing	235	11.562	5.143	0.336	305	7.294	0.000	*
	Deaf	72	6.803	3.516	0.417				

Significant ($p < 0.05$)

In Table 4, there is significant difference between hearing and deaf students on each of the variables. Hearing students have higher locus of control than their deaf counterparts. The scoring/coding of the locus of control was done such that strongly agreeing to an internal locus of control statement has a maximum of 4 points on an item. Hearing students also have significantly greater interest in schooling and significantly higher achievement in science.

It should however be noted that the achievement of students in science is generally poor both among the deaf and hearing students. The mean score for deaf students is 6.803, while that of hearing student is 11.562. In both cases, the average score is less than half of the maximum obtainable score of 30.

Discussion of Findings

Findings from the study show that the hearing students tend to be have internal locus of control significantly greater than their deaf counterparts. In a study carried out on the influence of locus of control on hearing student academic achievement, Uguak, Elias, Uli and Suandi (2007) reported that majority of the respondents (specifically 96%) of the learning responds were characterized to have internal locus of control. Also, the results revealed that locus of control were significant and positively related to academic achievement. The direct positive influence of locus of control on academic achievement in this study is therefore not surprising. This is because many studies have reported that locus of control influence many other achievement-related factors. For example Estrada, Dupoux and Wolmax (2006) reported a significant positive relationship between locus of control and both social adjustment and personal emotion adjustment. The hearing students were able to perform better in science than their deaf counterparts probably because the attribution orientation of the hearing students tends more

towards internal than their deaf counterparts. Ogunkola (2003) found that students who had internal locus of control orientation performed better than those who tended to the external.

It is also not surprising that interest in schooling of the deaf students is significantly lower than that of their hearing counterparts. Oyewumi (2004) identified some problem areas of adolescents with hearing impairment. He identified problem of coming to the term with their body image, problem of achieving independent identity and tendency to be aggressive. If the school environment is not encouraging, all these factors can reduce interest in schooling of students with learning impairment. Mba (1995) noted that defective hearing creates barrier to development and brings about disorganization of the individuals. The fact then remains that language is involved in the cognitive processes of thinking, reasoning, planning and problem-solving which is used in directing different activities. To this end, interpreters will surely facilitate the acquisition and use of language and improve the educational development of persons with hearing impairment. Schools should be made interesting to students especially the deaf by providing interpreters and facilities that will make learning easy for them.

Olatoye and Ogunkola (2008) found positive significant relationship between students' interest in schooling and the achievement in science. Also, interest in schooling significantly influenced achievement in science. Maduabam (2001) noted that students no longer have interest in learning in school but rather just to obtain certificate. This is because of over emphasis on paper qualification. It is important to stimulate students' interest in learning, both academic and vocational contents of the curriculum that can be relevant after school should be emphasized.

Conclusion and Recommendations

Locus of control and interest in schooling have both relative and combined significant influence on students' (hearing and deaf) achievement in science. The importance of these two independent variables in enhancing science achievement among hearing and deaf students cannot be overemphasized. It is however not cheery to note that deaf students performed significantly lower than their hearing counterparts in science, have less interest in school and also have less internal locus of control. In order to enhance science achievement among the deaf students, it is importance to put in place environment that will stimulate their interest in schooling. The need for counseling services especially for the deaf students cannot be overemphasized, interpreters, should be provided for them. They should also have facilities such books and other instructional materials that will assist them to learn. For both deaf and hearing students, laboratory school should be well equipped for meaningful science activities with qualified teacher in charge. This is necessary because though hearing students performed significantly better in science, the achievement level of the students is generally below average.

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Educational Solutions for Children with Cerebral Palsy

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Abstract

This paper characterizes educational strengths and needs of children with cerebral palsy (CP) and connects research findings from the University of Michigan's Adapted Cognitive Assessment Lab (ACAL) to current special educational requirements. It acknowledges the uniqueness of educating a child with significant motor and communication disabilities and suggests a reasonable starting point to develop an education plan for children with CP. The authors propose two key components critical to the educational success of children with CP: Accessible Assessment and Accessible Curriculum. Emphasis is placed on the importance of working within the mandated educational guidelines to best meet the individual educational needs of students with CP. Also included in the manuscript is a comprehensive appendix of resources related to the educational needs of children who receive special education services, a resource appendix specific to reading, examples of accommodations vs. modifications, and a diagram that highlights the key concepts of this article.

Educational Solutions for Children with Cerebral Palsy

Raising a child with cerebral palsy (CP) can be a complex experience for any parent. The diagnosis includes such a broad range of characteristics that even understanding all that it encompasses can be a challenge. Once a parent has acquired a basic understanding of the diagnosis, learning how it will affect their child's life can become a critical goal as well as responsibility. There is a wealth of information available about the different types of CP, the causes, and the potential ways it can affect a child's daily life. With the internet now a primary means to disseminate as well as obtain information, sorting through all of the available resources and finding those that are both effective and applicable to a particular child can be a daunting task.

While there is an increasingly large set of information regarding effective medical treatment and intervention for children with CP, educational needs and interventions are not as well characterized. There are readily available resources mandated in the educational setting for children with disabilities at a state and federal level that are supported by the contents of the child's Individualized Education Plan (IEP) (IDEA, 2004). However, appropriate services and supports, including cognitive and educational testing, are not always identified in the child's IEP.

There are specific accommodations and interventions for children who receive special education services under categories such as autistic impaired (AI), specific learning disability (SLD), and otherwise health impaired (OHI) under the auspices of Individuals with Disabilities Education Act (IDEA, 2004). However, CP is not a special education category; therefore, development of an appropriate education plan can be a significant challenge. Although CP is a condition distinguished primarily by its physical impairments stemming from early brain damage, there also are risks for learning difficulties associated with the underlying brain atypicalities. Children with CP may also have other types of impairments and conditions including speech difficulties, sensory impairments (e.g., vision difficulties), seizure disorders, pain and fatigue that can have significant effects on their ability to learn and succeed in the traditional academic setting. For this reason, appropriate educational services and supports are critical in promoting quality of life and independence for these children (see Appendix A).

Physical impairments affecting speech and motor abilities in children with CP make it difficult to assess cognition using traditional methods of testing. In order to measure cognitive capabilities independent from physical and communicative impairments, researchers at the University of Michigan's Adapted Cognitive Assessment Laboratory (ACAL) are conducting research that focuses on alternative testing methods through the use of assistive technology (AT) for children whose abilities could not be determined accurately through traditional standardized cognitive testing (Adapted Cognitive Assessment Laboratory).

In addition to conducting adapted assessments, the ACAL researchers have interviewed many families of children with CP over the course of several years and have actively participated in the IEP process by translating assessment findings into functional applications within the classroom and in the IEP document. Over the course of this research, the lab has been able to characterize specific educational needs for children with CP.

Although many children with CP receive their education under the auspices of IDEA and the IEP, the IEP document may not always contain relevant data. For example, failure to address any one of the three key components of the student's IEP (present level of academic achievement and educational performance, measurable goals and objectives, and statement of needed special education and other support and services) will undermine the requirements of a Free and Appropriate Public Education (FAPE) for a student with any type of disability, as this is the primary purpose of IDEA (U.S. Department of Education). Therefore, these students may not be challenged to meet their fullest potential in school and within their community. This article describes two key components that may help to characterize and address more fully the educational strengths and needs of children with CP: 1) accessible assessment; and 2) accessible curriculum. Appropriately adapted accessible assessments can provide students with access to the proper curriculum, as stated in IDEA (Karger & Hitchcock, 2003).

Accessible Assessment

The importance of reliable and valid assessment in determining the most appropriate curriculum for a child with any sort of disability cannot be overstated. For children with CP, this can be particularly challenging, as motor impairments may affect both ability to speak as well as ability to access standard assessment instruments. In order to provide appropriate education to students with speech and/or motor impairments, we must first find a reliable and valid means of measuring their cognitive abilities as well as their current level of academic functioning.

A common understanding among researchers and educators is that formal and informal measures of intellectual functioning and academic achievement are heavily based on language abilities. For children who cannot talk, these measures can underestimate levels of cognitive functioning, and result in inappropriate educational placement and instructional levels (Sabbadini et al, 2001). In addition, the findings can result in reduced expectations regarding a child's learning potential, which in turn, can have long-term negative effects on the development of optimal levels of independence. To address this need, the ACAL research team has developed adapted assessment procedures that can provide reliable and valid measurement of cognitive abilities in children with severe speech and motor impairments.

One ACAL study examined the feasibility of modifying tests of thinking skills and knowledge to accommodate the needs of children with disabilities (Warschausky et al, in revision). Specifically the research investigated the reliability and validity of computerized adaptations of common cognitive and academic tests with accessible responses via assistive technology. These tests are similar to the types of instruments utilized in a regular school setting or in a neuropsychological assessment clinic. These computerized adaptations enable children to use alternative access for responding, such as use of single switch scanning, or direct selection via head movement using a HeadMouse®. A Headmouse® enables a child to move the cursor using head movement via infrared technology, and to select a desired item by holding the cursor on it for a specified duration (e.g., 1.5 seconds). These adaptations allowed the researchers to minimize the motor demands that could potentially interfere with a child's ability to respond accurately. In addition to studying reliability and validity of these adapted instruments, the ACAL team has also used findings to better inform the IEP process. Members of this research team attend IEP meetings and describe a student's test results, helping to translate these results into appropriate adaptations in curriculum and environment.

In addition to having severe motor and speech impairments, children with CP are at risk for cognitive impairments. Two important areas of cognition identified by our research team as presenting unique challenges in children with CP are cognitive processing speed (thinking speed) and phonemic awareness. Previous research suggests that children with CP are at risk for slowed processing speed, but all of the processing speed tests used in previous research have also required the ability to make quick movements (Ito et al, 1996). Specifically, most traditional tests of processing speed require quick hand movements or rapid speech, such as quickly copying symbols or saying words. For children with CP, this becomes a confounding factor as their motor impairments interfere with their ability to respond as quickly as they are able to process information. The ACAL team is in the process of investigating processing speed independent of response speed.

In studies of the typical development of literacy, phonemic awareness is generally recognized as the strongest predictor of literacy outcome. The development of phonemic awareness skills in children with CP has become a growing area of interest. Some research has found that children with CP perform below their typically developing peers on measures of phonological awareness (Peeters et al, 2008). Nonverbal reasoning and speech abilities were the most important predictors of phonemic awareness for children with CP. However, the association between speech and phonemic awareness in children with CP is not a consistent finding in the literature (Dahlgren Sandberg & Helmquist 1996; Dahlgren & Sandberg, 2006). Although phonemic awareness develops in children without productive speech, it has not previously been shown to have the expected positive influence on literacy development (Sandberg, 1998). Recently, the ACAL examined phonemic awareness as a predictor of reading comprehension in children with CP and found that the same variables predict reading comprehension in children with cerebral palsy as in typically developing children, but that children with cerebral palsy continued to rely on phonological processing later in development (Asbell et al, in press). Productive speech had an indirect effect on reading comprehension that was mediated by phonemic awareness. Specifically, for children with CP the significant association between dysarthria and reading comprehension is mediated by phonemic awareness. There is a paucity of measures of phonemic awareness available to children who are not oral communicators. The ACAL has piloted forced-choice pictorial format instrumentation with psychometric work up still in progress.

