Science Teaching in Inclusive Classrooms

Theory & Foundations

Greg P. Stefanich, Editor

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Chapter 1
On the Outside Looking In

Greg Stefanich

This publication will blend research, theory, and practice to guide the classroom teacher in using teaching strategies that serve all students. It is designed as a resource book for practitioners. The primary goals are: 1) to instill in every teacher the patience, optimism, and generosity to bring out the best in his/her students, 2) to instill a commitment to make every child feel important and appreciated, and 3) to provide suggestions and checklists for self-analysis and reflection to assist any teacher seeking ideas in science teaching.

If American education is devoted to offer opportunities for *all* students to gain sufficient schooling to help them make life choices and become productive members of society, it is essential that *all teachers* have the knowledge to make appropriate adaptations so that every student, regardless of ability or disability, can become an active participant in the learning process. This basic statement brings to the forefront the complex nature of the issues of teaching science to students with disabilities. Because of that complexity, there is a great need to educate teachers to help them learn to make needed adaptations.

The complexity of how to educate all students persists. The degree to which schools are committed to developing opportunities for all students varies greatly. Some school subjects do offer individuals the opportunities for a greater quality of life and greater independence. However, some do not. For instance, exposure to the practical and expressive arts is a goal all but the most conservative educators accept, but the extent of the curriculum in these areas varies considerably within school districts and often depends on teacher performance and administrative dispositions. Should it be the responsibility of schools to provide an adapted curriculum for the most talented individuals in the arts? Should schools serve the vocational interests of the students? These questions relate to whether schools are committed to developing opportunities for all students or to serving a dominate subculture with a strong political presence. The early stages of the current education reform agenda, which capitalize on curriculum integration and technology, have forwarded some promising initiatives in defining appropriate standards and expectations for all students.

Certainly the academic areas of reading, writing, and basic computational skills are important for students to have. However, two central problems can be seen if the goal is to adapt curriculum so it is accessible to all students. First, much of what is currently taught is taught in the same way it was 50 years ago, in relative isolation to the content fields. Second, the skill practices needed to gain mathematical expertise can be augmented with user-friendly technology that is as available today as the wristwatch was 50 years ago. Yet, while adults often use technology to compensate for shortcomings in skills, like spelling and grammar, students with disabilities are too often denied the opportunity to use technology or have curricular adaptations made for them to help them express what they know and what they have learned. In fact, most standardized achievement tests do not allow the use of any assistive tools.

Science and social studies also present special problems. They promote special opportunities for developing resources, but they are both broad fields with an extensive and rapidly expanding knowledge base. Teachers will never agree on which segments of that knowledge base are of the greatest value for learners and future citizens. However, we do know that teaching the processes (tools of the scientist) is critical to having students develop the logic structures they need to understand the concepts in these disciplines.

Often, when it comes to educating all students the attitude today in a large majority of classrooms is "equal treatment is fair treatment," particularly for students who demonstrate academic achievement at acceptable levels. Many times the students most seriously shortchanged are those with disabilities who have average or above average academic performance. The only services they receive relate to general accommodations (like translators, assistive access devices, and interpreters). They receive little or no accommodations in science classrooms or laboratories. They are expected to be the "observers" or, if

they wish to participate, to become "experts" in providing their own suggestions for accommodation. Fair treatment isn't about equal treatment; it is about giving all students what they need to have a successful learning experience. Yet, the perception of "equal treatment" persists. School personnel, the families of school children, and even the students themselves generally believe:

- Students are responsible for their own learning.
- When students don't learn, there is something wrong with them.
- Schools are to determine what's wrong, with as much precision as possible, so students can be directed to the tracks, curricula, teachers, and classrooms that match their learning profiles.

These attitudes and beliefs must change. This publication is devoted to helping educators examine their roles and responsibilities in serving the needs of all students in our schools and to focusing on an awareness of unique conditions and needs of students with disabilities. Consider the few elements listed below as needed shifts in current educational practice to more inclusive education for all:

- A shift away from bureaucratic schools structured and organized according to ability, and a shift toward schools structured around student diversity with an instructional program that includes many different ways of organizing students for learning.
- A shift away from teaching approaches that emphasize the teacher as the one who disseminates content that students must retain, and a shift toward teaching approaches that emphasize role of the learner in creating knowledge, competence, and the ability to pursue further learning.
- A shift away from the school's role of providing educational services, and a shift toward a role of providing educational supports for learning.
- A shift away from trying to change or diminish a diverse school culture, and a shift toward valuing diversity.

Why Inclusive Education?

Most people's conditioning comes from a multitude of experiences with family and peers, plus observing and interacting with others in a variety of settings. Interpersonal communication skills are reflected in a person's ability to transmit and receive information from others. But the life experiences for most persons with disabilities are significantly different than those of the general population. Their opportunities to experience and fully adjust to the mores of the majority culture are usually much more limited. In cases of sensory and/or processing deficits, the disabled person may not process experiences in the same way as the general population. The nuances of interpersonal communication are highly sophisticated, and even small deviations can transform feelings of trust and confidence to feelings of skepticism and avoidance.

Many elements of this day-to-day social integration may present special challenges for students with disabilities. In the case of congenital disabilities, the relationship with the mother and family may have been disruptive due to the uniqueness of the situation. Interactions with the extended family may also be influenced. During early childhood, the quality and extent of interactions with other children and with the greater community outside the family may be significantly affected. During later childhood, group games and team activities are critical for effective social development. Students with disabilities are often excluded because accommodations are necessary to participate as a team member at the same rate or pace of others in the group. Adolescence has some special challenges as individuals investigate interactions involving intimate relationships with a member of the opposite sex. These settings are where adolescents discover interactions that are bonding, interactions that create negative perceptions, and interactions that create appropriate steps to move a relationship from one of acquaintance to one of love and caring. Yet students with disabilities are often excluded from the gatherings and parties where these interactions are played out.

Some things are changing. The personal computer has dramatically helped increase participation for persons with disabilities as new adaptations emerge from improved technology and engineering. This

has allowed many persons with disabilities to greatly improve their receptive and expressive communication, possibly reducing the ordinate number of behaviors and interactions they must work through on a daily basis. However, many of these adaptations are expensive, and non-disabled individuals with narrow views on civil and human rights may perceive this expense as being unfair or detracting from the needs of the general student population.

Because of the special challenges of social integration for people with disabilities, the educational environment is an ideal setting to blend together persons with physical, cultural, emotional, and intellectual diversity into a cohesive, mutually supportive group. Group synergism can become more powerful than the collective output of each person acting independently. In a democracy, this is what society is searching for and what businesses seek in their employees. Why shouldn't it be the essence of what we wish to accomplish in schooling? To accomplish these outcomes, the talents and abilities of *everyone* must be considered. The environment and interactions must be adjusted and modified to meet the capabilities and potentials of each individual.

Signature Feelings

To begin understanding how a school setting can become a supportive, inclusive learning community for all students, educators need insight into why their students feel/react as they do. Signature feelings are one major element of everyone's personal abilities to set and reach goals and to feel part of a community.

Signature feelings are inclinations, often unconscious, that have a significant effect on decisions individuals make about relationships. These feelings are often imprints from one comment or one episode that influence choices concerning interactions. These feelings often result in stereotypes (i.e. you can't trust..., ...has problems with alcohol) and inappropriate generalizations. They affect personal decisions (i.e. the comment overheard from your mother in a telephone conversation with your aunt—"...is a nice girl but she is not very good in mathematics") regarding career choices and goal setting. These signature feelings become carried out in everyday life. They relate to those you greet on the street or who you interact with in social situations and they relate to your academic dispositions (i.e. "I shouldn't take advanced algebra; I'm not very good in math"). They affect whom you make eye contact with, the areas you migrate to, and whom you avoid in a social context.

Persons with disabilities experience many challenges and disappointments resulting from the signature feelings they get from others. This often narrows their opportunities in interpersonal relationships, influences their choices of independence over interdependence, and limits their personal and professional lives.

Consistency is critical in nurturing social behaviors. However, persons with disabilities frequently experience inconsistency because adults and even peers often vary their interactions based on prejudices and attitudes in a social context. To perceive trust but experience avoidance can be a dehabilitating interaction for an individual. The result of inconsistent social overtures often creates signature feelings such as not trusting your dispositions of acceptance, or expecting the pain of avoidance if a social context changes. The long-term result often becomes to play relationships "close to the heart" rather than confidently reaching out toward collaborative opportunities. Yet skills of confidence and trust are the exact skills that enable people to advance professionally and move through the management hierarchy.

The role of educators is critical in nurturing the interpersonal development of students with disabilities. Professionals in each educational context need to work vigorously to refocus their signature feelings about students with disabilities to become more inclusive and more accepting in their teaching. Part of being a professional means educators have a responsibility not only during work, but during all 24 hours of a day. They must constantly be proactive in modeling inclusive behaviors in their personal lives. Cultural change takes place when those most visible in society model behaviors that improve the quality of life for everyone.

Meeting the social-emotional needs of all students is difficult and some may perceive it as being outside the arena of appropriate educational services. To address these needs one must consider not only the generally accepted norms of mutual cooperation and respect, but also other elements such as

etiquette and cultural values. Many students with disabilities (particularly those with physical disabilities, learning disabilities, and attention deficit disorders) have an input deficit or processing deficit which affects their ability to understand the subtle, and sometimes the obvious, messages in an interaction. Individuals with social-emotional anomalies are also more likely to experience inconsistencies in feedback concerning relationships. So, having an opportunity to engage in private interactions can be where those with limited social experiences gain the capacity to feel comfortable and secure in other informal social settings. The social context of the school should be safe and secure for all those present and assistance should be provided to help those who experience social anxieties.