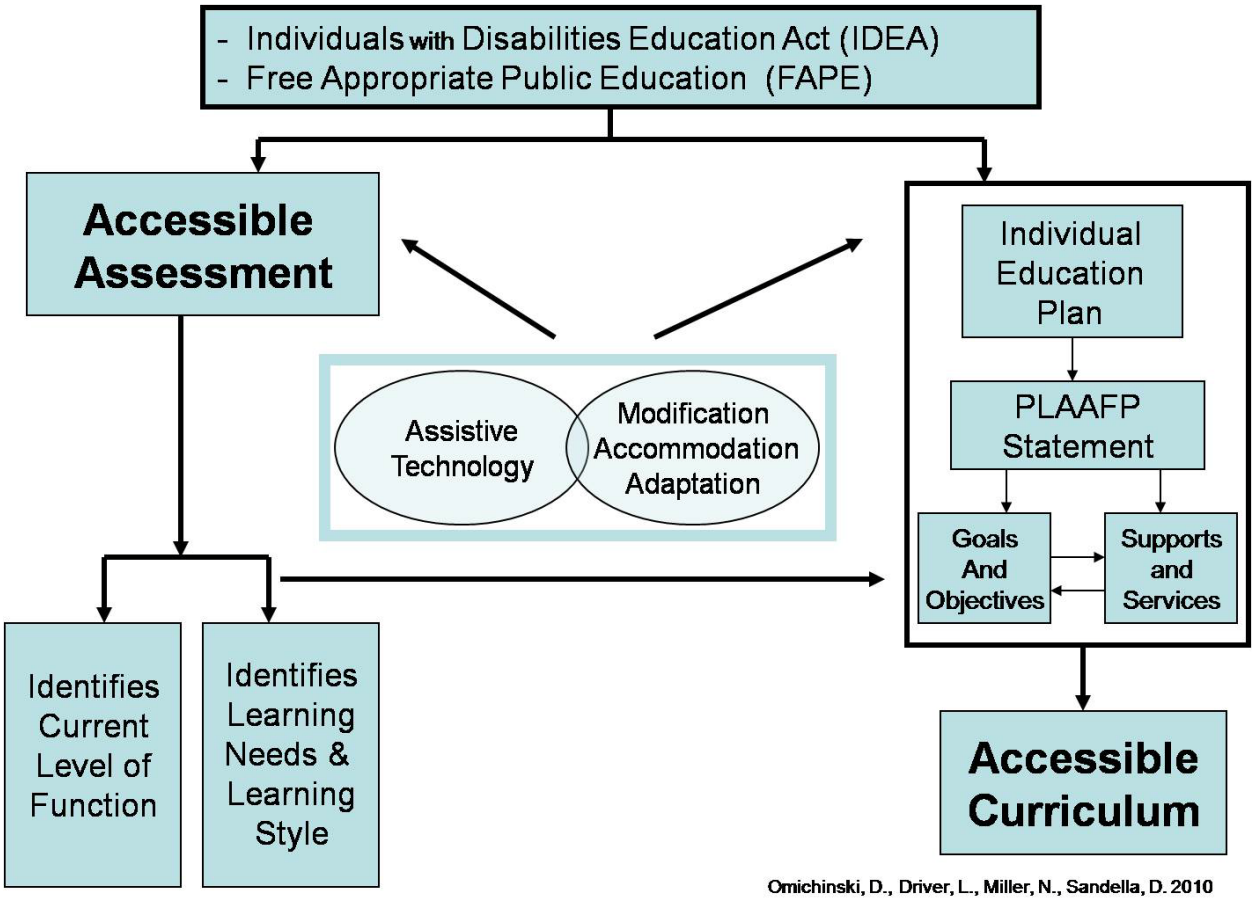
Ideally, adapted cognitive assessment will assist in the process of determining a child's current level of functioning as well as in identifying learning needs. The next challenge becomes how to translate these findings into classroom instruction techniques.

Accessible Curriculum

An accessible assessment is a good first step in guaranteeing that children with CP and associated speech and motor impairments receive an appropriate education. Once current levels of academic achievement, cognitive, and learning abilities have been determined, we must find ways to make the curriculum accessible. The combination of accessible assessments and accessible curricula can significantly increase the potential for further education, employment and independent living when planning for and developing transition goals as indicated in IDEA (NICHCY).

All children who have CP-associated impairments that affect learning and participation in school are eligible to receive special education services through IEPs as required by the IDEA. As stated in Sec. 300.320 of IDEA (1), the IEP should contain a statement of the child's Present Level of Academic Achievement and Functional Performance – also known as the PLAAFP. The PLAAFP statement should include information about how the child's disability affects involvement and progress in the general education curriculum (i.e., access to the same curriculum as typically developing students). In theory, the foundations of an IEP should be based upon the PLAAFP, as the purpose of the PLAAFP is to summarize the child's academic achievement, functional performance, and areas of need (Michigan Department of Education).

Figure 1: Flowchart of Key Concepts Discussed



Once a student's inability to access the typical curriculum is identified, the optimal solutions for adaptation, including either accommodations or modifications, must be determined. Accommodations and modifications are types of adaptations that are made to the environment, curriculum, instruction, or assessment practices so that students with disabilities can be successful learners and participate actively with other students in the general education classroom and in school-wide activities (Parent Educational Advocacy Training Center). Although accommodations and modifications both involve adaptations, they differ from each other in fundamental ways.

Accommodations are adjustments made to classroom instruction and testing to ensure that children are able to meet expectations of the general education curriculum. They often are defined in a student's IEP. Accommodations do not alter or lower the standards or expectations for learning; they simply change *how* a student obtains access to information as well as demonstrates learning. For example, allowing a child additional time to take a test would enable that child to demonstrate learning of the same material in a different way, and as such would be an accommodation. Accommodations may also include adjustments to the testing environment or the use of aids such as page magnifiers or large diameter pens that may allow a student to better demonstrate skills or abilities.

Modifications are changes in the curriculum or instruction that will affect *what* a child learns. Modifications may change instructional level, content, and/or performance criteria. For example, reducing the number of spelling words a child must learn each week is a change in curriculum that affects what the child learns, but still provides the opportunity for classroom participation. Although children with modified curricula are not expected to master the same academic content as others, they are provided the opportunity to participate in a meaningful and productive way in the general education classroom. Table 1 provides some examples of somewhat comparable adaptations that might be made in the classroom, and the headings under which those adaptations would fall.

Table 1: Examples of Accommodations and Modifications

	Accommodations		**Modifications**
	Test taken orally		Use of calculator on math test
	Large print text		Alternative texts on same topic
	Additional time for test taking		Questions re-worded using simpler language
	Peer support for note taking		Use of symbols versus text
	Use of computer for writing		Computerized spell check
	Tape record lectures		Outline vs. essay for major project

Access to literacy for students with disabilities has been an area of significant focus recently, both in research as well as in the educational setting (see Appendix B). For young children, accessible literacy learning is particularly important. Factors that affect early literacy planning decisions should include a description of prior attempts at reading instruction and the child's response to that instruction. There also may be need for a critical discussion about whether literacy is an appropriate goal for the child. If not, how best do we present information for optimal learning? There is an increasing research focus on outcomes measurement. As studies examine the effects of assistive technology access on reading acquisition, findings have clear implications for goals that pertain to reading remediation versus compensation. This type of goal-setting then affects planning for the most appropriate curriculum. Few guidelines exist to inform the decision regarding the use of technology in the classroom. How do we determine when a child's goals move from remediation to compensation (Edyburn, 2007)?

In addition to adapting curriculum materials, consideration must also be given to the amount of class time required by students with disabilities to access the adapted curriculum materials. A child with CP who uses an augmentative communication device typically requires significantly longer time to provide a response than does a child who can talk. Accommodating these needs within the classroom can be difficult. One solution might be to adapt core curriculum materials to make them accessible to all children. Materials could be disseminated to school programs with adaptations already created and available to those who need them.

The Center for Applied Special Technology (CAST), a nonprofit research and development organization founded in 1984, has designed an educational approach called Universal Design for Learning (UDL). This approach has 3 primary principles, all designed to expand learning opportunities for all children, especially those with disabilities. These principles incorporate alternative means for acquiring information, demonstrating knowledge, and actively participating in the classroom setting by offering flexible goals, methods, materials, and assessments that accommodate learner differences

Another resource for classroom accommodations for children with special needs is Response to Intervention (RTI), an educational model designed to help insure that all children receive the type of instruction they need to succeed. IDEA 2004 eliminated the requirement that students must demonstrate a severe discrepancy between intellectual ability and achievement in order to be eligible for special education services. RTI was developed as a means of earlier identification for children who are struggling with traditional instruction, and provides an alternative process for schools to design, implement, and evaluate educational interventions.

Addressing physical challenges in the classroom is an important part of developing an accessible curriculum. Issues concerning access to and within the classroom include transition from bus to classroom/classroom to bus, accessible entrances/exits, and a barrier-free environment to allow movement and access to materials. Adjustments and adaptations to the arrangement of the classroom as well as to specific activities may be necessary to provide a child with CP access to the general education classroom and curriculum. The PLAAFP should include information such as accessible aisle widths, desk height, and shelf height to support the notion of access (Doctoroff, 2001).

In addition to mobility and access to school materials, further adaptations may be required for specific activities. For example, children with CP who have speech and motor impairments may require an alternative means to answering questions within the classroom setting. This could range from something as simple as a button switch to activate a light, to sophisticated, interactive augmentative communication devices. Enabling a child to participate in these ways provides an opportunity for inclusion that might otherwise be overlooked.

General classroom activities also can be easily modified for children with motor impairments. For a child who has a physical impairment that affects one arm, holding down a sheet of paper with one hand while writing with the other might not be possible. Low-tech solutions to this type of situation could include a simple piece of tape or paper weight. Having one of the child's peers or an aide help to turn the pages of a book would allow the child to read from hard-copy books and may encourage socialization with peers. As referenced earlier, there are many types of assistive technology solutions for reading, including digital and audio versions of books (NIMAC/NIMAS). While these may seem like obvious or even insignificant adaptations, they are key components of an accessible curriculum. There are also numerous text-to-speech options that are compatible with most computers that enable reading of information available on the internet including various media sources (i.e. newspapers, magazines, etc.).

Social activities and friendships are a fundamental part of childhood, particularly in the school setting. The presence of friends and the ability to interact with peers should be made available to all children, including those who have CP. Children with CP are at risk, however, for social developmental difficulties (Nadeau & Tessier, 2006). For example, children with CP are more likely to experience verbal victimization than their typically-developing peers. Females with CP face increased social challenges as they are perceived by typically-developing peers to have a lower social status. They are more likely to be rejected by female peers, have fewer reciprocated friendships, and exhibit fewer social leadership skills, contributing to social isolation. Social components of education that tend to be overlooked with children with disabilities are the potential adverse effects of specific impairments on conversation and physical activity. A concerted effort should be made to ensure that necessary social adaptations are included in the child's education plan; for example, facilitated lunchtime interaction among typically-developing peers can be implemented by a school social worker, speech-language pathologist, or trained adult volunteer (Kneifel, 2009).

The playground is a major arena for social interactions and building peer relationships. A child with CP may be unable to participate in many traditional childhood games, such as baseball and kickball, due to motor or communication impairments. Despite the fact that children with CP may not be able to participate in the traditional ways, play and games can easily be adapted to incorporate all children. The game of baseball is a good example of a physical activity that can be adapted to foster peer relationships and socialization for all children. Modifications can be made such as using a designated batter and/or runner for a child with physical impairments. This sense of working as a "team within a team" promotes a sense of acceptance. Other roles that the child with CP can assume with appropriate adaptations are those of umpire, coach, team manager, or scorekeeper. At the very least, providing a team jersey and sitting in the dugout are effective ways to allow children with CP to actively participate and feel a part of a team.

The educational implications of a diagnosis of CP, although somewhat complex, need not be viewed as overwhelming or insurmountable. Children with cerebral palsy have the right to a free and appropriate public education, and a multitude of supports are available. There are multiple resources that can be identified and implemented in a broad variety of areas ranging from curriculum adaptations to alternative access to testing. Knowledge of these resources will provide much needed support for decisions related to educational programming and independence for children with CP.

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Appendix A

The writers of this document do not provide specific educational and/or medical advice and do not endorse any service(s) obtained through information provided in this appendix. The purpose of this appendix is to provide a resource list to parents and/or professionals who serve children with cerebral palsy. Use of these resources does not replace educational or medical consultation with a qualified professional to meet the educational and medical needs of you or others. Because of the nature of the internet information changes rapidly and, therefore, some information may be out of date at the time of access.

Institutions and Organizations

- **The Adapted Cognitive Assessment Lab (ACAL) at the University of Michigan -** http://sitemaker.umich.edu/acal/home

The ACAL is a research laboratory within the Department of Physical Medicine & Rehabilitation at the University of Michigan. The premise of this lab is to make standardized educational testing assessable to children with communication and motoric disabilities. Investigators in the ACAL conduct tests that separate the measurement of thinking capability from the physical demands of test taking – speaking, pointing, writing - through the use of assistive technology and computers. Families who are interested in enrolling their child to participate in research through the ACAL enroll their child directly on the lab's website or at the University of Michigan's *Engage Registry* at www.umengage.org/volunteer

- **The American Speech-Language-Hearing Association (ASHA)** - www.asha.org

ASHA is the professional, scientific, and credentialing association for 135,000 members and affiliates who are audiologists, speech-language pathologists and speech, language, and hearing scientists.