However, most people are generally inclined to ignore the need to nurture appropriate social experiences for persons with disabilities. This inclination becomes more obvious when one looks at social events through another set of glasses. For the past 20 years over 10% of the U.S. school population has been identified as having a disability. This percentage is gradually increasing and will likely approach 15% in the next decade. However, in social occasions the percentage of persons with disabilities is significantly underrepresented. The next time you attend a professional conference or social gathering look over the group and decide what percentage of those present have a disability. In many cases, one will find the individuals with disabilities who are present and comfortable in a social context acquired the disability as adults. A large percentage of persons who have special life challenges avoid social contexts where their disabilities will affect their interactions. No one appreciates being rejected, and these dispositions are frequently transmitted in group situations, particularly when significant numbers of the people are unfamiliar with each other. Social experiences are frequently much more traumatic and have more long lasting avoidance responses (many times physical) than physical challenges related to disability accommodations.

In general, persons with obvious physical disabilities receive fewer negative overtones than those with "invisible disabilities." In fact, it is not unusual to hear in private conversations people discuss those with "advantaged disabilities." Some people consider “advantaged disabilities” to be deviate maneuvers by guardians or the individuals themselves to use a disability label to leverage additional services or preferential employment conditions. People usually react with surprise, and often disbelief, when they are told that persons with disabilities are not a "protected class" in the work place as are females and minorities. The Individuals with Disabilities Education (IDEA) and Americans with Disabilities Act (ADA) essentially extend equal opportunity for those with disabilities so they can experience the same services and opportunities that have always been accessible to the general population. They are not receiving something extra; they are gaining access to what the general population has taken for granted as being universally available. American schools purport to provide an appropriate and challenging assortment of educational opportunities for all citizens. In the case of students with disabilities, this may often result in a substantive expense, just as medical or legal expenses are accrued if a person encounters an illness, accident, or a miscarriage of justice. Even so, everyone should have a right to pursue happiness and to fully experience the resources made available to the general citizenry.

Legislation from PL 94-142, SB 504, ADA, and IDEA 1997 are all initiatives to provide equal opportunities for persons with disabilities to experience the same full and independent life available to the general population. To have the ability to use language and numbers to acquire information and make decisions is a tremendous advantage in modern society. The purpose of education in America is to develop these abilities in *all* youth, not only those who fit the general norms. To extend special services to those who are not fully developing these skills in a traditional delivery system should be as natural as changing your walking path when there is an obstacle ahead. The essence of decision making is to modify and adjust in order to obtain a positive outcome.

Historical Framework for Educating All Students

Background

The 20th century has shown marked improvement in the quality of life for persons with disabilities. Initial efforts towards inclusion provided opportunities in the private sector, with impetus towards vocational rehabilitation coupled with more extensive reforms stimulated by civil rights legislation. In 1918 the Soldier's Rehabilitation Act was passed which provided for vocational retraining of disabled veterans. The Vocational Rehabilitation Act of 1920 extended the same vocational benefits to civilians. Initially limited to those with "physical disabilities," the Act had to be renewed annually until 1935 when rehabilitation received permanent status under the Social Securities Act. The Vocational Rehabilitation Act of 1943 expanded services to include medical and physical restoration devices and to include those with mental illness. The Vocational Rehabilitation Act of 1954 further enhanced opportunities for Americans with disabilities to receive educational opportunities commensurate with their interests and abilities.

With the emergence of the Department of Health, Education, and Welfare in 1953, along with improved services through state and community rehabilitation programs, it became viable for persons with disabilities to function as an included constituency in American society. In 1965, Public Law 333 established behavioral disabilities and cultural and economic deprivation as handicapping conditions, enabling these individuals greater access to training, rehabilitation services, and self-help programs.

The Rehabilitation Act of 1973 opened many doors for persons with disabilities. Under Section 502 of this legislation, the Architectural and Transportation Compliance Board was established which helped reduce architectural barriers and provided technical assistance. Section 504 prohibited discrimination in education and employment with equal access to programs and services for persons with disabilities.

Much stronger legislation, the Americans with Disabilities Act (ADA) of 1990, provided employees with disabilities legal protection against discrimination in public and private arenas. Through ADA, the responsibility for reasonable accommodation rests clearly upon employers. Those who fail to comply can be sued for compensatory damages. This legislation provides more than 43 million people with disabilities the same civil rights protections provided on the basis of gender, race, and religion.

It took over 50 years from the Vocational Rehabilitation Act of 1920 to reach the needs of *all* children in our schools. In 1975, Public Law 94-142 (the Education of All Handicapped Children Act) guaranteed free, appropriate public education for all children with disabilities. Contained within this legislation are the rights of children to receive an education in the least restrictive environment.

These mandates make it clear that a person with disabilities has a right to access regular education programs if such programs are appropriate with the addition of supplementary aids and services. Although some progress has been made in more use of technology, little significant progress has been made to familiarize general classroom teachers with their responsibilities toward meeting the needs of all students. Interventions such as creating and using adaptive materials, modifying lessons and strategies, modifying the laboratory environment to allow full participation, and adapting evaluation of students with disabilities are still perceived as responsibilities left to special educators.

Recent findings in educational research appear to support inclusion as a more desirable alternative than segregated instruction for students with disabilities. Ferguson and Asch (1989) found that the more time children with disabilities spent in regular classes, the more they achieved as adults in employment and continuing education. This held true regardless of gender, race, socioeconomic status (SES), type of disability, or the age at which the child gained access to general education. Research reviews and meta-analyses known as the special education “efficacy studies” (Lipsky & Gartner 1989, p. 19) showed that placement outside of general education had little or no positive effects for students regardless of the intensity or type of disability. In a review of three meta-analyses that looked at the most effective setting for educating students with special needs, Baker, Wang, and Walbert (1994) concluded that “special-

needs students educated in regular classes do better academically and socially than comparable students in noninclusive settings" (p. 34). Their review yielded the same results regardless of the type of disability or grade level.

Regarding students with severe disabilities, Hollowood, Salisbury, Rainforth, and Palombaro (1995) found including these students was not detrimental to classmates. Other researchers (Costello, 1991; Kaskinen-Chapman, 1992) found such inclusion enhanced classmates' as well as their own learning (e.g., Cole & Meyer, 1991; Strain, 1983; Straub & Peck, 1994), and yielded social and emotional benefits for all students, with self-esteem and attendance improving for some students considered "at-risk" (Kelly, 1992). This research, coupled with strong public pressures to change current models of delivery in schools, provides a strong impetus for major educational reform. A question certain to be addressed in the courts in the next decade is the extent and degree of responsibility educators have in accommodating the educational needs of students with disabilities.

Numbers of Students Served

Research also shows numbers of students who receive special services. The United States Department of Education (1999) National Center for Educational Statistics reported that 12.8% of all students in 1997-98 had a disabling condition reflecting a population of 5,904,000 individuals receiving special services in schools. Learning disabilities, including attention deficit disorders, comprise the largest percentage - 46.2% - followed by speech and language impairments, 17.9%; mental retardation, 10.0%; and serious emotional disturbances, 7.7%. Approximately 4.3% of school age students had a physical disability or health impairment. The U.S. Department of Education (1999) reported the following: speech or language impaired - 2.3% (1,022,000); hard of hearing and deaf - .15% (67,000); motor/orthopedic impaired - .15% (63,000); other health impaired - .41% (133,000); visually impaired - .05% (25,000); multi-disabled -.23% (93,000). In addition, other identified conditions eligible for special education services include: learning disabled – 5.91% (2,578,000); mentally impaired - 1.28% (570,000); and seriously emotionally disturbed - .98% (438,000). Plus, with improved services for early intervention, 1.22% of all preschool children (544,000) are receiving special education services.

There is enormous variation in these impairments; they can assume many forms and each require some specific and unique implications for instruction. These impairments, particularly in the case of health impairments, may require many different adaptations from day-to-day depending upon the effects of the disability itself (i.e., acute occurrences, progressive diseases, or incapacitating conditions), the effects of the medication used in treating the disability, and the changing conditions of the learning environment. A frequently neglected entity are the most talented students with physical disabilities. Over 500,000 gifted students with disabilities receive little accommodations because they are achieving "on grade level," or get special help from persons without the content knowledge to fully understand their academic needs.

The social and emotional diversity among students with disabilities closely parallels that of the general population. Sometimes, there's an inclination to cluster people to describe common characteristics, but this can present some particularly difficult circumstances for persons with low incidence disabilities. Are some persons with disabilities bubbly and expressive while others are reserved? Do some seek ways to avoid work while others are responsible and remain persistent? Do some avoid uncertain circumstances while others seem to be overanxious risk-takers? Yes, all are true for persons with disabilities just like the general population.

In fact, many persons with disabilities are not pleased with activities like "disability awareness day" just as many would be displeased with something like "obesity awareness day." These platforms tend to overlook the uniqueness and dignity of the individual. Most individuals know the challenges and inconveniences they must face and with appropriate accommodations probably prefer to address them in a private manner. Inappropriate treatment by adults is a common daily experience of many persons with disabilities. Whether it is overt discomfort, being ignored or avoided, having lower expectations and/or undervaluing their contributions, each experience has a way of saying "you don't belong." Perhaps one of the highest levels of courage are persons with disabilities who, in spite of constant

bombardment with rejection signals and being undervalued, wake up in the morning and say inside "I will try again today."

General Information on Teaching Science to Students with Disabilities

Over 30 years ago the Education of All Handicapped Children Act (PL 94-142) was enacted. But are general classroom teachers better educated to serve students with special needs today? Do our teacher preparation programs provide more than an awareness of types and characteristics of exceptionality? Do teachers entering the profession receive adequate preparation on assistance, training, and services to meet the needs of all exceptional learners, and are these services even available in our schools?