- **Rehabilitation Engineering and Assistive Technology Society of North America (RESNA) -** www.resna.org

RESNA's mission is to support people with a common interest in technology and disability. Members or RESNA include researchers, clinicians, suppliers, manufacturers, consumers and educators who work in nonprofit and for-profit settings. All members are dedicated to promoting the exchange of ideas and information for the advancement of assistive technology.

- **Michigan's Integrated Technology Supports (MITS) -** www.cenmi.org/mits/Home.aspx

The overall purpose of Michigan's Integrated Technology Supports (MITS) is to provide information services, support materials, and technical assistance and training to local and intermediate school districts in Michigan.

- **Michigan Rehabilitation Services (MRS) -** www.michigan.gov/mdcd/0,1607,7-122-25392---,00.html

The mission of MRS is to partner with individuals and employers to achieve quality employment outcomes and independence for persons with disabilities.

- **United Cerebral Palsy (UCP) -** UCP - www.ucp.org & UCP Michigan www.ucpmichigan.org

UCP is the leading source of information on cerebral palsy and is a pivotal advocate for the rights of persons with any disability. As one of the largest health charities in America, the UCP mission

is to advance the independence, productivity and full citizenship of people with disabilities through an affiliate network.

- **My Child Without Limits Support Community**
  www.inspire.com/groups/my-child-without-limits/about

The My Child Without Limits Support Community connects families, friends and caregivers for support and inspiration. The My Child Without Limits Support Community is sponsored by United Cerebral Palsy in partnership with Inspire**.**

- **Teen Cerebral Palsy Blog -** www.teencerebralpalsy.com

The goal of this website is to offer a place for teens with cerebral palsy to connect with other teens and share information.

- **Easter Seals (of Michigan) -** www.easterseals.com

Easter Seals has been helping individuals with disabilities and special needs, and their families, live better lives for nearly 90 years. From child development centers to physical rehabilitation and job training for people with disabilities, Easter Seals offers a variety of services to help people with disabilities address life's challenges and achieve personal goals.

- **Council for Exceptional Children (CEC) – Division for Physical, Health and Multiple Disabilities (DPHMD) -** http://web.utk.edu/~dphmd

The Division for Physical, Health and Multiple Disabilities (DPHMD) is the official division of the Council for Exceptional Children (CEC) that advocates for quality education for all individuals with physical disabilities, multiple disabilities, and special health care needs served in schools, hospitals, or home settings.

Electronic Text

- **Net Trekker d.i. -** mi.learnport.org

Net Trekker d.i. is available to Michigan teachers through Michigan LearnPort. This website contains a database of educational research articles. The websites allows the user to search by subject, title, author, language, Michigan's Grade Level Content Expectations (GLCE), reading level and much more. Net Trekker contains teaching resources, lesson plans and reference materials, and has a built in text to speech reader that reads aloud any text document in Net Trekker.

- **Bookshare** – www.bookshare.org

Bookshare™ is free for all U.S. students with qualifying disabilities. Student memberships are currently funded by an award from the U.S. Department of Education Office of Special Education Programs (OSEP).

- **Project Gutenberg -** www.gutenberg.org

Project Gutenberg stores electronic versions of books in the public domain from authors such as Shakespeare, Jack London, Lewis Carroll, and Edgar Allen Poe. These e-texts are available in the simplest form making them compatible with 99% of the software used around the world. Simply search for the book you want and click on the link to open a plain text version of the book.

- **The Digital Book Index -** www.digitalbookindex.org

This site is a portal to other e-text sites, providing links to over 141,000 full-text digital books from commercial and non-commercial publishers, universities, and various private sites. Most of these books, texts, and documents are available free and many others are available at very modest cost.

Resources for Locating Electronic Text

- www.greatschools.org/LD/assistive-technology/electronic-text-valuable-tool-for-students-with-ld.gs?content=988

This website provides resources for students with learning disabilities who may require electronic text. Electronic computer-displayed text can be an important resource for students with learning disabilities (LD), because it can be altered to meet their needs. A child with LD may benefit from changes to the appearance or organization of electronic text.

Text-to-Speech

- **ClickSpeak –** http://clickspeak.clcworld.net/downloads.html

CLiCk, Speak is a simple, mouse driven program that works with Mozilla's FireFox. Download the CLliCk, Speak add-on and it is added to your FireFox browser as a new tool bar. CLiCk, Speak highlights the text as it speaks. It has several voices to choose from and comes with multilingual support, which can be beneficial for students learning a foreign language who need to hear their foreign language web sites read aloud.

- **Natural Reader for PC -** www.naturalreaders.com

Natural Reader reads text directly from the web and can be used as a desktop TTS reader. NaturalReader reads the text aloud, (no need to copy and paste into new reader document) and can also be used as a full-document reader. It also provides additional support features such as highlighting each word as it is read. NaturalReader's appeal is its ability to convert text into clear, natural sounding voices.

Adjusting Text Presentation

- **Vu-Bar 4 -** www.fxc.btinternet.co.uk/assistive.htm

Vu-Bar provides the reader with an on-screen, adjustable, slotted ruler. This tool is great for students who often skip lines when reading or need a more focused guide on a text cluttered page.

- **WordFlashReader -** http://wordflashreader.sourceforge.net

This is an essential program for readers who have difficulty with visual discrimination, eye control, visual tracking or who find the text on a standard web page too overwhelming. WordFlashReader works by flashing each word, or chunks of words from the text sequentially onto the screen. The background color, font size and color, and text chunk size are fully adjustable.

- **Virtual Magnifier -** http://magnifier.sourceforge.net

Virtual Magnifier is perfect for students with low vision. It provides the reader with a magnifying glass that follows mouse movements. Move the lens around the screen to magnify any area of interest. After downloading, Virtual Magnifier installs an icon in your system's tray. This is also a great tool to use to zoom in on a specific part of a document.

Assistive Technology (AT)

- **AT and the IEP -** www.fctd.info/uploads//IEP_print.pdf

The Individuals with Disability Education ACT (IDEA) requires public schools to make available to all eligible children with disabilities a free appropriate public education (FAPE) in the least restrictive environment appropriate to their individual needs. This document explains the correlation between AT and the IEP.

- **AT and the Law** - http://www.fctd.info/resources/ATlaws_print.pdf

This website assists families in understanding how Federal law affects their child's access to AT through brief summaries of laws that affect the provision of assistive technology and special education services.

- **AT 101** - www.fctd.info/resources/AT101_print.pdf

This website offers parents and educators basic information about the importance of AT and how with proper assessment the use of AT can support independence.

- **Matching AT Tools with Individual Needs** - www.greatschools.org/LD/assistive-technology/matching-assistive-technology-tools-to-individual-needs.gs?content=968

This website guides the reader in selecting the appropriate technology for students with learning disabilities through careful analysis of the dynamic interaction between the individual, technology, task, and context.

- **Fact Sheets on Assistive Technology** - www.fctd.info/resources/index.php

The Family Center on Technology and Disability (FCTD) is a resource designed to support organizations and programs that work with families of children and youth with disabilities. They offer a range of information and services on the subject of assistive technologies. The FCTD have four new Assistive Technology Fact Sheets available on their website.

- **Center for Technology in Education (CTE)** - http://cte.jhu.edu

This website is dedicated to assisting parents and educators in removing barriers to achievement, especially for children with disabilities. It illustrates how to assess individual learning needs and how to implement assistive and instructional technologies that allow students to participate in daily academic activities and improve achievement.

Individual Education Program (IEP) and Individual with Disabilities Education Act (IDEA)

- **Accommodations, Modifications, and Alternate Assessments and the IEP** *http://www.greatschools.org/LD/school-learning/accommodations-IEP.gs?content=713*

This website describes accommodations, modifications, and alternate assessments, how and when they may be appropriate for a child with special needs, and how they affect instruction and assessment.

- **Bridges4Kids IEP Goals and Objectives Bank** - http://www.bridges4kids.org/IEP/iep.goal.bank.pdf

This 177-page document assists parents and professionals in forming goals for children of all ages in the special education system. The Goal Bank allows users to locate specific goals as used in the eSIS SPED Full software. Content areas include English, functional academics, independent living, mathematics, mathematics readiness, motor, recreation and leisure, self-management and daily living, social emotional, speech and language, study skills, and vocational/career education.

- **Standards-Based Individualized Education Program Examples –** http://projectforum.org/docs/Standards-BasedIEPExamples.pdf

This document presents a seven-step process to be used in developing a standards-based IEP. Each step is followed by guiding questions for the IEP team to consider in making data-based decisions. The student examples contained in this guide provide an opportunity for educators and parents to think about and apply the steps toward developing and implementing a standards-based IEP.

- **Center for Educational Networking** http://www.cenmi.org

CEN is a statewide education information network offering products and services.

- **IDEA Partnership** www.ideapartnership.org

This Web site provides information about the collaborative work of more than 55 national organizations, as well as technical assistance providers, and state and local organizations and agencies. Together with the Office of Special Education Programs, the partner organizations form a community with the potential to transform the way we work. IDEA Partnership facilitates interaction and shared work across professional organizations addressing common issues.

- **IEP Overview** http://www.nichcy.org/EducateChildren/IEP/Pages/overview.aspx

This website defines the IEP process and assists in preparing first time parents of children with special education needs.

- **ERIC (Educations Resources Information Center)** - **Creating Useful Individualized Educational Programs (IEPs)** –

www.eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/16/d3/23.pdf
This digest was created by ERIC, THE EDUCATIONAL RESOURCES INFORMATION CENTER (1-800-LET-ERIC). It is a useful guide in helping individuals create IEPs that are in accordance with IDEA requirements.

- **IEP Goals: The Basics** - www.greatschools.org/LD/school-learning/individualized-education-program-iep-goals.gs?content=709

This website assists in writing annual, measurable goals within your child's IEP in specific areas of disability – academic, developmental, and functional. Goals represent what you and the other IEP team members think your child will be able to accomplish in his area(s) of disability - academic, developmental, and functional - in a year's time.

- **National Center for Learning Disabilities IDEA Parent Guide** - www.ncld.org/publications-a-more/parent-advocacy-guides/idea-parent-guide

An online guide for parents to the Individuals with Disabilities Education Act explaining the federal laws that underpin special education in every state. Teachers can use the guide to better understand the rights and requirements of their students with special needs.

- **National Dissemination Center for Children with Disabilities** - www.nichcy.org/Pages/Home.aspx

A project of the Academy for Educational Development, NICHCY offers information on various aspects of disability, including IDEA legislation.

- **National Early Childhood Center** - www.nectac.org/idea/idea.asp

The NEC Center website offers a series of documents that review the statutory changes in IDEA 2004. The site also offers links to summaries of changes in the law prepared by various groups.

- **U.S. Department of Education: Model IEP Form** - http://idea.ed.gov/download/modelform1_IEP.pdf

This document specifies Part B regulations (34 CFR §§300.320-300.328) regarding the IEP content as well as procedures school districts must follow to develop, review, and revise the IEP for each child.

- **U.S. Department of Education – Office of Special Education** - www.osepideasthatwork.org/toolkit/index.asp

This online Tool Kit brings together the most current and accurate information, including research briefs and resources designed to improve instruction, assessment, and accountability for students with disabilities. The Tool Kit is intended to assist state personnel, schools and families in their efforts to ensure that all students with disabilities receive a quality education.

- **U.S. Department of Education, Special Education & Rehabilitative Services, IDEA 2004 News, Information and Resources** - www2.ed.gov/policy/speced/guid/idea/idea2004.html

This website offers up-to-date news, information and resources on *IDEA.*

- **Congressional Research Service – IDEA Analysis** http://www.cec.sped.org//AM/Template.cfm?Section=Home&WebsiteKey=ccc2b576-80bf-48af-8827-0acb530166fb

This website provides an analysis of the IDEA law published by Congressional Research Service, a part of the Library of Congress that serves as the research arm of Congress.

- **Wrightslaw** - www.wrightslaw.com

Parents, advocates, educators and attorneys go to IDEA 2004 at Wrightslaw for information about IDEA issues: child find, eligibility, evaluations, reevaluations, high stakes testing, IEPs, accommodations, alternate assessments, educational placements, transition, parental rights and more

Parent Advocacy and Listservs

- **CP Parent** - www.cpparent.org

The CPParent.org web site supports the CPParent email list. CPParent is a group of parents, caregivers and others who work with children with cerebral palsy.

- **Bridges4Kids** – www.bridges4kids.org

This non-profit parent organization provides a comprehensive system of information and referral for parents and professionals working with children from birth through transition to adult life.

- **Parent Advocacy Coalition for Educational Rights Center** - www.pacer.org

PACER's mission is to expand opportunities and enhance the quality of life of children and young adults with disabilities and their families, based on the concept of parents helping parents.

- **Family Center** - www.fctd.info/about/purpose.php

Family Center is a resource designed to support organizations and programs that work with families of children and youth with disabilities. The Center offers a range of information and services on the subject of assistive technologies for organizations, parents, educators and interested friends.

- **Michigan Alliance for Families** - http://michiganallianceforfamilies.org

Michigan Alliance for Families provides information, support and education to families of children and adults with disabilities from birth to age 26 who are in the educational system. The purpose of the project is to increase the involvement of families in their children's education and the educational system in general.

- **Partners in Education** - www.partnersinpolicymaking.com/education

This 6 hour, self-directed e-learning course helps parents with children who have developmental disabilities to understand and maximize the benefits of special education services and inclusion for their children.

- **Council for Exceptional Children** - www.cec.sped.org//AM/Template.cfm?Section=Home

CEC is the largest international professional organization dedicated to improving educational outcomes for individuals with exceptionalities, students with disabilities, and/or the gifted. CEC advocates for appropriate governmental policies, sets professional standards, provides continual professional development, advocates for newly and historically underserved individuals with exceptionalities, and helps professionals obtain conditions and resources necessary for effective professional practice.

- **IESNews Listserv** - www2.ed.gov/about/offices/list/ies/signupform.html

IESNews Listserv is a free service offered by the U.S. Institute of Education Sciences. Information available on this IES Web site includes the latest information on such topics as funding and training opportunities, IES-sponsored research, new publications, and education facts and figures from the National Center for Education Statistics.

- **Great Schools** - www.greatschools.org/LD.topic?content=1541

This website provides support, resources and information free of charge to parents of children with learning disabilities and to children themselves.

- **The National Organization on Disability (NOD) e-Newsletter** - www.nod.org/index.cfm?fuseaction=page.viewPage&pageID=26

The NOD e-newsletter includes news addressing the participation and contributions of people with disabilities in all aspects of life, including news from NOD as well as disability news, information, and resources from a variety of national and international sources.

Appendix B

Federally Funded Reading Resources

- **National Reading Panel (NRP)** – a United States government body created in 1997 at the request of Congress and charged with the mission of evaluating the effectiveness of different approaches used to teach children to read. The subsequent NRP report that was released in 2000 was used as the basis for creation of the Reading First program, a part of the No Child Left Behind legislation enacted under then-President George W. Bush. This legislation has been the impetus for increased research into how to improve curricula in an effort to increase the number of children who are able to meet academic requirements each year. One aspect of this research involves ways to adapt classroom materials to make them more accessible to all children. For children with CP and associated speech and motor impairments, this becomes a critical and challenging task. www.nationalreadingpanel.org

- **What Works Clearinghouse (WWC)** – established by the U.S. Department of Education's Institute of Education Sciences (IES) in 2002, the WWC has become a central source of scientific evidence for what works in education. Among other functions, the WWC helps educators make informed decisions regarding the effectiveness of specific programs and interventions by providing rigorous reviews of current research. http://ies.ed.gov/ncee/wwc

- **National Instructional Materials Access Center (NIMAC)** - created under IDEA 2004, NIMAC is a federally funded, national electronic file repository that uses assistive technology to make core print instructional materials available in an electronic format. http://www.nimac.us

Accessible Reading Curriculums

- **E**arly **L**iteracy **S**kills **B**uilder (ELSB), Browder, D et al, 2007 - a program designed to accelerate reading development in students with moderate and severe cognitive disabilities that addresses the five essential components of reading identified by the National Reading Panel (2000). The ELSB promotes the use of grade appropriate literature through giving teachers a method to share stories. Assistive technology adaptations are incorporated throughout this scripted early literacy program. http://education.uncc.edu/access/RAISEProject.htm http://www.attainmentcompany.com/featured/elsb/

- **Project RAISE (Reading Accommodations and Interventions for Students with Emergent Literacy)** – a project developed by the University of North Carolina at Charlotte (U.S. Department of Education Contract #H324K04004) to evaluate the effects of the development and implementation of the **E**arly **L**iteracy **S**kills **B**uilder (ELSB). http://www.speechpathology.com/articles/article_detail.asp?article_id=337

- **Accessible Literacy Learning (ALL) Curriculum** –David McNaughton, and Janice Light, Pennsylvania State University, 2009 - A unique, e**vidence-based reading** curriculum designed to teach reading skills to students with a range of disabilities, including cerebral palsy, Down syndrome, autism and developmental apraxia. ALL is also

ideal for teaching reading to individuals who use augmentative and alternative communication (AAC). http://aacliteracy.psu.edu/AdditionalResources.html

Texts on Literacy

- ***Emergent Literacy and Language Development: Promoting Learning in Early Childhood***. Paula M. Rhyner, Ed., Guilford Press: New York, 2009. This text explores the connection between language acquisition and emergent literacy skills, and how this sets the stage for later literacy development.

- ***Language and Literacy Learning in Schools. Challenges in Language and Literacy***. Elaine R. Silliman and Louise C. Wilkinson, Eds., Guilford Press: New York, 2007. This text presents evidence-based practices for integrating language and literacy knowledge to enhance children's learning in today's standards-based classrooms. The authors identify models for effective collaboration among speech-language pathologists, general and special educators, and reading specialists.

Teachers' Perceptions on Special Education Preparation: A Descriptive Study

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Abstract

The purpose of this study was to analyze teachers' perceptions of their ability to instruct students with disabilities. A statewide survey was administered in Ohio to pre-service and in-service teachers regarding their perceptions of their teacher preparation programs and their respective ability to instruct students with special needs. Question and statements from the survey regarding their perceptions, concerns, and beliefs on instructing students with disabilities were disaggregated. Results of the survey indicated that both pre-service and in-service teachers felt adequately prepared to teach students with special needs but ongoing professional development lacked the support teachers desired.

Teachers' Perceptions on Special Education Preparation: A Descriptive Study

Teacher preparation has profound implications for educators in inclusive settings as they face increased pressure to perform to a wider set of roles than in previous generations (Avramidis, Bayliss, & Burden, 2000; Knight, 1999). Teachers now are expected to rise to the challenge of an increasingly diverse classroom (Peterson & Beloin, 1992), adjust their teaching strategies to accommodate varying learning styles (Kortman, 2001), and to be psychologically and practically prepared to take on the dynamic role of an inclusive educator (Mullen, 2001). Since teachers are the primary agents in the implementation of curriculum in inclusive classrooms their perceptions about their preparation must be considered as it is likely that these perceptions may influence their behavior toward and their acceptance of students with disabilities (Hammond & Ingalls, 2003). Further, the attitudes of instructing students with disabilities may have some bearing on the success of inclusive educational programs (Van Reusen, Shoho, & Barker, 2001).

The federal *No Child Left Behind (NCLB) Act* of 2001 and the Individuals with *Disabilities Education Improve Act 2004* (*IDEA*) are mandates that hold states and schools accountable for the academic progress of all students. At the heart of these two federal laws is the requirement that teachers be qualified to instruct all students within their licensure area. The inclusion of students with disabilities in the general education classroom has diversified the classroom more than ever. One of the pillars of NCLB is based on stronger accountability for all students' achievement (U.S. Department of Education, n.d.). Students are now expected to achieve academic proficiency for their grade level on state testing regardless of their academic ability. Although inclusion is becoming more and more common, some researchers are still skeptical of the effectiveness of inclusion (Jordan, Schwartz, & McGhie-Richmond, 2009). Teachers have reported feeling unprepared to work with students with disabilities within the general education classroom (Burstein et al., 2004). They also report that they have little time to collaborate with other teachers or make accommodations for students with special needs (Burstein et al., 2004).

However, there is evidence that students with disabilities can succeed in the general education setting as long as teachers use specific teaching strategies (Gibb, Tunbridge, Chua, & Frederickson, 2007).

In a review of the literature, it was found that there is no one characteristic or formula for a successful inclusive classroom (Burstein et al., 2004). Rather it is a combination of many different factors that must come together in order for a successful inclusive classroom to exist (Worell, 2008). Among some of the many factors that are associated with successful inclusion are positive teacher attitudes, ongoing professional development regarding special education, and a strong instructional background (Worell, 2008).

Positive Attitudes

In order for inclusion to be successful, both the general and special education teacher must have a positive attitude toward inclusion (Smith & Leonard, 2005). One study by Monsen and Fredrickson (2004) found that students taught by teachers who have positive attitudes towards inclusion were found to have higher levels of classroom satisfaction and lower levels of conflict compared to teachers with negative attitudes (Gibb et al., 2007). Bender, Vail, and, Scott (1995) found that negative teacher attitudes towards inclusion can ultimately cause the school to fail in implementing successful inclusive programs.

Professional Development

In order for inclusion to be successful, all teachers must have a strong knowledge base about their students' disabilities, educational needs, and what accommodations or modifications should be provided (Worrell, 2008). However, general education teachers often feel unprepared to include students with special needs within their classrooms (Burstein et al., 2004). Teacher preparation programs and professional development that focus on preparing teachers to work with students with disabilities are critical for student success. In a study which included 56 middle school general educators in a southeastern school district, 41.5% of teachers that had been teaching for an average of 13 years reported that they had not taken any courses focusing primarily on how to teach students with disabilities (deBettencourt, 1999). This same study found that the more special education classes a teacher had taken, the more frequently they used different types of instructional strategies that helped their students with special needs learn in their inclusive classroom (deBettencourt, 1999).

Ongoing professional development that focuses on inclusive practices is critical for student success (Worell, 2008). In a 2004 study of two southern California school districts that followed a model of change to promote inclusive practices, researchers found that districts which provided extensive professional development activities to general and special education teachers had positive outcomes (Burstein et al., 2004). In this study, a three year professional development training that met three to five days per week to focus on how to implement inclusive practices resulted in participants reporting that the staff development was imperative to their preparation for inclusion because it gave them the knowledge and skills for implementation.

Strong Instructional Background

In order for students with disabilities to have access to the general education curriculum, it is critical that teachers use effective teaching strategies (Fox, Farrell, & Davis, 2004). Corbett's (2001) found that teachers in an inclusive primary school used multiple teaching strategies at

various levels in order to assure active participation by all the students. Stockall and Gartin's (2002) study of an award winning Blue Ribbon inclusive school, found that teachers facilitated active student participation by forming cooperative groupings that included mixed ability levels and individual responsibilities within the group. Students in the groups were cooperative and encouraging to students with disabilities and often included them in social situations. Teachers in this study frequently modified the curriculum and the amount of work required so that students with disabilities could be successfully included.

As noted in the literature, positive teacher attitudes, ongoing professional development regarding special education, and a strong instructional background are critical for the success of students within inclusive classrooms. If students with disabilities are to have access to the general education curriculum and be successful in inclusive settings, it is critical that general education teachers have the skills to work with struggling students (Smith, Robb, West & Tyler, 2010). Legislation such as NCLB and IDEA hold teachers accountable for the success of all students. Therefore, teacher preparation programs must rise to the challenge of assuring that all teacher candidates graduate with the knowledge, skills and disposition to meet the increasingly diverse classroom.

Method

This study explored teachers' perceptions on their preparation to instruct students with disabilities. The study was driven by the following research questions:

(1) Do pre-service and newly hired teachers perceive their teacher preparation program provided a strong foundation for meeting the needs of children with disabilities?

(2) Do newly hired teachers perceive that professional development on inclusive practices was useful in instructing students with disabilities?

Data compiled by Ohio's teacher training Institutions of Higher Education that participated in a statewide survey know as Teacher Quality Partnership (TQP) in 2006-2007 was analyzed for this study. TQP was a comprehensive, longitudinal study of the effectiveness of teacher preparation for pre-service and in-service teachers for the State of Ohio (TQP, 2008). "All of Ohio's 50 colleges and universities that provide teacher preparation programs have formed a consortium to identify how the preparation and development of new teachers effect the success of the students they serve" (Rosas & West 2009, p. 4).

Participants

Participants for this study represent two populations: pre-service undergraduate students and in-service teachers. The pre-service teachers consisted of individuals who were seeking their first general or special education teaching license at the elementary, middle and/or high school level in an Ohio institute of higher education. In-service teacher participants were novice teachers who graduated from an Ohio Institutions of Higher Education within the past two years and were teaching general or special education at the elementary, middle and/or high school level. All participants included in this study volunteered to participate in the Ohio statewide Teacher Quality Partnership (TQP) Study. Pre-service teachers completed the survey during their final semester of their teacher preparation program during the academic year of 2006-2007. The in-

service teacher were recruited by letter and asked to participate in the statewide TQP study during the academic year of 2006 - 2007.