A first and foremost preparation challenge is to familiarize science educators and practicing science teachers with educational practices that will allow students with disabilities an opportunity to experience a program in science that is challenging and rewarding commensurate with their capabilities. Professional educators must develop proficiency in: 1) how to provide access to knowledge in all aspects of the curriculum; and 2) how to make appropriate adaptations in curriculum content, teaching materials, physical settings, instructional strategies, and assessment instruments for students with disabilities. The challenge to educators is not only to improve teaching, but also to put in place mechanisms that elicit participation and responsibility on the part of the students. This must be characterized by clear vision and coordinated, consistent, and purposeful actions (Stefanich, 1994).

The best index of an effective school is how the adults interact. Adults may think they teach students how to behave by managing behavior, or teach them responsibility by holding them responsible. But these are actions of control and power demonstrating dominance by an adult over someone who is lesser, either in strength or ability. Children don't learn to talk like adults through direct interaction with adults. Rather they learn to talk by watching and listening to adults talk. Much work is needed in the school community to have the adults model the types of actions they would like their students to exhibit as adults. It begins when students leave for school. All adults, including bus drivers, teacher associates, custodial staff, teachers, and administrators need guidance on greeting people in ways that make them feel important and appreciated. Students need to see this every day and experience consistency. They can learn the importance and value of a positive disposition, but only if there is strong modeling by adults.

Highly effective teachers adapt and modify. Significant differences can be seen between teachers who teach groups of students and those who look at the uniqueness of each individual. Communication and understanding is needed for all students, but especially for those with disabilities. They do make the life of teachers more difficult and challenging because standard instructional materials are often not appropriate. The type and time of modification must reflect the context of the student's needs.

A common danger students with disabilities encounter is the cumulative effects of sympathy and low expectations. A convenient teaching action is just to expect less from those who don't perform well on common group assignments. Similar low expectations occur by having the student with disabilities only be an observer during science experiments or by providing peer assistance in activities that require writing or fine motor coordination.

American education has a long-standing history of low expectations for students with disabilities. These expectations influence: (a) the amount of time students with disabilities spend learning science and the amount of time they are actively engaged in investigation in the science laboratory, (b) the academic focus and quality of objectives, (c) the sequence and depth of the learning opportunities afforded to students, (d) access to knowledge and resources, (e) homework expectations, and (f) curriculum alignment. The results of low expectations are often cumulative, thereby forcing many students with disabilities to pursue careers which do not reflect their interests or abilities.

When students realize low expectations, it may be the result of teacher decisions that sustain mediocrity in students. The behaviors teachers model in the way they learn are reflected in the students' behaviors. Teachers must make hundreds of decisions every day. In trying to cope with the intensity of multiple inputs, decisions are often made quickly, carried out, and forgotten. Ask yourself if your reactions and actions often become so automatic that you are unaware of your own thinking processes.

In much the same way when students are given an assignment, they just start "doing it." They do not reflect on previous learning, they do not think about why they are doing the assignment, and they seldom reflect on the thinking skills and strategies after they are done. Patterns of carelessness are reinforced consistently in the traditional educational system. Papers are turned in, graded, and returned. The same students always get the "As", and the same students always get the lower grades. Papers which reflect substandard efforts are not returned to the students to be redone; quality standards are not met through a series of refinements; and complaints are expressed about the quality of student work. Educators too often fit this operational definition of insanity: "repeating the same thing and expecting different results." The same complaints from teachers have lasted for centuries, yet examinations of professional practice indicate little change in teaching methods concerning testing and grading.

A major thread common to meeting expectations, performing successfully, and advancing in the adult world is the effective use of language. Therefore, throughout the year, extra effort should be devoted to the process of contextual language instruction in an atmosphere of support, acceptance, and refinement for all students. Skills of communication require rigor and repetition. Proofreading, refinement, and precision in an accepting environment are essential skills in developing a growing, conscientious attitude about clarity and effective communication. Science teachers can model the importance of the language arts and mathematics as essential process skills for clear and articulate communication.

On the other hand, expecting too much can be equally devastating. Many physical disabilities place a strain on a student's endurance and time. The student probably needs more rest, it may take longer to get ready for school or to get set up for homework, and activities that are routine for most students may be physically challenging. Much depends upon the relationship between the student and the teacher in establishing an appropriate balance.

Effective teachers also need skills as effective coaches who have the ability to enlist support, cooperation, and responsibility of all players. They develop a team synergism that accomplishes more than each individual contributor. Each individual is brought into the unit with some unique skills and responsibilities that will help bring about success. This is exactly what effective teachers also do. Their ability to instill in each child his/her worth and importance as a learner and to develop a class cohesiveness are critical teaching skills. These teaching skills help students remain persistent because they all feel important and appreciated. Effective schools have structure and order, a business-like disposition. Students in the school should have a place to be and a meaningful responsibility that is appropriate and challenging from the time they enter until the time they leave. Nurturing a positive climate, sharing responsibility to assist students in the development of basic skills, and helping with management and routines should not rest with certain individuals. All professionals must perceive these elements as joint and collective responsibilities.

If you perceive yourself only as a science teacher, you are meeting just a part of your responsibility as an educator. Highly effective teachers address student socialization as well as academic instruction. Time and attention should be devoted every day to helping an isolated child become a part of the class and school community. However, teachers must be aware that not all students carry their perceptions of what it means to be included. There are those who are more comfortable being quiet and these behaviors must be respected as well. By getting to know each student, most teachers will be able to distinguish whether school relationships are healthy or need improvement. If there are difficulties, teachers can help bring everyone into the community of scholars who work together and celebrate the accomplishments of each other. Good schools value and support the healthy generation and socialization of *everyone* present.

Cawley (1994) reported that science teachers generally have little training or experience working with students with disabilities and, in general, special educators have little or no exposure to science. Patton, Polloway, and Cronin (1990) in a survey of special education teachers found: a) 42% of special education teachers received no training in science; b) 38% of children in self-contained special education classes did not receive any instruction in science; c) among special educators who did teach science, nearly half devoted less than 60 minutes a week to science and nearly 90% of the teachers surveyed depended upon a textbook for science instruction. Ysseldyke, Thurlow, Christenson, and Weiss (1987) reported that for students with mild disabilities, approximately 200 minutes of reading instruction was received for one minute of science instruction.

Research in education has indicated a continuing lack of responsiveness by science teachers to adjust the learning environment so students with disabilities feel a sense of success and accomplishment. In an examination of science grades for over 400 students with mild disabilities in grades 9-12 , Cawley, Kahn, and Tedesco (1989) reported 50-60% of the grades were Ds or Fs. Donahoe and Zigmond (1988) reported 69% of the science grades for 9th grade students with learning disabilities were D or below.

Jones' (1992) research indicated students with learning disabilities demonstrated a reduced sense of control in all aspects of their lives as compared to disabled peers. She stated: " . . . they often fail to develop efficient and effective strategies for learning. They do not know how to control and direct their thinking to learn, to gain more knowledge, or how to remember what they learn" (p. 136).

Physical Accommodations

Physical adaptations and emotional adaptations have a permeating importance for all settings and all individuals. In addition to making the curriculum more accessible, they communicate to everyone that all individuals are important, and we have different needs depending upon personal circumstances.

A beetle is brought in from the preschool playground during outdoor play. An elementary teacher introduces the science process of predicting using bouncing balls. A middle level teacher takes a trip to the seashore. A high school chemistry lab uses acids and bases in titration. These events and many more every day offer an opportunity for all students to expand their awareness of science. However, in many cases the student with disabilities does not get to handle things because of teacher inconvenience, unwillingness to make adaptations, or just an overall lack of awareness and sensitivity of classroom teachers. Early experiences, extending throughout the school age years, often instill in the disabled student the idea that his/her role is one of a "passive observer" in an active learning setting. As a result, students with disabilities often become passive observers in activity-centered settings because their unique needs are not considered with sufficient positive regard. It is not surprising that a lack of exploratory experiences in childhood and adolescence become barriers to later learning, particularly when the primary means of instruction are expository, verbal, or through print materials.

Robert Rehwoldt, a paraplegic chemist, described the lack of sufficient consideration given to providing a physical environment in which the disabled can participate. He stated:

> Most high school science laboratories are not constructed so that the student with orthopedic disabilities can participate in experiments. Limited resources and a lack of imagination may have actually prevented high school students with disabilities from experiencing science in a positive and constructively challenging fashion. (as cited in Rehwoldt & Samoff, 1978, p. 132)

In studies on instruction of deaf students, Lang (1994) stated that the majority of instruction deaf students receive in science is by teachers with inadequate content preparation in the discipline. Less than 5% of teachers of deaf children reported a major in the physical sciences. He concluded, "Although 86% of deaf students report liking science, their academic preparation is inadequate for post-secondary education" (p. 148).

Often simple teacher initiatives to make the students with disabilities feel important and appreciated can pay rich dividends in student cooperation and initiative. Consider the following reflections from an individual who experienced a mild bout with polio at the age of 12.

> I consider myself fortunate to have been raised in a small community with very limited services. Shared responsibility for chores and membership in a large family tended to prevent any tendencies for a sedentary lifestyle. The greatest difficulties encountered were emotional and social, feeling insecure in my ability to establish friendships or caring relationships. My major physical barriers were a lack of coordination and limited endurance. There were no special education services in the community other than a traveling speech therapist who served several districts in the county. My physical rehabilitation program required frequent absences from school during junior high school because the closest rehabilitation services were 30 miles away. Academic accommodations rested largely upon the sensitivity and willingness of individual teachers to modify and adapt instruction. (Stefanich, et al. 2000)

Many educators might consider the modifications made that had the greatest impact for this student to be inappropriate. For example, an English teacher discussed assignments individually and allowed the student to make oral presentations before the start of school rather than in front of the class; an algebra teacher waived homework assignments and gave a grade based just on test scores; and an English teacher modified and adapted writing assignments for each student, not only those with disabilities, in a high school of 90 students. Most important of all was the non-verbal communication from teachers, some who showed encouragement and acceptance. However, others created a sense of isolation and rejection because they felt modifications interfered with the standard academic program being presented. If students with disabilities can constantly count on those who care and are willing to accommodate, they can cope with those who are less considerate of their needs. The impact of a single teacher can have a profound effect on the development of any student, but this is especially true for a student with special needs. As a teacher, it is your choice. Are you willing to put yourself into the mind of the child and make accommodations that will promote his/her healthy development? One teacher, in one setting, can make a world of difference.