Survey Instrument

The survey used in this study was developed by the TQP research group. This research group consisted of faculty representing Ohio's Institutions of Higher Education that offered teacher preparation programs. The survey was comprehensive and consisted of statements regarding perceptions and beliefs about teaching; the quality of their teacher preparation; teaching concerns; and for in-service teachers their perceptions of professional development and mentoring. Using a 5-Point Likert scale, each participant was asked to rank statements ranging from 1 to 5. Pre-service teachers were asked to complete the 11 page survey with approximately 167 questions/statements during the final semester of their program of studies. Most pre-service participants completed the survey during their student teaching seminar meeting. The in-service teachers were contacted through a letter requesting their participation in the survey and asked to complete a 21 page survey with approximately 361 questions. The TQP survey has been administered to Ohio's pre-service teachers since 2004 and to in-service teachers since 2005. Since 2007, there has been three distribution of the survey with approximately 7,000 teachers completing the survey. While specific reliability data was not available, the researchers from the TQP study (Loadman, 2007) have assured that the survey is a reliable instrument and that mean scores across the three years of administration have been very similar. An analysis of variance, assessing statistical differences from the previous groups were completed and revealed that the survey had a high reliability for all previous groups that took the survey.

For the purpose of this study, only questions and/or statements on teachers' perceptions of their teacher preparation programs regarding skills and knowledge to instruct students with disabilities, and staff development perceptions followed by the participants' ratings were disaggregated from the data set. Questions and/or statements were grouped into three areas. The first area consisted of six questions or statements pertaining to the teacher participants' perception of their readiness to teach students with disabilities, that is how they perceived their teacher training institute prepared them to work with special education populations. The second area consisted of four questions pertaining to staff development that the in-service teacher received regarding special education. Descriptive statistics were used to analyze the data.

Results

Demographics

The participants for this study consisted of two populations, pre-service and in-service teachers. All 50 Institutes of Higher Education in Ohio that prepare teachers participated in the pre-service survey during the 2006-2007 academic year. Demographic information obtained from the survey revealed that the pre-service teacher participants were primarily white, not of Hispanic origin (91%, n=5,306) and female (76%, n= 5168). These participants were teacher candidates seeking initial Ohio licensure in one or more of the following major Ohio teaching licensure areas: Early Childhood (Pre-K – 3rd grade), Middle Childhood (4th-9th grade), Adolescent Young Adult (7th-12th grade), and special education (K-12 grade).

The second population in this study consisted of in-service teachers who graduated within two years from an Ohio Institution of Higher Education that offered a teacher training program. The

in-service teachers were contacted via a letter requesting their participation in the TQP study. Demographic data from the completed survey indicated that the participants were primarily white, not of Hispanic origin (95%, n=1,159) and female (81%, n= 1,146). These teacher participants held one or more of the following major Ohio licensure areas: Early Childhood (Pre-K – 3rd grade), Middle Childhood (4th-9th grade), Adolescent Young Adult (7th-12th grade), and special education (K-12 grade).

Instructional Foundation for Teaching Students with Disabilities

In an effort to determine teacher participants' perceptions of how well they believe their teacher licensure program prepared them to instruct students with disabilities, six survey statements were disaggregated from the data. Using a 5-Point Likert scale, each participant was asked to rank statements ranging from (1) "Not at All" to (5) "Very Well. The first statement asked the teacher participants to rate how well their teacher preparation institute prepared them to address special learning needs and/or difficulties. Both pre-service (*M*=3.80, *S.D.* = 0.96) and in-service (*M*=3.66, *S.D.* = 0.99) teacher participants indicated that they felt their teacher preparation institute prepared them adequately to address special learning needs and/or difficulties. The second question, asked participants to rate how well they felt their teacher preparation program prepared them to tailor teaching and curriculum to individual students' needs. Both pre-service (*M*=3.98, *S.D.* = 0.89) and in-service (*M*=3.72, *S.D.* =0.92) teacher participants felt that their professional preparation institute adequately prepared them to tailor teaching and curriculum to individual students' needs. The third statement in the survey revealed that both the pre-service (*M*=4.14, *S.D.* = 0.82) and in-service (*M*=4.01, *S.D.* = 0.89) teacher participant felt that their teacher preparation program prepared them well to choose differentiated teaching strategies to meet the needs of different levels of students. The fourth statement selected for analysis from the survey revealed that both pre-service (*M*=3.61, *S.D.* 1.05) and in-service (*M*= 3.44, *S.D.* 1.09) teacher participants felt adequately prepared to refer students for special assistance when appropriate. The fifth statement revealed that both pre-service (*M*=3.69, *S.D.* = 1.05) and in-service (*M*=3.50, *S.D.* =1.06) participants felt adequately prepared to work with a variety of students with special needs. The last statement selected from the survey indicated that pre-service (*M*=3.92, *S.D.* =1.12) and in-service (*M*=3.71, *S.D.* =1.25) teachers felt that their licensure program provided them with an adequate foundation for adapting and modifying instruction and curriculum for meeting the needs of children with disabilities. The findings are presented in Table 1.

Table 1

Teacher Participants Perception on Teacher Preparation to Instruct Students with Disabilities

Question/Statement	Pre-service Teacher *N*	Mean	*S.D.*	In-service Teacher *N*	Mean	*S.D.*
How well did your professional preparation prepare you to address special learning needs and/or difficulties	5267	3.80	0.96	1085	3.66	0.99
How well did your professional preparation prepare you to tailor teaching and curriculum to individual students' needs.	5251	3.98	0.89	1082	3.72	0.92
How well did your professional preparation prepare you to choose different teaching strategies to meet the needs of different levels of students	5258	4.14	0.82	1079	4.01	0.89
How well did your professional preparation prepare you to refer students for special assistance when appropriate (e.g. speaking, reading).	5251	3.61	1.05	1078	3.44	1.09
How well did your professional preparation prepare you to work with students with a variety of special needs.	5255	3.69	1.05	1078	3.50	1.06
My program gave me an adequate foundation in adapting and modifying instruction and curriculum for meeting the needs of children with disabilities (i.e. special education labels) in general-education classrooms.	5364	3.92	1.12	1151	3.71	1.25

Note: Scales are measured on a 5 Point Scale: 1 = Not at all; 5 = Very Well.

Overall the results of the survey indicated that both pre-service and in-service teacher participants felt that their teacher preparation program adequately prepared them to instruct students with special needs. In order to determine if there was a statistical difference between pre-service and in-service teachers' mean perception score, a *t*-test was completed. Results from the *t*-test (α=.05) indicated the mean differences for each question were statistically significant between pre-service and in-service teachers. Looking at the means of the questions, the most significant difference in response for both pre-service and in-service teachers involved the following question, "How well

did your professional instruction prepare you to choose different teaching strategies to meet the needs of different levels of students?" This was the only question that was rated by both pre-service and in-service teacher participants as "well". Table 2 presents the results of the *t*-test.

Table 2
t-tests of Teacher Participants Perception on Teacher Preparation to Instruct Students with Disabilities

Question/Statement	*t*	*df*	*p*	*MD*	*SED*	*95% CI*
How well did your professional preparation prepare you to address special learning needs and/or difficulties	4.3507*	6350	0.0001	0.1400	0.032	0.0768
How well did your professional preparation prepare you to tailor teaching and curriculum to individual students' needs.	8.6993*	6331	0.0001	0.2600	0.030	0.2013
How well did your professional Preparation prepare you to choose different teaching strategies to meet the needs of different levels of students	4.6734*	6335	0.0001	0.1300	0.028	0.0753
How well did your professional Preparation prepare you to refer students for special assistance when appropriate (e.g. speaking, reading).	4.8103*	6327	0.0001	0.1700	0.035	0.1006
How well did your professional Preparation prepare you to work with students with a variety of special needs.	5.8899*	53591	0.0001	0.1900	0.032	0.1265
My program gave me an adequate foundation in adapting and modifying instruction and curriculum for meeting the needs of children with disabilities (i.e. special education labels) in general-education classrooms.	5.6508*	6513	0.0001	0.2100	0.037	0.1370

α=.05; Equal variances not assumed
*significant t value. Note: Survey Results were composed of a 5 Point Likert Scale ranging from (1) Not at all to (5) Very well.

Professional Development

In-service teacher participants were asked to judge the usefulness of the professional development they received as new teachers. Four questions/statements regarding in-service teachers' perception were disaggregated from the TQP data and analyzed. Using a 5-Point Likert scale, each participant was asked to rank statements ranging from (1) "Not Useful" to (5) "Very Useful". The in-service teacher indicated that both the heterogeneous (*M*=3.50; *S.D.* 0.94) and the full inclusion (*M*=3.48; *S.D.* 0.99) training was somewhat useful. However, the in-service teachers indicated that professional development for addressing the needs of students with disabilities was not useful (*M*=.59; *S.D.*=0.49). In addition, the professional development that focused on the use of teaching strategies designed for diverse learners was also considered not useful (*M*=0.73; *S.D.*= 0.44). Table 3 presents the findings regarding professional development perceptions.

Table 3
In-service Teachers' Perception of Usefulness of Professional Development Related to Special Education

Item Description	Usefulness		
	N	Mean	*S.D.*
Teaching heterogeneous groups	410	3.50	0.94
Full Inclusion	354	3.48	0.99
Address the needs of students with disabilities.	951	0.59	0.49
Use of teaching strategies designed for diverse learners	950	0.73	0.44

Note: Scales are measured on a 5 Point Scale: 1= Not Useful; 5=Extremely Useful

Discussion

This study investigated the perception of pre-service and newly hired in-service teachers' on their preparedness to instruct students with disabilities. While both pre-service and in-service teachers appear that they felt their teacher preparation program adequately prepared them to instruct students with disabilities. A closer examination of the data revealed that in-service teachers within 1-2 years experience felt less prepared then pre-service teachers. In-service teachers consistently ranked each statement/question slightly lower than the pre-service teachers. In addition, the in-service teachers indicated that professional development addressing special education was not useful. Educational planners and administrators should incorporate practical and effective instructional techniques that would be useful to inclusive classroom. This view supports the recommendation by the Meyer Report (2001) in which the need for support, training for general education teachers is needed.

This study needs to serve as a wake-up call to teacher preparation programs to re-examine how they are instructing their preservice teaching candidates. Further initial instruction for teachers needs to be placed on differentiated instruction to meet the needs of diverse learners. It appears as if inservice teachers recognize an unmet need in their education once they leave the protected hall of the institution. In addition the rating of a three on a five point Likert Scale in this study indicates adequate preparation. If teachers are responsible for the academic preparation of others they should at least feel well prepared to meet the academic needs of students with disabilities within the inclusive classroom setting.

A limitation to this study was the lack of experience of in-service teachers; in-service teachers in this study only had two years of teaching experience. Further research would be needed to determine if experienced teachers with more classroom experience perceived their ability to teach students with disabilities beyond an adequate level. An additional limitation was the lack of disaggregated data grouping participants' licensure area according to their response. Another limitation of the study was the voluntary survey submission for teachers participating in the TQP study. The convenient sample of pre-service teachers completed the survey during their student teaching seminar whereas the in-service teachers were contacted by letter and asked to participate in the study. Thus in-service teachers' response rates were lower than that of the pre-service teachers. A larger sample of in-service teachers is needed in order to generalize results.

In summary, this study found that both pre-service and in-service teachers perceived they are adequately prepared to teach students with disabilities and in-service teachers believed that their professional development training was not useful in meeting the needs to instruct students with disabilities. Adequate perception of readiness to teach students with disabilities is unacceptable. No one wants to leave a child behind. Institutions of Higher Education must provide more competently prepared teachers to meet the needs of inclusive settings.

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Comparison of Metacognitive Strategies Used by Individuals with ADHD in Online Instruction

Victoria Brown

Abstract

The purpose of this study was to identify barriers that students with attention deficit/ hyperactivity disorder (ADHD) experienced in a web-based course delivery model and to determine what accommodations and metacognitive strategies individuals used to compensate for those barriers. This case study compared interactions of two individuals identified with ADHD to three other individuals without ADHD as they participated in an online lesson. Interviews were also conducted to obtain the participants' perceptions of how they prepared for class. The observations and interviews were analyzed to determine patterns of behavior. As a result of this study, an understanding of how two students with ADHD interacted with web-based instruction enhanced the understanding of how to use multimedia to support student learning in online environments.

Comparison of Metacognitive Strategies Used by Individuals with ADHD in Online Instruction

Technology advances have increased internet speeds and the availability open sourced educational content. With the use of social networking websites, teachers and students are able to create instructional videos and interactive lessons to share with others. With relative ease, teachers can locate educational material that meets individual needs of learners with different learning strengths. Electronic information can be converted into a variety of media formats unlocking the promise of independently accessing educational material by individuals with disabilities (Rose & Meyer, 2002). Lessons produced for the internet use color, graphics, tables, and multimedia simulations to provide interest and motivation in order to enhance understanding of content (Elder-Hinshaw, Manset-Williamson, Nelson, & Dunn, 2006; Ross & Schulz, 1999; Solomonidou, Garagouni-Areou, & Zafiropoulou, 2004). While the technology can provide increased access, individuals with disabilities also experience challenges in using computers. Instruction designed with interactivity requires individuals to connect learning objectives with navigational decisions through metacognitive strategies (Davidson-Shivers, Shorter, Jordan, & Rasmussen, 1999). Individuals with attention deficit disorder (ADHD) exhibit deficits in metacognition (Barkley, 1998; Borkowski, Peck, Reid, & Kurtz, 1983; Manganello, 1995; Purvis & Tannock, 1997; Voelker, Carter, Sprague, Gdowski, & Lachar, 1989) . This study explored how weak metacognitive strategies prevented individuals with ADHD from successfully interacting with instructional material delivered online through an interactive website.

The Internet and ADHD

Many of the features available for instruction on the internet distract individuals with ADHD, preventing them from fully benefiting from lessons delivered online. Distractibility experienced by individuals with ADHD attributes to their attending to all the stimuli in the environment simultaneously. Distracting stimuli in online environments consist of blinking text, flashing onscreen objects, scrolling marquee headings, and continual animation (Crow, 2008; Peters-

Walter, 1998). Interactive features such as pop-up messages or windows and graphics that do not enhance the content are also distracting (Crow).

Several accommodations are available to enhance the learning experiences of individuals with ADHD. Changes in fonts through the use of colors, bolding, and italics clue learners to important content and provide structure to the content (Meiert, 2009). Short reading passages convey information quickly before the learner becomes distracted, and audio clips for reading aloud those passages assist in staying focused on the content (Solomonidou et al, 2004). Finally, designing the navigation to be consistent across the instructional material reduces the decisions made by the learners, enabling them to focus on the content rather than on determining the best pathway through the instruction (Meiert).

Metacognition and Navigational Decisions

Use of metacognition is linked to navigational decisions that learners make as they selected pathways through instructional materials (Davidson-Shivers, Shorter, Jordan, & Rasmussen, 1999). Lessons developed for the internet are not necessarily sequential, creating the potential for learners to become disorientated and confused. Through various buttons and links, learners select a pathway through the instruction. As they progress through the lesson, learners evaluate the effectiveness of that pathway in accomplishing instructional objectives. If the learners are not accomplishing the learning tasks, they should revise their planned pathway to locate a more effective one. For these reasons, students with higher intellectual skills adopt better navigational strategies than those with lower skills (Anderson-Inman, Knox-Quinn, & Horney, 1996). Low ability students often become lost, causing them to view many screens without an educational purpose (McGrath, 1992).

Limitations in Developing Metacognitive Skills

According to the *Diagnostic and Statistical Manual of Disorders*, individuals with ADHD struggle with impulsivity, attention, and hyperactivity (APA, 2000). Symptoms exhibited by individuals with ADHD in these three areas impacts their ability to develop metacognitive strategies (Barkley & Murphy, 1998; Borkowaski, Peck, Reid,, & Kurtz, 1983). Specifically, individuals with ADHD exhibit difficulty in monitoring errors during learning (Schachar, Chen, Logan, Ornstein, Crosbie, Ickawixz, & Pakulak et al, 2004). As a result, they struggle with the executive functions of planning, execution, and evaluation of their actions in achieving their instructional goals (Oosterlann, Scheres, & Sergeant, 2004). Impulsivity, inattention, and hyperactivity also interfere with those with ADHD ability to practice metacognitive strategies, which leads to the use of immature metacognitive strategies as compared with their peers (Borkowski et al). Because of the lack of metacognitive strategies, it is possible that individuals with ADHD experience additional challenges in navigating instructional material online.

Method

Research Design

This case study explored the interactions of individuals with ADHD and those without any disability to answer two research questions. First, what barriers do individuals with ADHD encounter while interacting with instructional material presented in a multimedia learning environment compared with individuals without ADHD? Second, what metacognitive strategies do individuals with ADHD use to interact with instructional material presented in a multimedia

learning environment compared with individuals without ADHD? Each group was analyzed within the context of its learning environment. A cross analysis of the two groups was performed for comparison that allowed a better understanding of interactions by individuals with ADHD in a multimedia environment.

Because the purpose of the study was to understand the barriers individuals with ADHD faced, and the metacognitive strategies they used, the study activities were conducted at the different locations. The locations were places where the students would typically interact with their online class instruction. The first step in the process was to conduct a pre-interview to allow the observer to evaluate the type of technology the students were using to access the material, to determine if the individuals had a diagnosis of ADHD, to gain their perceptions of how they interacted with instruction online, the metacognitive strategies they used, and the accommodations, if any, they used when studying online. The second step was to observe the students as they interacted with an online multimedia lesson.

Lesson Development

The online lesson for this study was designed to include: (a) components that required the use of metacognitive strategies and (b) incorporated the recommended design elements identified in the previous research for individuals with attention deficit disorders. The topic for the lesson, universal design, was selected because the learners were not familiar with the concepts outlined in the universal design model. The participants were currently teachers or individuals who designed instruction for companies. Universal design provided the participants with a frame of reference in which to better design instruction for individuals with a variety of learning preferences. For this reason, the lesson topic was interesting to them.

To address the identified needs of the individuals with ADHD, the lesson had several built-in accommodations. The lesson was developed without using flashing text, icons, or images. Only one style of font, black Times New Roman, was used. Main topics were bolded and subtopics were bolded and italicized. Content was chunked into small pieces. The sections about the design principles contained a table with each principle clearly identified. Bullets were used to list important relevant facts. The lesson was developed using Gagne's (1985) nine steps of instruction: identifying of the purpose, stating learning goals, presenting the information, providing practice with guidance, applying knowledge, assessing outcomes, and connecting knowledge to future learning opportunities.

Several cognitive barriers were also embedded that would typically be in an online lesson. At the beginning of the lesson, links to scaffolding tools were provided that would support different learning styles. These tools were designed to provide clues to relevant information and would assist the participants in planning a pathway through the instruction. The learners could select a visual overview of the lesson by clicking on a link to a concept map or to a linear overview by selecting a PowerPoint presentation. The tools also included a set of keywords, the instructional objectives, and a list of guiding questions. At the beginning of the lesson, the students were informed about an assignment and a self-evaluative quiz available at the end of the lesson to establish a purpose for the lesson. Throughout the lesson, links provided additional information on the subtopics that clarified content knowledge. These links were not necessary for the completion of the assignments but they provided a distraction that typically occurs in a

multimedia environments. For any link the participants selected, they had to determine if the information provided enhanced their comprehension of the instructional material.

Participants

Requests for volunteers were sent to graduate students enrolled in education courses. Older students with experience in online courses were targeted for two reasons. First, older students would be able to articulate their thoughts and feelings about the strategies they were using in the coursework. Second, the older students would have actually practiced the strategies. By observing the barriers the older students encountered and the strategies they were using, teachers can develop adaptations and strategies for younger students as they interacted with online instructional material. Individuals selected for the non-ADHD group had no cognitive or learning disabilities. The individuals in the second group had a professional diagnosis of ADHD.

Participants without ADHD. Of the volunteers, five individuals were selected to participate in the study; three of them qualified for the group without ADHD. Below is a description of each volunteer.

1. James had a bachelor's degree in education, but quickly decided he did not enjoy teaching, so he went into banking. He then decided to obtain a master's in instructional design to complement his educational background while allowing him to move to the corporate world. At the time of the study, he had taken only one online course.
2. Paul was serving in the U. S. Air Force. He joined the service upon completing high school. While serving in the Air Force, he completed a bachelor's degree and was working on a master's degree. He believed the degree would assist him in obtaining employment after retirement from the Air Force. Paul had extensive experience since he had taken at least one online course per semester for three semesters.
3. Belinda joined the U. S. Navy upon graduation from high school. While in the Navy, she took classes; however, she did not finish the bachelor's degree until she left the service. She was working on a master's degree. She had taken three online classes.

Participants with ADHD. Two of the five volunteers selected to participate in the study met the qualifications for the group with ADHD. A short description of each volunteer is provided below.

1. Janet was completing her Ph. D. through an online program. Before working on the Ph.D., she was a special education teacher and director of special education in a small rural district. Many of her courses were offered online, so she had a great deal of experience in taking online classes. Janet had displayed symptoms of ADHD since childhood. She reported that her mother put her in a harness (this was before child harnesses were popular) because she would run away from her mother on trips or outings. On one occasion, Janet managed to slip away from an aunt, almost drowning in a nearby lake.
2. Michael was a special education teacher in a combined middle and high school setting. He was taking classes to complete his master's in special education. He had taken two online classes. He was diagnosed by a psychologist with ADHD as an adult. He had taken medication but did not like the side effects of weight loss, loss of appetite, lack of sleep, and bloated stomach. The medicine also made him feel wired.

Pre-interviews

Semi-structured interviews were conducted prior to the lesson observation. The semi-structured interview approach included preplanned questions to ensure consistency across all the participants. This approach provided flexibility to explore the participants' thoughts and feelings. All interviews were conducted in the participants' homes to verify they had an internet connection and a computer capable of accessing the lesson. The interviews with the two participants with ADHD allowed the disability impacted their interactions in both the classroom and with multimedia instruction. The interviews for the group without disabilities determined whether the participants had any disability that could potentially interfere with sequential interpretation of the data.

The Observation of Lesson Interaction

A lesson on universal design was created for a multimedia environment with online access. Observational information was collected in three ways. First, field notes captured the learning environments and researcher's impressions during the instructional session. Second, the participants were asked to verbalize their thoughts as they proceeded through the lesson, so the observer could note the reasons for their navigation decisions. At the same time, an audiotape recorded their statements. Finally, video audit trails were used to capture the students' interactions on the screen.

Post-Interviews

A follow-up interviews was also conducted after the semi-structured interviews and observations. The purpose of the follow-up interviews were to ensure that the interpretations made were an accurate representation of the individual challenges and metacognitive strategies used. This interview prevents the researcher's postitonality from being imposed upon the data collected, allowing an accurate picture to emerge about how individuals interact in a multimedia environment.

Data Analysis

Content analysis was used for coding and categorizing the audio and video trails of the lesson observations. To assist in the content analysis a set of codes assisted in identifying the barriers individuals with ADHD encountered in an online learning environment. The code categories were based upon the definition of ADHD in the *Diagnostic Statistical Manual IV-TR [DSM-IV-TR]* (APA, 2000). The *DSM-IV-TR* subdivides the symptoms of AHDH into three types of characteristics of impulsivity, hyperactivity, and distractibility. The codes and descriptions are listed in Table 1, Attention Deficit and Hyperactive Disorder Barriers.

Table 1

Attention Deficit and Hyperactive Disorder Barriers

Category	Behavioral examples
Distractibility	Difficulty remembering where items are located within the web page
	Makes careless mistakes
	Difficulty sustaining attention to tasks
	Difficulty following through on instructions and fails to finish tasks
	Difficulty in organizing tasks and activities
	Reluctant to engage in tasks that require sustained effort
	Finds detail-required tasks tedious and stressful
	Inability to complete tasks, particularly boring ones
	Difficulty in following both verbal and written directions
	Delays beginning tasks
Impulsivity	Difficulty in waiting; irritated when waiting in line
	Makes important decisions without complete information
Hyperactivity	Fidgets or squirms
	Difficulty sitting down
	Difficulty engaging quietly in activities
	Strong internal feeling of restlessness
	More comfortable with stimulating activities

The second set of codes identified and categorized metacognitive strategies at surface and deep levels. Table 2 shows the codes and behavioral descriptions used for the second content analysis. The coding was based upon merged definitions by Snow, Corno, and Jackson's (1996) of the surface and deep learning strategies and Weinstein and Mayer's (1986) classification system consisting of eight types of metacognitive strategies. Embedded into the categories and the levels are Dwyer, Tomei, and Mohr (2000) research on the developmental stages of metacognition.