A publication of the American Chemical Society titled, *Working Chemists with Disabilities* (Blumenkopf, Stern, Swanson, & Wohlers, 1996) contains annotations from the careers of practicing chemists and descriptions of accommodations that make their professional work more successful. The following paragraphs present commentary drawn from the descriptions, which will enlighten teachers of students with disabilities.

The biographies indicate the most serious barriers are attitudinal rather than physical. Anne Swanson, the dean of the School of Natural Sciences at Sonoma State University, was described by the obstetrician at birth as “a hopeless case involving profound mental retardation who will never function in society” (p. 51; Blumenkopf, Stern, Swanson, & Wohlers, 1996). Todd Blumenkopf, a research chemist at Pfizer, was taken aside by a school administrator at age 14 and told, "You don't want to go to regular school. You'd really rather be with your own kind” (p. 34). Judy Summers-Gates, a chemist with FDA in Philadelphia has impaired vision, multiple sclerosis, and select hand movement because of carpal tunnel syndrome. She said, "I had to fight my parents, the school, teachers, guidance counselor, and the state vocational rehabilitation agency. Everyone thought it was crazy for a kid, almost blind, to major in chemistry." (p. 16)

These barriers also exist within the individual and in society. Del Robinson is a senior development consultant for UOP and has progressive multiple sclerosis. UOP is a leading industrial supplier to refineries, petrochemical, and gas processing industries. He states, "If you think you are disabled, you are. Everyone has handicaps. Some are physical. Some are mental. Some are emotional. Some, I suppose, are spiritual. Everyone has problems. I've never gotten to know anyone very well at all without realizing that I wouldn't want to trade my problems for theirs! My disability is no worse than anybody else's—it's just different." (p. 9)

William Zoller was afflicted with a traumatic brain injury and profound memory loss. After rehabilitation, he has become the most highly rated teacher in the Chemistry Department of the University of Washington (p. 14). Thomas Doyle indicates that for deaf persons willing to pursue a degree in chemistry, "Most of the physical, technical barriers are gone." Society's negative attitudes are

probably the major remaining barrier to getting more young people with disabilities into science careers (p. 30).

Many of the adaptations are not expensive. Perhaps the lowest cost adaptation noted in the publication was shared by Thomas Doyle, a profoundly deaf internationally known organic chemist responsible for U.S. FDA laboratory research on the analysis of chiral drugs. The field studies the effects and side effects of medications. His accommodation involves taping a strip of tissue paper to an exhaust hood opening and observing if it is working and/or functioning properly. Many common laboratory accommodations are modifications in the workstation to make the equipment and supplies accessible. Other important accommodations are safety devices like eyewashes, showers, evacuation procedures in case of an emergency, and modified signal devices such as fire alarms. Dorthy Miner, a part-time extension associate with the North Carolina Cooperative Extension Service at North Carolina State University, suffers from cervical vertebrae damage, chronic migraines, and severe pain if she lifts heavy objects or engages in repeated arm movements. She states that flexible work hours are her most important accommodation (p. 21).

Safety comes up constantly as an unwarranted concern. Summers-Gates states that concerns about safety are exaggerated. "I simply took extra care and extra time in setting up and using apparatus" (p. 16). William Skawinski, a blind chemist with retinitis pigmentosa, is a professor at the New Jersey Institute of Technology. He states a visual impairment imposes an extraordinary sense of orderliness and neatness on the individual. Neatness and orderliness are the cardinal rules of safety (p. 58). An extensive study of safety conducted by Anne Swanson and Norman Steere found persons with disabilities pose no greater safety hazard in the classroom, laboratory, or workplace than their able-bodied peers (p. 4).

Todd Blumenkopf, as a senior research investigator, spends much of his time in the laboratory. He discusses several safety precautions that he has long used to accommodate chemistry in a seated position. "You learn to think the experiment through ahead of time and wear appropriate protective gear that might be a little different from what a standing scientist might choose to wear." For instance, Blumenkopf's face is closer to the apparatus and reacting chemicals than a chemist who is standing; thus, he chooses to wear a full-face safety shield rather than safety glasses at times, probably more often than most other chemists. He wears a heavy rubber apron to protect against injury if an acid or corrosive chemical should spill into his lap, and he keeps a lightweight fire extinguisher by his work area. Blumenkopf uses extra-heavy heat-resistant gloves for carrying hot objects. He grips objects harder when wheeling his chair, and sometimes he uses the gloves to rest a hot object safely on his lap. Blumenkopf must use nonlatex products, especially nonlatex gloves; like half of those born with spina bifida, and like an increasing number of laboratory workers, he is allergic to latex. The Pfizer Health Center is aware of his allergy in the unlikely event that he must be treated in an emergency. (p. 37-38)

Blumenkopf acknowledges that many modifications "don't come cheap, but they benefit the more able-bodied users along with those with disabilities" (p. 37). Ron Nieman has Kugelberg-Welander disease, a form of muscular dystrophy. He also serves as the director of the Nuclear Magnetic Resonance Laboratory at Arizona State University. He encourages employees to seek out persons with disabilities. He states, "A person with a disability seeking employment is likely to be very successful, creative in solving problems, and competent in ways that you seldom find in other job applicants." (p. 59) They are more likely to be persistent and inventive in overcoming obstacles, where others are likely to become frustrated and disillusioned.

Gail Pickut, a high school chemistry teacher, utilizes an aide to help with physical accommodations. Principal Richard Thorbahn states, "Ms. Pickut is a genius as an educator...Everyone benefited, especially the students." (p. 39) She states, "As long as you have your mental facilities, why should physical problems be a barrier? You don't need to be an athlete to teach. If you love to teach and love kids, then just find a way to do it." (p. 41) Tod Waldrop is an incomplete quadriplegic who is paralyzed from just below the arms and has limited hand movement. He states, "Most of my problems and frustrations are the same as my able-bodied co-workers. They have nothing to do with the disability." (p. 50)

The importance of affective factors on learning cannot be overemphasized. Creating a classroom environment that promotes student interdependence instills an appreciation of human diversity and

brings out within the student a sense of feeling important. This idea is strongly supported in educational research (Biklen, 1992; Villa, Thousand, Stainback, & Stainback, 1992). The effective teacher is willing to devote time to establish a sense of trust and confidence from every student. Student motivation is affected by trust in the teacher, a perceived commitment of the teacher to help the student experience success as a learner, and a perceived interest that the teacher wants to know the student as a person.

Community involvement has also been found to contribute significantly to reducing the number of students who are at-risk (Brookover & Lezotte, 1979). Teachers who spend the time to involve and communicate with parents, to welcome and respect their input, find this often provides large dividends. In addition, Lacey (1991) recommended involving the community by finding volunteers to serve as mentors who provide surrogate support to students with disabilities. These individuals keep in close communication with the child's parents, the school, and the teachers.

Emotional Accommodations

Many students with disabilities have encountered traumatic life experiences. These may have major effects on students in the classroom. One emerging biomedical theory, the biogenic amine theory, holds that stress or trauma can create abnormalities in postsynaptic (receiving) neurons creating too many receptors. The individual feels "starved" for "mood sweetener" hormones such as norepinephrine, serotonin, or dopamine and, as a result, has feelings of depression, compulsiveness, or anxiety (Kremer, 1993).

Regulation becomes extremely difficult. If drugs are used to provide adequate amounts of the biogenic amines, the cell becomes overstimulated and reduces the number of receptors by drawing them back into the cell membrane where they become inactive (Kramer, 1993, pp. 130-133). Kramer (1993) stated, "and the neural-transmitter pathways that are out of kilter in each of these symptom complexes appear to be similar whether the illness is depression or compulsivity, or addiction, and whether the animal under study is rat, rhesus, or man" (p. 130).

One observable influence of people affected by traumatic experiences is exceeding vulnerability to stress. The influences of strong social supports are critical in helping the individual function well in an educational setting. Kramer (1993) presented cognitive therapy to create a supportive environment to help reframe environmental stimuli, redefining what is perceived as rejection so that sensitive or anxious individuals avert their functionally autonomous responses (p. 128).

From a school perspective, this biomedical theory indicates that students will work harder to receive support and encouragement than to avoid negative consequences. Threats, punishment, and negative comments are almost always harmful to motivation and affect. Teachers can make a difference by demonstrating enthusiasm in posture, voice, mobility, and excitement. The manner of teaching can bring out science as a fascinating topic of study which helps us understand the world around us.

Students' emotionality and ability to develop a sense of trust is so important that science teachers must be willing to serve an active role in assisting student socialization along with academic instruction. Science teachers who are warm and receptive to individual student needs are critical if we are to improve student and public perceptions toward science. In many cases, science teachers with an elitist attitude have contributed to a public perception that anything beyond general science and biology is appropriate only for those who plan to go to college, and anything beyond a third year of high school science is appropriate only for those seeking careers in scientific or related fields.

Being able to detect the feelings and emotional states in students' oral and body language, being accepting of alternative points of view, being able to accurately express another person's feelings, and being able to help a child express ideas are characteristics all great teachers share. In a classroom setting where another person's ideas are laughed at or ridiculed, morale quickly declines, questions are not asked, and problems are not posed for fear of displaying ignorance or experiencing embarrassment. An accepting teacher can help students resolve their internal conflicts, using anger management and conflict resolution to help them deal more effectively with their school environment. Teachers will never

succeed by confronting the confrontational student. In many cases, this disposition has developed during the child's first year of life and the student perceives yielding to confrontation as a threat to his/her basic fabric of survival.