Table 2

Possible Metacognitive Strategies at Surface and Deep Levels

Metacognition categories	Surface strategies	Deep strategies
Rehearsal	Moveds lips when problem solving or making observations	Engaged in rehearsal strategies
	Engaged in rehearsal strategies when instructed to but not successful when	Spontaneously use rehearsal strategies

	initiating the strategy	
Organizational	Had the ability to use organizational strategies but does not unless prompted	Used taxonomy categories
Comprehension monitoring	Used knowledge of themselves and preferred learning style to monitor comprehension Established learning goals	Used pre-reading questions Selected main idea and important details Accessed relevant prior knowledge Used knowledge of strategies Monitors the selection and use of strategies Used self-questioning

Metacognition categories	Surface strategies	Deep strategies
Elaboration	Experiences difficulty in spontaneously generating useful keyword images Uses imagery that is imposed	Used keywords and images whe trained Generalized elaboration strategi to other settings Added symbolic construction
Affective & motivation	Uses relation and positive self-talk t reduce performance anxiety	Monitored the selection and use strategies Used self-questioning Used keywords and images Eliminated both external and internal distractions to enhanc attention and concentration Established priorities Set a time schedule to reduce procrastination

*Drawn from research by Weinstein and Mayer (1986); Weinstein (2000); & Dwyer, Tomei, & Mohr (2000).

Results

The findings of the research are presented individually, followed by the findings as analyzed based upon the group without ADHD and the group with ADHD. Finally, the two groups are compared for differences and similarities.

Non-ADHD Group

James

Pre-interview. James identified the telephone, radio, hunger, email, and television as distractions to his online studies; these distractions randomly interrupted his thought processes. Studying at home, however, allowed him to focus on the online instructional material because he was actively involved in learning. In the classroom, James reported being distracted by the other students and that he struggled to attend over an extended period of time.

Lesson interaction. James carefully planned his approach to the lesson by turning off the television and radio. He read through the entire lesson and determined the difficulty of the activities. James then evaluated the support tools and clicked on all the links. He used two of the support tools, keywords and the PowerPoint presentation, to monitor his comprehension. This was James' first exposure to keywords in a online lesson. He appreciated the keywords because "it kinda gives you an idea of what the instructor thinks is important." Metacognition was crucial in James' interactions with the online material since he linked the learning objectives to one of the scaffolding tools available in the lesson. "I got to the self-test. I want to go through that (the PowerPoint) so that I know more before I take the test. I don't want to miss any. I figure this will be a good time to go to the PowerPoint." James used complex elaboration strategies by drawing on his background knowledge of how his daughter learned to relate to the instructional material. He was able to develop an approach to the learning tasks, execute that plan, and evaluate the plan's effectiveness. At times, James became impatient when the links opened slowly and became frustrated with the time consuming tutorial on designing a universally designed lesson available on the Center for Applied Special Technology (http://cast.org) website. Typically, he would have stopped the lesson and returned to that portion later. James experienced two barriers: the inability to attend over an extended period of time and impatience with downloading of web pages. He exhibited the surface strategy of talking to himself to keep himself focused as a method to monitor his attending behavior. Overall, James exhibited 24 deep learning strategies.

Post--interview. In the post-interview, James confirmed the observations as accurate. He stated that during a typical lesson, he would not have turned off his email or telephone. He also stated that he would have returned at a later date to review the content of the lesson and to work through the tutorial.

Paul

Pre-Interview. Paul experienced several barriers to learning. He reported distractions in both classroom and online environments. In the classroom, he found conversations held by other students distracting and rude. Family distractions occurred when he studied at home for his online class. To compensate, he often worked in the conference room at his office.

Lesson Interaction. Paul's primary objective was to accomplish the goals of the class in the most efficient manner possible by tracking his activities, printing instructional materials, keeping a notebook, using grading rubrics, opening all possible links before starting (to quickly move through the lesson), scanning the material to determine relevancy, and relating material to personal experiences. As Paul developed an understanding of the material, he immediately began

applied the lesson material to his current studies which is a complex comprehension monitoring strategy: "I am trying to think of how to apply it (universal design). As someone in training for instructional design, this provides some unique barriers to have multiple presentations for everyone." Paul became impatient with load time for web pages. As a result, he systematically opened all the links required to complete the lesson before returning to the instructional material. He then used the toolbar to toggle between pages.

Paul exhibited many deep metacognitive strategies. He used the guiding questions and objectives available at the beginning of the lesson to determine what material was relevant, a comprehension-monitoring strategy. The guiding questions and objectives "gave me something to look for" as he proceeded through the lesson. Paul used several top-to-bottom reading comprehension strategies by connecting the subtopics to the main topic. He related the ideas presented in the lesson to past work in instructional design and to the way his children learned the development of instructional material using the universal design principles. Paul demonstrated strength in comprehension monitoring by developing, executing, and monitoring a plan for meeting instructional objectives. Paul used deep learning metacognitive strategies 44 times and used a wide variety of metacognitive skills.

Post-interview. In his post-interview, Paul agreed with the assessment of his metacognitive use. He clarified that his goals during an online lesson were related to what the instructor wanted him to learn versus what he wanted to learn. In open-ended learning environments, he would have set his own learning goals, which may be different from the instructor's goals. For Paul, as a seasoned learner, focusing on instructor goals improved his efficient use of time.

Belinda

Pre-interview. Belinda experienced distractions in both the classroom and in working online. Belinda reported barriers in the classroom related to uncomfortable seats and people talking. Online distractions included household chores, telephone calls, and dropped internet connections interrupting her as she worked on the instructional material.

Lesson interaction. Belinda used several strategies to ensure success in the online environment. She organized her study material, printed off pages, reviewed objectives, established standards, used support tools, and elaborated on content. Belinda carefully read the lesson as it was presented to her. After reading the introduction, she clicked on the concept map and reviewed the PowerPoint presentation. She did not finish the online lesson because the work she had completed on the tutorial was lost when she accidentally closed the window. Belinda used one surface learning strategy in the comprehension-monitoring category by giving credence to the designer's expertise in judging the importance of links versus developing her own opinion. Belinda relied on advanced complex elaboration by personally identifying with the content through her grandson, who struggled with reading. Belinda became very excited about the application of universal design in the classroom. Her elaboration became integrated with attitude and motivational changes when she realized that her sister, who was a teacher, could use this information. "I could encourage her to get her own website. She can post homework assignments so parents have access to it. She could put links on there for further information and references for her students. This gives them that flexibility." As a result, Belinda spent more time exploring links than the other participants. She used 41 deep-learning strategies during the lesson.

Post-interview. In Belinda's post-interview, she indicated that she used advanced metacognitive strategies by implementing those strategies to accomplish learning objectives, even though she did not display those strategies during the lesson. She would also have returned to the lesson to further develop her knowledge on the universal design principles . She was very interested in the topic. To achieve that goal, she would have wanted to spend more time following the links available in the lesson.

ADHD Group

Janet

Pre-Interview. Janet experienced many barriers in both classroom and multimedia environments. Her barriers included high levels of distractibility, stray thoughts, forgetfulness, and hyperactivity. Janet found the classroom very distracting. Distractions included looking out the window, watching others taking notes, hearing sounds made by other students, squeaking chalk, the teacher moving too much or not enough. Her laptop helped her because she could type as the teacher talked. Janet also experienced distractions in the online environment. She looked out the window, wanted to care for her horses, watched television, and surfed the net.

Lesson interactions. Impulsivity was the main challenge that disrupted Janet's learning. She made 102 screen changes by following links irrelevant to the lesson and by using a search strategy that did not work for locating an answer to a high-level quiz question. Janet attempted to apply one computer strategy by opening all the links on the page. However, she later became lost looking for the right open window as she proceeded through the lesson. She repeatedly said, "Where am I?"

The lack of short-term memory was evident throughout the lesson. Janet struggled to remember anything long enough to follow through, including following directions. She frequently forgot where she was in the lesson. After opening a link Janet said, "Why was I doing this?" She followed a link to the Center for Applied Special Technology website which promotes universal design. No other student considered taking that link. Janet became frustrated when she could not log in to the site.

Janet experienced several other barriers. Impatience contributed to her becoming lost and confused. She often clicked on a web page and moved to the next click before the web pages even loaded into the browser window. Documenting the number of clicks was very difficult. The videotape had to be played a frame at a time to track the screen changes. Stray thoughts were triggered throughout the instruction. On three occasions, Janet left the instruction to check out the Detroit Red Wings hockey site or her email. On three other occasions, she had to leave the website because she was frustrated with the instruction and needed a break.

During the 45 minute online lesson, Janet's behavior resulted in 31 barriers. She averaged 1 challenge per 1.5 minutes. Her total barriers did not include the 103 window changes as a result of her impulsivity. Janet was opening or closing a window at an average rate of 1 per 26 seconds.

The combination of the two types of barriers translated into an interference in learning occurring every 19 seconds.

Janet attempted to use self-regulatory and deep metacognitive strategies; however, the attempts did not accomplish the learning goals. She opened links before she started the lesson to reduce time spent in loading the pages; never the less, she became confused as to which links she already visited. She also attempted to use the search button to assist her in locating answers to the self-quiz. The search button strategy would have worked for a factual question. In this case, the questions were designed to illicit metacognitive strategies so they required critical thinking. She repeated the search button strategy several times, even though the approach did not work. The goals Janet established for herself were unrelated to the lesson content, such as "I am going to find the answer to this question". Janet finally became so frustrated that she quit the lesson without finishing it.

Janet used one deep-learning strategy successfully: advanced-complex elaboration. She referred to her background knowledge about coping with a disability to understand the concepts of universal design. Janet used a number of surface-learning strategies. She monitored her comprehension through knowledge of her preferred learning style.

Janet's use of metacognitive skills was at the developmental stage. She used self-talk on seven occasions to monitor and to evaluate her progress, which is the first metacognitive developmental stage (Barkley, 1998; Weinstein & Mayer, 1986). Many times the self-talk statements were negative, for example,: "I failed at that." At times, Janet moved her mouse along a line of text to guide her reading, which is also a beginning metacognition monitoring strategy. Janet's behavior reflected the observations in previous literature that people with ADHD cannot successfully use metacognitive strategies because they are not able to remember the strategy long enough to execute it (Borkowski et al, 1983; Ylvisaker & DeBonis, 2000). Janet used 19 surface metacognitive strategies and 5 deep strategies in the elaboration category.

Post-Interview. In Janet's post-interview, she was surprised by some of the observations. She thought all learners clicked around the website. She thought she was demonstrating how efficient she was at using the computer. She acknowledged the challenges she experienced when learning online as noted by the observer. When asked how she did manage to learn material, Janet stated that she had to revisit a website many times and to use rote memory techniques to pass exams. Both strategies involved many repetitions before she could be successful.
Michael

Pre-Interview. Michael found taking classes on campus very difficult because he was unable to control his learning environment. He was distracted by the noises other students made and by visual distractions in the classroom. Even attempting to focus on a projector screen or a blackboard was difficult because his eyes wandered to other parts of the room. He was distracted by his own thoughts. He did not take courses which met for two to three hours because it was too difficult to sit that long. Test taking was a challenge for him because he forgot memorized facts. Instead of focusing on the questions, he worried about the time and felt a need to race through the test to finish.

Michael preferred learning online because he could control his learning environment. He developed several strategies to assist him. He used a laptop computer with a small screen to draw his eyes inward to the lesson. The laptop screen faced a corner with no pictures or wall hangings, thus limiting room distractions. The printer was placed in another room to give legitimate reason for moving around, addressing his hyperactivity. He believed the kinesthetic movement of typing and moving through screens enabled him to stay focused on the assignments. He previewed the lesson to chunk the content into small segments. If he did not understand the lesson, he contacted classmates or the instructor to receive a verbal explanation of the project. He relied on examples provided by the instructor. Studying online allowed Michael the choice to read from the computer screen or to print the material, providing variety in his interaction with the material.

Lesson Interactions. Michael exhibited several accommodations for his disability during the lesson. To prevent distractions, he turned off the television, email, and instant messenger. For the most part, he read the lesson in a very sequential manner. Only once did Michael review information and follow a link. When asked why he had followed only one link, he stated that he was worried about staying on task. The links had the potential to distract him. He seemed to enjoy the interactive nature of the lesson. Interestingly, Michael displayed less impulsivity of all the subjects. He patiently waited for links to come up which allowed him to be the only one of the subjects to actually complete the tutorial correctly. His lack of impulsivity seemed to assist him in implementing the accommodations he had developed for studying. At the end of the lesson, Michael mentioned that he did not utilize a couple of the strategies that he typically used, such as chunking into smaller segments and moving around at different time intervals during the observations.

During the lesson, Michael exhibited several barriers related to his disability. First, he had difficulty following directions. For example, he was unable to navigate through the self-test because he wanted to type in the answers rather than push the button. His difficulty in following directions could be attributed to his inability to put information into long-term memory. The directions for the lesson were at the beginning of the tutorial. Even though he read the directions, he was at a loss as to what to do upon the completion of the lesson. During the lesson, he was impatient with the learning material; as a result, he read very quickly. This could be an unconscious attempt to accommodate for his forgetfulness. By reading quickly, he was attempting to gather as much information as he could into short-term memory to use it in the assignment. In this case, Michael was able to answer the questions related to the last part of the lesson correctly but missed questions from the beginning of the lesson.

Michael's use of metacognitive strategies formed an interesting pattern. He rated highest in advanced basic elaboration because he was very aware of how his disability impacted his ability to learn, and he was able to monitor his comprehension through his knowledge of his learning style. For instance Michael stated, “I am impatient. I try to get through everything as soon as possible, especially when there is a lot of information. For me to learn something, it has to be done in pieces.” Michael also developed a plan based upon his accommodations and implemented it. He read the lesson straight through following only one link. The plan was partially successful. He was able to answer the last three questions on the self-test correctly. Otherwise, Michael used few metacognitive strategies in either the surface or the deep categories. Michael mentioned that he felt that he only just now is “learning how to learn.” Michael used advanced basic elaboration

strategies from the deep-learning strategies by using accommodations for his ADHD five times and by beginning comprehensive monitoring from the surface learning strategies ten times.

Post-Interview. In the post-interview, Michael confirmed the observations as accurate. He noted that he would have returned to the lesson at a later time to follow through on the links that were embedded in the lesson and to review the material. Repetition was key to his being successful in any learning environment. His ability to revisit the information was a key to his preference in taking online classes. He admitted he was just beginning to understand "how to learn."

Research Question 1: Barriers

The three subjects without ADHD reported few characteristics of ADHD. James and Paul reported difficulty attending but did not display problems with distractibility during the observations of their lesson. Paul mentioned difficulty sitting when he was stressed. Belinda reported fidgeting. The only characteristic of ADHD displayed by the participants during the lessons were difficulty in waiting while a web page was loading. All three participants clicked on buttons or accidentally closed an important window when a page did not load quickly. This impulsivity also prevented the subjects from completing the universally designed tutor created by Center for Applied Special Technology. All subjects also noted distractions in the classroom and eliminated those distractions in the online learning environment by turning off email, telephones, televisions, and radios.

Janet and Michael are two unique individuals with ADHD. As such, they interacted differently with the course material. Both individuals experienced barriers related to their ability to remember what they were reading or doing. Both individuals appeared to have difficulty in following directions. Their reason for not following directions appeared to be related to remembering what the directions were long enough to follow them. However, Michael was able to retain information in memory longer than Janet. Once he completed an activity, he would forget what his next step should be. Michael was able to implement accommodations for ADHD because he exhibited no characteristics of impulsivity. Michael's lack of impulsivity resulted in his being the only participant to complete the tutorial on the Center for Applied Special Technology site.

Janet's impulsivity appeared to impact her ability to implement strategies. She would click on links quickly, causing her to become lost. She would forget why she implemented the strategy or the information required to implement the strategy. Both individuals decided not to follow links. Michael’s reasoning allowed him to focus. Janet tried to log-on to one site when following a link and became confused by the links found on the opened page. Janet's confusion as she followed links contributed to her decision to stop. Both participants stated that they would return to the lesson at a later time to follow skipped links. After about 45 minutes, neither Janet nor Michael was able to continue. Janet said after 45 minutes, her “brain had reached its saturation point.” Michael was just not able to continue sitting to attend to the instruction. Neither subject used the cognitive scaffolding supports which could have guided their learning. Five types of supports were provided in the lesson: a concept map, PowerPoint presentation, keywords, learning objectives, and guiding questions. Janet did click on the concept map, then closed it quickly and Michael reported that concept maps were confusing to him.

Research Question 2: Metacognition

The individuals without ADHD used predominately deep-learning strategies, exhibiting only two examples of a surface-learning strategy. James used deep-learning strategies 37 times. Paul was observed using deep-learning strategies 52 times. Belinda used advanced basic elaboration strategies often and deep-learning strategies 49 times.

Interactions with the metacognitive elements of the lesson were also similar across all three participants. Each of the participants used at least one of the organizational support tools: the concept map, keywords, PowerPoint presentations, learning objectives, or guiding questions. Their preferences were different: Belinda and Paul used the concept map, while Paul determined whether information was relevant based upon the learning objectives. James thought the keywords and the PowerPoint presentation were useful. All three participants also followed a similar pattern in determining the relevance of the links to the Center for Applied Special Technology website. Each of them read the first linked web pages carefully. The participants scanned the next linked web page, and only read sections that were of interest to them. By the third link, they ignored or quickly scanned the web pages because they had realized that the links were just providing more detailed information which was not required to complete the assignments.

Even though each individual approached the lesson in his or her own unique way, similarities were evident across the variety of strategies used. All three participants indicated that they would have printed a portion of the lesson in an actual course. Of the deep strategies, all the participants were able to eliminate both external and internal distractions to enhance attention and used scanning to determine the relevance of the material presented in achieving their goals. The three participants were able to develop a plan, execute it, and evaluate its effectiveness. All the participants were aware of their strengths and weaknesses in learning.

Differences were noted between Paul and the other participants. He used the complex organizational strategies by structuring the material to make his learning efficient, and he was able to identify which information was important as it related to a goal. Belinda and James used basic organizational strategies of the taxonomy categories to organize their information. The difference could be attributed to Paul's learning objectives being slightly different. He was interested in completing the lesson in a time-efficient manner, whereas the other two students were relatively new to the online program and did not have as much experience.

The individuals with ADHD were very different from each other, which attributed to the difference in characteristics exhibited by each. Janet reported and displayed characteristics across all three categories of distractibility, impulsivity, and hyperactivity. Michael reported characteristics in the two categories of distractibility and hyperactivity. He did not report or exhibit impulsivity, which allowed him to develop accommodations and to implement those accommodations as he studied. Janet appeared to be more aware of available learning strategies due to prior experiences in educational environments. However, her ability to successfully implement the strategies was impaired by her impulsivity. Michael used more accommodations than learning strategies to be successful in his online learning classes.

Even though the two individuals with ADHD in this study were very different, similarities still existed between them. Both reported and exhibited a greater number of surface-learning strategies than deep-learning strategies. Janet and Michael used comprehension monitoring, metacognitive strategies because they were aware of their strengths and weaknesses in relationship to their ability to learn. Living with a disability seemed to heighten each individual's awareness in that category. Janet attempted to monitor her comprehension strategies five times. However, distractibility and impulsivity interfered with the successful application of those strategies, thus impacting her ability to learn relevant material.

Discussion

Comparison of the two groups ensured the observations made in the case study of students with ADHD were atypical. Patterns of interactions and metacognitive use indicated differences between the two case studies (see Table 3 for a complete analysis of the frequency of metacognitive strategies used during observations). The individuals with ADHD reported and displayed more surface-learning strategies and fewer overall learning strategies compared with the students without ADHD. The participants without ADHD reported and displayed more deep-metacognitive strategies than those with ADHD. Janet displayed an awareness of metacognition by implementing metacognitive strategies as often as one of the students without ADHD; however, her strategies placed her at the beginning stages of development and she was unable to use those strategies successfully. Michael used few learning strategies; nevertheless, he had several accommodations to address his learning needs. He was becoming aware of metacognitive strategies and how those strategies could be useful in learning. All the students were able to identify their learning strengths and weaknesses. These findings coincide with previous research that students with ADHD use fewer and less advanced metacognitive strategies than students without ADHD (Borkowsk et al, 1983; Cohen et al, 2000; Ylvisaker & BeBonis, 2000).

Table 3

Frequency of Metacognitive Strategies during Observations

	Non-ADHD			With ADHD	
	James	Paul	Belinda	Janet	Michael
Surface basic rehearsal	0	0	0	1	0
Surface basic organizational	0	1	0	1	0
Surface comprehensive monitoring	5	2	9	15	10
Total surface strategies	5	3	9	17	10
Surface basic organizational	0	0	3	0	0
Deep elaboration	0	4	0	1	0
Deep organizational	0	3	0	0	0
Deep comprehension monitoring	21	32	28	4	0
Deep affective and motivational	3	5	10	0	0
Total deep strategies	24	44	41	5	0

One other observation should be noted here. The lesson was designed according to the recommendations in literature to support the learners with ADHD or with cognitive disorders in an online environment. The lesson was chunked into small segments, font changes were limited, information was presented in a specific consistent format, no distracting images or animations were used, and metacognitive scaffolding tools were provided. Even with these adaptations built into the instruction, the individuals with ADHD still struggled with the acquisition of the material. Although both participants struggled with online classes, they both noted that they liked those classes because they were able to revisit the material until they understood it. Revisiting was not observed because of the artificial environment.

Recommendations for Multimedia Evaluation

Teachers can evaluate certain features of the multimedia instructional material to ensure that the selection of software minimizes the impact of ADHD symptoms upon learning. The instructional material should limit the number of links off the original page or screen of instruction to prevent confusion and accidental closing of important windows. With advances in network connectivity, it is possible to encounter slow download speeds when using telephone lines, 3G cell phone connects, or overloaded wireless routers. The slower downloads experienced in these situations can cause students with ADHD to click away from the instruction or to open extra windows while waiting for pages to load. Teachers should anticipate the need to prompt students to be patient at points in the program where media elements take time to load or to preload those elements before

students begin the instruction. To reduce frustration, teachers should pre-identify breaking points in long passages or lessons to address the short attention spans.

Online instruction should have several features to enhance the accessibility for individuals with ADHD. Due to short-term memory barriers, the instruction should be reinforced frequently through feedback or by applying the information in an instructional activity. Interspersing self-quiz questions throughout the lesson rather than just one quiz at the end of a section is another approach to reinforce content. Teachers should look for brief reviews of the previously presented information before beginning a new concept to assist in making connections to old material. The most relevant content should be at the beginning of the lesson so that students can be taught to focus on that material first. Teacher-created instructional materials should include multi-step instructions presented visually with bullets or numbered lists rather than include a sentence structure approach to compensate for the challenge related to short-term memory problems. Since individuals with ADHD struggle with using metacognitive strategies, the instruction could include strategies to guide them in the processes of memorization and problem solving while acquiring the content information. Online instruction with clearly defined instructional pathways reduces the decisions about which links to follow from the main instructional page.

Environmental adaptations can also be helpful for individuals with ADHD when using the computer for learning. For instance, using a computer with a small screen can help to draw the eyes to the instruction, especially when placed against a soothing background. Another approach is to identify legitimate reasons for the student to move around during instruction while staying focused on the learning task, such as stopping for a snack, a drink, or retrieving documents from a printer placed in another location. Teachers should remind students to limit distractions by closing email, instant messenger programs, and games to reduce temptation to be off task.

Limitations

This study had several limitations. The number of participants in the study was small. Each individual was different and displayed a different range of characteristics and learning strategies at differing levels of frequency. These differences impacted the ability of the individuals to use metacognitive strategies. Therefore, the results of this study cannot be generalized to the larger population. Another limitation of the study was the artificial simulation of the learning environment. Even though the study was conducted in the locations the students would typically study for an online course, the participants limited typical family interruptions, taking breaks, answering the telephone and email, and interacting on social websites, all of which might have not been eliminated under typical conditions. Furthermore, the lesson encouraged the use of metacognitive skills, the students may have used a different set of metacognitive skills for assignments requiring a grade.

Conclusion

Technology is constantly evolving and provides opportunities to continue exploring how the innovations can compensate for the barriers individuals with disabilities experience. Even when lessons are designed using best practices, individuals with ADHD still face barriers in learning environments that have multimedia elements. Because opening web pages can take a few seconds, all the participants clicked on other links within the pages. As Internet speeds increase, links will

open instantly. Will this improvement eliminate that challenge? Or will the faster internet just allow an impulsive people to open more links, causing them to become more confused? The faster internet will allow more multimedia components to be embedded within web pages which could possibly distract from the content or lead to increased comprehension though the interactivity multimedia could provide.

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