Teacher modeling is probably the greatest influence on student behavior. Overt modeling involves demonstrating a skill or activity by performing it. However, indirect actions and mannerisms associated with stereotypical attitudes often have a great influence on classroom atmosphere and the acceptance level of the students. Rosenshine (1979), in a research summary, reported that effective teachers are warm, concerned, flexible, and allow students more freedom to move within the classroom. Actions send powerful messages: being receptive to the expressions of each student; maintaining a posture of encouragement; recognizing the responsibilities of each student; being responsive to a student's unique strengths and limitations; designing class activities so every student feels included; and modifying instruction so each student feels challenged and successful. These messages are reflected in the classroom and in the school and will influence decisions and attitudes the students will hold throughout their lives.

Students with Disabilities Who Are Also At-Risk

Working with students with disabilities who are also at-risk is demanding and often emotionally draining. Many of the reasons why students are at-risk come from factors outside of the school environment and, in many cases, are not perceived by public constituents as areas of the school responsibility. Yet, if not addressed, these external factors make efforts toward student success almost hopeless.

The following actions are found to be effective for all students, but particularly, for students who are at-risk. Keep in mind that at-risk students expect confrontation and will often engage in inappropriate actions to validate the label they have been given. In this way, they can generate an affirmation that they do not belong, thereby justifying their denial of identification with the institution and the authority figures within it.

Many at-risk students have developed a belief that inevitably they will fail. Often they have instilled within themselves an attitude that adults cannot be trusted and that adults will act out against them if they make a mistake. This perception probably has built up over time and will only be alleviated over time. Successes in teaching at-risk students cannot be measured in daily or even weekly performance; significant change often takes months. Regression often occurs particularly when a student feels helpless or senses a threat to his/her relationships.

Counseling intervention can help students sort out problems and reduce many at-risk factors. Social services staff can often gain easier access to the family to help make adjustments for the child outside of school. Tutoring has proven to be an effective aid, and the use of parent volunteers, or more capable peer helpers, can be a successful, low-cost strategy (Earle, 1990). Offering additional help, often outside of the regular school day, in homework enhancement, study skills, life skills, and job skills have shown favorable outcomes (Benedict, Snell, & Miller, 1987).

The school administrator can help at-risk students by carefully selecting teachers and providing extra support to assist in meeting the special needs of the student with disabilities. Encouraging and recognizing teachers' special efforts can make them feel important and appreciated.

Some time each day should be devoted to reflection, and, when possible, collaboration in teacher's work with at-risk students with disabilities. During this time, teachers can initiate, implement, and evaluate a strategy that addresses a problem which needs improvement. They can think about what is known and what additional information would help make a better decision. Determine if the plan is working or should be discarded, and reflect on the plan and make a judgement to determine if an alternative approach would be more humane and/or more efficient.

At the same time, we've learned what doesn't work with at-risk students with disabilities. The traditional structures of a common course of study predicated on equal treatment being fair treatment fails to provide the necessary structure and support needed for students at-risk. Many of the solutions in common practice today do, in fact, aggravate the problem. Those practices generally consist of

remediation, grade retention, ability grouping or tracking, and sometimes suspension (Quinn, 1991, p. 81).

If we are to successfully educate students at-risk and prepare them for a productive life, our educational system must respond to the internal and external factors that placed these students at-risk. We can design programs to meet students' needs and reduce the components of risk.

Current Promising Practices for Adapting Materials

The use of adapted materials has been reported as being effective with mainstreamed students (Hoover, 1990). If we are to improve instruction for students with disabilities, and probably for all students, science teachers will need to become oriented to multi-modality teaching. They must be willing to accommodate instruction and adjust the learning environment so *all* students can achieve success and *all* students can be active participants in the learning process. They must become accustomed to teaching fewer concepts with richer insights, deeper understanding, greater attention to application, and more relationships. Instructors of science methods must model appropriate strategies in their classes if we are to bring about change in current practices.

"If you don't know where you are going you are never lost." The majority of decisions that teachers make relate to instructional context. Teachers generally assume the information contained in the print material used by the students is appropriate and generally give little thought to content accommodation. Rosenshine and Stevens (1986), in a meta-analysis of studies on direct instruction, found that more effective teachers maintained a strong academic focus and spent less time on non-academic activities.

Specifically, Olarewaju (1988) found 7th grade students had a better attitude toward an integrated science program in classes guided by instructional objectives. Brophy and Good (1986) reported teachers who plan and organize on a daily basis prior to instruction produce higher levels of student achievement. Prior planning is essential in preparing students for learning. Ausubel (1968) proposed the idea of advanced organizers to help students prepare for learning. By aligning objectives to prior knowledge and experiences, the students have greater opportunity to make personal meaning of the facts and concepts presented in instruction. Shostak (1990) recommended planning the first 5 minutes as "entry" into the lesson. This would include clarification of expectations, reflection using an advanced organizer, and introduction of the lesson topic. In a similar fashion, the last 5 minutes of the lesson should be directed to "closure" to reinforce the key points of the lesson and transfer learning by bringing in applications which relate to age-appropriate experiences.

Instruction. Research on instruction provides support for using a variety of methods to deliver instruction. Brophy and Good (1986), in a review of research on instructional methods, reported that the systematic use of a variety of techniques leads to higher levels of student performance than heavy reliance on one technique (p. 342). This is particularly important for instruction directed to students with disabilities. In many cases a teacher cannot discern the limitations of an impairment. Through a variety of instructional approaches, the student is able to bring input from learning experiences in an area of strength to compensate and fill in learning missed because of processing difficulty.

Multi-modality instruction is especially critical in helping students with disabilities gain a familiarity with the content material. Scruggs, Mastropieri, Bakken, and Brigham (1993), in presenting suggestions for teaching science lessons to students with disabilities, stated that students with disabilities are likely to encounter far fewer problems when participating in activity oriented approaches to science education. The use of multi-modality approaches both in teaching and in assessment has shown positive effects (Cheney, 1989). An example of the importance of direct experience is well illustrated in a study conducted by Recht and Leslie (1988). The researchers identified junior high school students on their knowledge of baseball and their reading ability. They determined four categories of students: good readers/high baseball knowledge, good readers/low baseball knowledge, poor readers/high baseball knowledge, and poor readers/low baseball knowledge. Poor readers who knew baseball remembered more than good readers with low baseball knowledge and almost as much as good readers with good baseball knowledge. Poor readers with low baseball knowledge remembered the least about what they read. What the study clearly indicated is that having

familiarity with the material is often more important than one's ability to assimilate and remember information.

Wood (1990) noted that strategies which lend multiple exposures to new terms and concepts enhance opportunities for student mastery. Actual examples or models are especially helpful to students with disabilities. In many cases, these individuals do not have as many experiences as those with greater mobility who constantly receive a variety of exposures to the world by being able to visit places in a community.

Adjusting the length of assignments and acquiring alternative resources with different levels of reading ability improve student success rates (Lawrence, 1988). To maximize the efficiency of the educational program, all teachers must provide students with assistance in basic skills (Brookover & Lezotte, 1979). If a teacher is to have standards of quality, students must be guided to meet the standard. This is going to typically require resubmitting an assignment until it reflects the desired quality. For example, in preparing a laboratory report following an experiment, if students are to produce a report of high quality, there must be a process of refinement that requires careful planning with a scope and sequence. The teacher may begin with organization of the collected data, followed by data analysis and establishing inferences and generalizations. Checking arithmetic calculations and organizing the data may require several refinements. Developing a quality narrative demands that the science teacher has a good command of the mechanics of written expression; it may require collaboration with other teachers. Writing refinement may begin with capitalization, then progress to putting a subject and verb in every sentence and then to syntax and clarity of expression. The challenge offered to the student should be attainable. Guidance and encouragement must be provided. Having high expectations does not mean demanding higher standards; it means earning the higher standards by guiding students through the learning process in steps students can master.

Evaluation. Student evaluations in various forms determine progress and performance by making value judgements on the quality of students' work. Formative evaluation primarily provides feedback to students and guides them in their learning. Effective formative evaluation helps students correct misconceptions, gives the teacher feedback on the effectiveness of instruction and the appropriateness of the curriculum, and helps the teacher match instructional decisions with a student's instructional needs. A type of formative evaluation, immediate feedback, is the most helpful to learners. It refers directly to a behavior or assignment that may challenge the students but it is a task possible to perform. Using immediate feedback, students and teachers can check on clarity through observation and questioning, help students unscramble confusion, and help them examine their understanding by performing authentic tasks.

Many students with disabilities will be unable to demonstrate their true level of understanding under traditional testing conditions. Although tests and quizzes are one means of evaluation, they should not be the dominant tool used in evaluation. In many instances, the added difficulty of needing to focus to a large extent on carrying out the mechanics of the response can hinder student performance. Assessment strategies where the student is allowed to share what he/she knows are often more effective. Students with disabilities must be allowed to receive examinations in a comfortable setting and on a timetable which enables them to share what they have learned.

Other evaluations can be used in a science class. Conducting a science investigation monitored by a teacher is an excellent means of assessing student abilities to use science processes. Operational definitions allow students to indicate an understanding of a concept by relating examples or sharing thoughts on how something works.

The use of portfolios and exhibitions allows students to accumulate samples of their work. Paulson, Paulson, and Meyer (1991, p. 60) described portfolios as a personal collection of student work in one or more areas. The portfolio should reflect student participation in selecting the contents, student knowledge criteria for judging merit, and elements of student self-reflection. Through an anecdotal reflection, students can share what they know and what they can do.

A teacher's willingness to examine students' work to ascertain where problems are occurring has been shown to significantly improve student learning. Bloom (1976) and McDonald and Elias (1976) reported that improving the diagnostic ability of teachers results in improving student performance.

Summative evaluation is also an important component in meeting professional responsibilities as a teacher, but must be utilized with discretion. Summative evaluation is valuable in providing feedback on how much information the students have learned and retained. The results of summative evaluation are often used to make placement decisions, to certify students as being competent in a field of knowledge, or to norm and compare students. These measures can provide valuable information, but are generally of little value in helping students' learning. Research has shown that student performance decreases when teachers emphasize an evaluation system based on a comparison of classmates' achievements (Brookover & Lezotte, 1979). Evidence has also indicated that increased student absenteeism and higher dropout rates occurred in classrooms with a higher percentage of lower grades, a competitive atmosphere, and arbitrarily high standards (Moos & Moos, 1978; Trickett & Moos, 1974).

The following are suggestions for teachers who wish to maintain high standards and, at the same time, avoid the negative effects of competitive evaluation frameworks.

- Keep expectations high, reward effort and perseverance.
- Don't give praise or rewards that are not deserved.
- Don't single out a student more than necessary, and do actively seek opportunities that provide positive socialization experiences with peers.
- Reflect on instructional techniques and provide sufficient time for independent work where special needs can be accommodated if necessary.
- Use formative evaluation and become aware of "critical features" of concepts if the student is unable to master all of the objectives.

Student Placement and Labeling

Teachers should be cautious in their actions as a result of interpretations of student performance on standardized assessment instruments. The use and interpretation of evaluation instruments is a fundamental concern in student identification for special services. Indeed, the validity and reliability of tests used for classification and placement has been repeatedly challenged (Gartner & Lipsky, 1987; Stainback, Stainback, & Bunch, 1989; Wang & Wahlberg, 1988). Gartner and Lipsky (1987) described these tests as "barely more accurate than a flip of the coin" (p. 372). Addressing the relative permanence of such classifications, Gartner and Lipsky stated that less than 5% of the students are declassified and returned to the mainstream of regular education. Wolfensberger and Thomas (1983) have argued that a great deal of unfair treatment of clients is from professionals who unconsciously devalue the people they are trying to serve.

Collaboration

Collaboration is a supportive system in which teachers utilize the expertise of other educators to solve problems. The existing dual system of regular and special education has fostered definitive boundaries between these two areas with little sharing of expertise and support. Science teachers often find themselves basically alone in their efforts to serve students with special needs who are placed in their classrooms. This isolation makes teachers more resistant to the changes involved with including special needs students. Perceptions that may interfere with effective collaboration can become ingrained in professional practice. Unless they are brought to the surface, they serve as persistent bottlenecks to collegiality between professionals. A few are listed below:

TOO OFTEN, SCIENCE TEACHERS:

- see their responsibility as setting high standards, and holding to these high standards for all students. Some may go a step further and perceive their responsibility as "culling" those who would diminish the overall quality of the scientific community.

- believe their primary responsibility is to disseminate content. They often practice methods of delivery (ie: lecture-recitation and verification laboratory exercises) that focus on disseminating information rather than discussion of concepts with frequent feedback and sharing of ideas.
- believe students are and should be held accountable for their own learning. They perceive evaluation as a process of reporting student progress towards established standards.
- believe that when students don't learn something there is something wrong with the student.
- Believe that if there is something wrong with the student, a specialist is needed to correct the deficit.

TOO OFTEN, SPECIAL EDUCATION TEACHERS:

- believe expectations should be modified to meet the abilities of the student. They are inclined to sacrifice high standards for student comfort.
- want students to perceive success in the process of evaluation. They perceive that it is appropriate to provide both guidance and assistance when conducting assessments for classroom teachers.
- believe their primary role is to help students with assignments and tests, and provide support for the development of basic skills.
- do not have a sound understanding of the science content being taught and do not perceive a need to have operational capabilities with the concepts in the science curriculum.
- lack the use of information science tools to locate resources and conduct investigations with students. Therefore, students seldom receive enrichment in science learning through multi-modality, hands-on laboratory experiences under the direction of the resource specialist.
- emphasize external reinforcement to enlist the student cooperation. They believe that good strategies utilize high structure and constant monitoring. Effective instruction is following a structured IEP, with explicit objectives and formal assessment procedures clearly denoted.

Although collaboration is presented more thoroughly in another chapter, a commitment to mutual support between regular education and special education teachers is critical if we are to achieve greater success in addressing the learning needs of students with disabilities. Villa and Thousand (1988) suggested that if teachers knew support was available they would show more willingness to meet the needs of integrated students. Three common teacher support models are presented in the literature:

1. Teacher Assistant Teams, in which groups of people (teachers, counselors, administrators, parents) join together to provide support to the classroom teachers in their attempt to provide appropriate opportunities to all students (Stainback, W., & Stainback, S., 1989);

2. Collaborative Consultation, an arrangement between a special education teacher and regular education teacher in which both teachers share their expertise with each other in an attempt to accurately describe problems and mutually develop solutions to the problems; and

3. Cooperative Teaching, in which regular and special educators coordinate their efforts to jointly teach heterogeneous groups of students in integrated settings to meet the needs of all students (Bauwens, Hourcade, & Friend, 1989).

The benefits to students include increased social status through integration, more science, better science expertise, reduced isolation, and increased assistance when needed. The benefits to teachers include increased instructional and management support, shared expertise, a greater number of creative problem-solving methods, a better understanding of themselves as they interact, increased feedback, and greater companionship and assurance.

However, there are barriers to using these support models. Regular classroom teachers may see the intended collaboration as an intrusion. Special educators may challenge the capacity of the regular teacher to accommodate the classroom and anticipate and fear meetings with resistive partners. In addition, conflict may result relating to the domination of one partner, expectations that one partner will be responsible for getting the job done, and the overall availability of the special educator to be in the classroom when needed.

Collaborative approaches have great promise; however, agreements have to be reached between all parties for this approach to operate effectively. Takes (1993) identified these factors for agreement: shared commitment among participants, issues of autonomy and isolation, assistance requested and provided, trust and balance of power in a relationship, development of the relationship, conflict resolution, and professional growth.

Collaboration may be one of few current viable alternatives for meeting the needs of students with disabilities in science. In light of current research findings, it appears that regular classroom teachers are ill-equipped to accommodate instruction to the student with disabilities in the regular science classroom and special education teachers have little science knowledge. If left alone, evidence also shows that special education teachers do not teach much science and are inclined to be textbook dependent. Following an extensive research study on collaboration, Takes (1993) provided the following policy recommendations:

1. Provide inservice regarding what such a collaboration program might look like and consist of. This would allow teachers to begin a thought process geared toward making a change in the near future.

2. Provide an opportunity for teachers to observe cooperative teaching in action and to discuss the model with those observed.

3. Provide an opportunity for staff to discuss the advantages and disadvantages of such a program and also to list possible barriers to instituting such a program.

4. Provide opportunities for teachers to reexamine traditional teaching practices and the degree to which cooperative teaching challenges those practices.

5. Provide a description of professional growth expectations and how teachers should meet these expectations.

6. Provide opportunities during contract time and noncontract time for cooperating teachers to meet and begin the development of relationships as well as instructional plans together (pp. 374-375).

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Chapter 2
Nature of the Learner: Implications for Teachers from the Constructivist Perspective

Greg Stefanich & Yannis Hadzegeorgiou

Some say there has never been an effective teacher, only individuals who are great facilitators of learning, acclaimed as effective teachers. This idea of facilitating learning, according to research, is essential for learning to take place. Engaging the learner in the teaching-learning process must occur for learning to take place. This action, then, is essential for effective science teaching and learning.

Unfortunately, there is no consensus on the best way to prepare teachers to become facilitators of learning, partly because there is no consensus on how and why we learn. However, three major schools of thought do provide the premises for most educational preparation programs: behavioral theories, developmental theories, and perceptual theories.

Behavioral psychologists believe that learning consists of making connections between events (stimuli) and behaviors (responses). In the early stages, the learner is able to make basic emotional responses through signal learning (like smiling when the voice of a parent is heard). These develop into more controlled responses and connecting stimuli using motor and verbal chains. Further stimulation enables the learner to identify similarities and differences and use discrimination to form concepts. Finally, concepts are blended into schema involving complex interactions used in problem solving and abstract thinking.

Behaviorists believe that it is important for educators to develop clear outcomes and that instruction should be directed toward these outcomes. Correct answers should be reinforced to increase the likelihood of retention. At later stages of development it is important to expose students to new and different patterns to help them gain new insights and greater skill in problem solving. The approach emphasizes the effects of external events on the individual (Woolfolk, 1993, pp. 156-209).

Developmental psychologists feel that the thinking of children is distinctly different from the thinking of adults. Furthermore they believe that as individuals progress through life, thinking patterns change drastically over a short period of time and then remain stable for relatively long periods. Although the path to intellectual maturity is the same for everyone, the rate at which one progresses depends upon several factors. They perceive learning as an external process that should be observed directly (Woolfolk, 1993, p.196). Developmentalists feel it is important that teachers provide experiences to students that match the students' cognitive maturity. It's especially important to include hands-on, tactile activities throughout the elementary grades. Piaget, although a genetic epistemologist, belongs to the developmentalist school of thought, since he approached the problem of knowledge and learning from a developmental perspective. His ideas are discussed in this chapter.

Perceptual psychologists, reflecting a third school of thought, deal with the ways individuals perceive themselves. The most important role of educators, they say, is helping students develop positive self-images by providing encouragement and structuring learning experiences in which the child can achieve success.

Perceptual psychologists feel the best road to the production of persistent adults is to provide students with high levels of successful experiences. They believe that emotions are closely tied to learning and that good teachers are concerned with both how a student feels about the learning setting as well as what is learned. These elements appear to coincide with biomedical research using brain probe stimulation. Our current understandings of perceptual psychology come largely from the work of behavioral theorists which originated in Germany with extensive applied research in the United States (Woolfolk, 1993, p. 244-245).

This research indicated that when memory is triggered, not only is the information learned retrieved, but also the emotional context in which the learning took place.

Recently, however, another school of thought has become very influential within the educational community. According to this school of thought, learning is the result of an interaction between a person's mental processes and their cultural, historical, and institutional setting (Rogoff, 1990; Wertsch, 1991; Wertsch & Kanner, 1993). A fundamental difference between this school of the thought - the social learning school, which is based upon Vygotsky' s (1981, 1986) work - and the developmentalist school is the relationship between learning and development. According to the latter, an individual should be developmentally ready (mature) to learn. According to the social learning theory, an individual can learn, even if he or she is not developmentally mature enough, provided that he or she is challenged and given appropriate help by a more proficient adult. In other words, according to developmentalists, development precedes learning, while according to social learning theorists, learning can take place in advance of development (Berk & Winsler, 1995).

Apparently, these theoretical models present different orientations of learning and of how knowledge and emotion function in individuals' minds. However, over the past two decades the behaviorist model has been severely criticized on the grounds that positivist epistemology (on which behaviorism is based) was found to be inadequate to explain the problem of human knowledge in general (Chalmers, 1982, 1990) and school learning in particular (Clemenson, 1990). Using a teacher as a disseminator of tacit knowledge, concepts, and relationships is not considered to be an adequate way to convey how individuals learn.

These criticisms as well as the evidence from empirical research resulted in the development of another learning model. According to this model - the constructivist model - learning is constructed within the individual, as a result of direct experiences with objects and events, in metaphors and relationships that are unique to the individual. Resnick (1983), in her quite short but influential article, gave the fundamental position on which this model is based: Learners construct their understanding, that is, they do not mirror what they are told or read. They are always trying to link new information to what they already know.

However the inferences and generalizations associated with the constructivist learning model and the constructivist epistemology - as opposed to positivism - in general are also being challenged. On the one hand, learners construct their own understanding in order to make sense of the world, both prior to and after formal instruction. This means that this kind of understanding can be very different from that of the scientific community, and therefore students should be provided with opportunities for changing their ideas. This is the reason why the social learning theory has been incorporated into the constructivist model (Driver et al., 1994; Hodson & Hodson, 1998). On the other hand, adults commonly question students' decisions. Adults don't understand how students can arrive at what appear to be inappropriate decisions with a reasonable system of logic. Students, particularly those who process information in a nontraditional way, are perceived as being manipulative and intentionally disruptive. Although they often are young adults in appearance, and apply reasonable thought to directed learning, they often fail to apply the same logic structures when making independent decisions. Is this something we should expect as educators? A strong basis of research supports the notion that the thinking child is distinctly different from the thinking adult, yet schools generally do not respond to these unique elements of thought when planning curriculum or guiding student decisions (Sternberg & Berg, 1993).

Despite criticisms against the constructivist perspective (Hadzigeorgiou, 1999; Osborne, 1996; Solomon, 1994), its message that the learner is not a passive agent who simply waits to be filled with knowledge by the teacher cannot be dismissed. The most important thing about constructivism is that it was a movement against didacticism. It challenged teachers who were, as Osborne (1996) put it, "wedded to a didactic model of transmission by offering variety and diversity" (p. 76).

Although the contributions to this model are diverse and go back to the Venetian philosopher Vico Giambatista (Hadzigeorgiou, 1994) and the work of Dewey (1916), the contribution by Piaget (1970) and Kelly (1955, 1970) deserve special attention since they both made an explicit reference to the idea of "construction."

Piaget's Epistemology and the Development of Mental Structures

The work of Piaget has provided a sound epistemology of the reasoning patterns reflected in human cognition. In rejecting traditional empiricism and the copy theory of knowledge, as well as traditional idealism and rationalism, Piaget proposed that knowledge is constructed through an active interplay of experiences and the developing mental (or cognitive) structures. His ideas are elaborated in his books *Genetic Epistemology* (1970), *Biology and Knowledge* (1971), and *Epistemology and Psychology* (1972).

Starting from the premise that "all reality - biological, physical, psychological, sociological, intellectual - is evolving in the direction of progress" (Kitchener, 1986, p. 6), Piaget explained reason and understanding in evolutionary terms. This evolutionary explanation also led Piaget to adopt the biological terms "Assimilation" and "Accommodation," that is, two simultaneous processes occurring while the "organism," and hence the epistemic subject, interacts with the environment in order to satisfy its "epistemic needs," and "Equilibration," that is, a state of equilibrium resulting from the satisfaction of those needs. It is obvious, according to this biological model, that the essence of cognition lies in its adaptive function.

Apparently, the Piagetian terms Assimilation and Accommodation are used to describe the cognitive processes employed by the learner in the classroom environment. Piaget's mental functioning model deals with the adaptation of the learner to this environment (Ginsburg & Opper, 1998). According to this model, learners all develop mental data-processing procedures which Piaget calls mental structures. Differences in mental structures distinguish one intellectual level from another and allow increased processing of more complex data with an individual's development. A small mental structure, called the scheme, is the basic generic unit of the cognitive structure. Assimilation is the process of incorporating data into existing structures and may be done only by the learner (Renner & Marek, 1988).

When learners are aware that there is a mismatch between their mental structures and what they have assimilated, they become concerned and enter a state which Piaget described as disequilibrium. This state of mismatch may result in new schemas being built or in modification of structures. The entire process that leads to adjustment or change of mental structures as a consequence of assimilation and disequilibrium is called accommodation. Assimilation, accommodation, adaptation, and organization are referred to as the functional invariants of intelligence (Piaget, 1963). The process is the same regardless of the age of the learner. The relationships between assimilation, accommodation, adaptation, and organization are called intellectual functions and are inferred to represent the learning process (Renner & Marek, 1988). These mental structures are the systems that transform information received from the environment and give it meaning. The initial response is at the sensorimotor level. With development, the learner's unintentional actions are replaced by intentional actions.

Later, understanding is sought, events are anticipated, and objects are replaced by internalized intellectual processes (Piaget, 1966). Information is primarily acquired through a system of MESS (Mental Experience Storage System) acquisition. Little processing of information occurs; rather the individual is forming a schema, which can be thought of as drawing air into a balloon.

At the next level, preoperational thought, the process of learning continues to emerge, again primarily through the MESS process. Although learners use some internal symbolic manipulations of reality, most learning takes place through the ongoing assimilation of information. Thinking is tied to perception and has a tendency to center on the most outstanding feature of an object. Thought is largely irreversible with little conscious reflective thought (Piaget, 1968).

The third stage, concrete operations, is marked by the commencement of a coherent and integrated system by which external reality is organized and manipulated. The thought process becomes reversible, and the invariance of objects is recognized (Piaget, 1966). The individual begins to employ a MOP (Memory Organization Point) system of learning. Thinking now becomes a continual interaction of MESSs and MOPs in the development of logical thought and reasoning. At the concrete operations stage, cognitive structures are bound to concrete experiences within a schema structure. Use of a

concrete operation in one instance does not ensure use of the operation in a different circumstance (Piaget, 1966, pp. 139-147).

The isolation of schema has significant implications for instruction. In describing the origins of mental structure, Inhelder and Piaget (1969) reported the order of succession of the stages of intellectual development is invariant. The cognitive structures at one stage become incorporated into the cognitive structures of later stages. This development of reasoning is further explained by Maier (1969) who summarized the transition from sensorimotor to formal operational thought in the following manner: "Intellectual behavior evolves descriptively from activity without thought, to thought with less emphasis on activity. In other words, cognitive behavior evolves from doing to doing knowingly, and finally to conceptualization" (p. 156).

The ability to draw from a number of schema in employing logical reasoning patterns begins to emerge with the advent of concrete operations, generally considered common in the reasoning of individuals after age seven. The depth and complexity of reasoning continues to mature as long as a person continues to actively seek new knowledge and new insights. There is a constant interplay, not well understood by the community of scholars of human learning, between content, conceptual-process, and social-interactive knowledge.

Learners at the concrete operations level often experience great difficulty applying reasoning processes when instruction is delivered through written or verbal modes of expression. Such expository modes of instructional delivery by their nature are consistently ineffective.

Students tend to deal with concepts in isolation. They cannot effectively consider a number of isolated examples and apply these to a general theory or principle. They are unable to cognitively process variable time frames or situations which require simultaneous consideration of multiple characters or events.

Finally, at the stage of formal operations, the use of integrated thought processes exist within the learner's cognitive framework. Learners can integrate a number of schema in order to form statements or propositions about reality. They can apply combinatorial logic and hypothetical deductive reasoning. The learner is able to deal with abstractions and follow literature and social studies concepts which require cognitive processing of variable time frames. The learner returns to a state of equilibrium when structures have been adjusted to accommodate new inputs from the environment.

It deserves to be pointed out that the Piagetian idea of autonomous construction of mental structures or schemata is based on both heredity and environment. Something must be innate that allows for autonomous development; and external experiences must also play a major role in the interaction between the student and the environment. Piaget (1970) reported that cognitive structures exist even in deaf and blind children, although, due to lack of sensory input, they develop much later.

The Piagetian Notion of Equilibration

Given the centrality of the notion of equilibration in both the Piagetian epistemology and the theory of intellectual development, it is important to deal with it in more detail. Equilibration, as has already been mentioned, is the process by which mental structures are revised. New learning, being possible because new structures have been formed, depends on accommodation, which is the result of disequilibrium caused by assimilation (Renner & Marek, 1988). Piaget (1977) stated that the driving force of intellectual development is the disequilibrium experienced by the subject. Glasersfeld (1989) believed that the learning theory that emerged from Piaget's work can be summarized "by saying that cognitive change and learning take place when a schema, instead of producing the expected result, leads to perturbation, and perturbation, in turn, leads to accommodation that establishes a new equilibrium" (p. 128).

In describing pedagogical implications relating to equilibration, Piaget (1977) noted three classical factors: the influences of the physical environment (the external experience of objects); innateness (the hereditary program); and social transmission (the effects of social influences) (p. 3). He said that equilibration is a complex interactive process involving an assimilation, in the biological sense of the term,

and integration of the external data into the structures of the subject,accommodating to the schemas of the situation. Therefore, even rote assimilation is an integration, whereby the subject is assimilating the object into his schemas and, at the same time, accommodating his schemas to the special characteristics of the object.

In all learning the condition of the subject is sensitive to a stimulus only when the learner possesses a schema that permits the capacity for a response. Knowledge is always the product of interaction (equilibration) between assimilation and accommodation. In the construction of any operational structure, a learner goes through much trial and error that involves in large part self-regulations.

Piaget (1977) described three types of equilibration: In basic reasoning such as conservation, representation involves equilibration between the structures of the learner and the objects. At the pre-operational level after many trials, the learners make the same errors as at the beginning. However, at the operational level the repetition of the judgement results in a very clear diminishing of the illusion. At a more advanced level, there is equilibration among the subsystems of the learner's schemas. For example, there may be a conflict between a logico-mathematical operations (applying mathematics concepts to variables) and spatial operations (describing metaphysical motions such as mechanics in Newtonian physics). These operations often evolve at different speeds. However, to reason well requires coordinating the two, that is, an equilibration of the systems. The third level Piaget (1977) described as fundamental. This is an equilibration between the parts of a subject's knowledge and the totality of his/her knowledge. There is a constant differentiation and integration that involves self-regulatory mechanisms.

Equilibration is not passive; it is constantly interactive in which all parts are interdependent. In the viable mind, it is a search for better and better coherence in the sense of an extended field. In a pluralistic society, the complexity and nature of the interactions often becomes more difficult because the subsystems are not closed and many aspects are not entirely decidable. In cognitive social systems, the links are the very sources of action and they are different than reasoning in the metaphysical world in a field such as physics.

The different aspects of equilibration must be considered in teaching. On one hand, the teacher serves as a guide to help students develop a sense of confidence in the use of meta-physical knowledge to describe interactions and investigate hypotheses in the physical world. At the same time, students are searching for better coherence of the totality of reasoning by integrating and differentiating in social-cognitive schema which have no equivalency in the physical sciences. Piaget (1973/1985) implied that an equilibrated mental structure and an equilibrated physical structure have abstract properties in common, and the mental program is arranged to value and conserve equilibrated structures in the same way the physical world accommodates certain reasoning operations.

Piaget (1985) described equilibrium as self-regulation, or as an ongoing process that leads to better equilibrium rather than returning to more stable forms of a former equilibrium. Every structure has an influence on structures that follow it and is based on the structures preceding it. The instructional goal of each new assimilation and accommodation is to enlarge reasoning into a more consistent totality, as opposed to a cumulative piling up of information pieces when teaching exists outside of the framework of the learner.

Teachers promote learning by providing students with opportunities for assimilation that will cause disequilibrium (Renner & Marek, 1988). Lawson (1982) presented a detailed discussion of the concept of psychological equilibrium as it related to its usefulness in biology instruction. He described equilibration as "the internal mental process by which individuals develop intellectually." The equilibration process can be used as the route to internalization of external knowledge presented by the teacher. First, the student is prompted to discover that previous ways of thinking are inadequate to assimilate the new information. Then time must be given for mental reorganization (accommodation) of the information which allows assimilation of the new material. The teacher's role is to ask questions, provide materials, participate in the exercise, and act as class chairperson and secretary.

In Lawson's view, the teacher gathers class data and solicits its meaning. Most importantly, the teacher is not a provider of information, but a director of its meaning. Lawson (1982) commented, "How often have you heard teachers complain that their students fail to apply what they have

supposedly learned? Perhaps if these teachers took a look at equilibration theory seriously they would have less to complain about" (p. 404).

The learner's adaptation to inputs from the environment is represented by assimilation and accommodation which causes a change in the learner's mental structures that leads to equilibrium (Renner & Marek, 1988). Piaget used the term organization to describe the relationships that exist between a new mental structure and previous mental structures. He called organization the accord of thought with itself.

Renner (1979) provided the following insight:

> Knowing an object, event, or situation, then, means that mental structures have been constructed that will enable data from the environment to be transformed by the learner. Learning, therefore, is an active process which is aimed at the construction by the learner of systems of transformations called mental structures. (p. 279)

From a postmodernist perspective on curriculum development, Doll (1993) acknowledged the centrality of self-organization. Given that order and organization emerge from disorder and chaos, then opportunities for learners to experience perturbations that will in turn lead them to reorganize their ideas should be given a central role in curriculum development. This notion of self-organization is in line with a holistic - ecological worldview as opposed to a mechanistic view. In curricular terms, according to the mechanistic worldview, order and organization are imposed from without, while according to the holistic-ecological view they are emerging from within. The implications, therefore, specifically for instructional practices are that learners are given opportunities to experience disequilibrium and then time to reflect and reorganize in order to restore equilibrium. These opportunities might include concrete (hands-on) activities, computer simulation, and questions that make students aware of explicit verbal discrepancies (Hadzigeorgiou, 1999).

However, having discussed the notion of equilibration, it is not the sole determinant of the learning process. It is very important that teachers also pay attention to the ways students interpret their experiences and the meanings they create from them. Apparently, these meanings and interpretations are based on students' prior beliefs and expectations. It is the latter that determine to a great extent, if not solely, the outcome of the learning process. Therefore, it is important to review Kelly's theory of personal constructs.

Kelly's Theory of Personal Constructs

An epistemology of the interpretive tradition is at the heart of Kelly's (1955) theory of personal constructs which stressed the fact that "whatever the world may be, man can come to grips with it only by placing his own interpretation upon what he sees" (Kelly, 1970, p. 2). Kelly's work (1970), initially published almost 40 years ago, offered a constructivist perspective since it viewed the individual as a "scientist" who builds for him or herself internal models in an effort to understand and make predictions about events of the external world. These models are subject to modification, since construction of reality is constantly tested out so that better predictions can be made in the future. For Kelly, human behavior is anticipatory rather than reactive.

Kelly's theory is based upon the philosophical position of constructive alternativism, the notion that there are many workable alternative ways for one to construct his/her world. The theory itself starts with the basic assumption, or postulate, that a person's processes are psychologically channelized by ways in which the person anticipates events (Kelly, 1955, p. 560).

Classroom practices based upon Kelly' s theory of personal constructs should include discussion of interpretations and meanings and also respect for a variety of views—even differing views. Classroom experiences, therefore, should be organized so that students have the opportunity to articulate their personal constructions and negotiate the personal meanings of such constructions. Science education, from such a perspective, "would be an experimental affair for the student where existing constructs are tested for their ability to predict and control external event's" (Fetherston, 1997, p. 804).

Central to the theory of personal constructs is the notion that "the thoughtful man is neither the prisoner of his environment nor the victim of his biography" (Kelly, 1955, p. 560), but, instead "an inveterate inquirer, self - invented and shaped, sometimes wonderfully and sometimes disastrously, by the direction of his enquiries (Bannister & Fransella, 1986, p. vii).

It is evident that, contrary to the deterministic ideas of both Freudianism, namely, that we are the victims of our infancy, and our reinforcement activities respectively, constructive alternativism views people as free agents able to construct their own reality and take also the responsibility for such constructions. According to Holland (1970):

> The very idea of construct, as distinct from a concept, is that it introduces criteria of relevance and responsibility. Action can only be subjected to moral judgement in the context of what a man might have done, as a field of choice around what he did, and perceptions, being selective, negate certain possibilities. We are then responsible for our construing since this is the formative structure of our choosing. (Holland, 1970, p. 125).

It becomes quite apparent that Kelly's theory of personal constructs shares with existentialism a number of features: They are both theories of action; they both treat the individual as a person as opposed to an object or even a biological organism; and they both include responsibility. Kelly himself equated the philosophical position of constructive alternativism with an "epistemological responsibility" (Kelly,1970, p. 2). In fact, the notion of responsibility is an important one, for as Kelly himself further remarked, "even the most valuable construction we have yet contrived - even our particular notion of God Himself - is one for which we shall have to continue to take personal responsibility, at least until someone turns up with a better one" (Kelly, 1970 , p. 4).

Although Kelly's ideas have immense implications for a wide variety of fields, their consequences for conceptual, or rather "constructive," understanding are significant and far-reaching, too. For accepting the notions of free choice and "epistemological responsibility," the idea that neither the reinforcement nor the motivational methods have worked so far becomes justified. Meaning is constructed by the cognitive apparatus of the learner. It is not communicated by the teacher to the learner. It is created in the mind of the student. We have to recognize that wisdom can't be told (Sauders, 1992). It may even happen without teachers, textbooks, and schools. It is, therefore, important that the classroom becomes a place where students feel free to offer their personal constructions, to be applied and used in new situations to support or alter their or others' previous structures. Teachers, other adults, and peers can enhance learning by facilitating learners in challenging and formulating their own cognitive structures (Yager, 1992a). Kelly's theory of personal constructs provided opportunities to both students and teachers for bridging the distinction between personal meaning and the formal knowledge of school science (Fetherston, 1997).

The Constructivist Model of Learning

Central to both Piagete's epistemology and the Kelly's theory of personal constructs is the idea of the active role of the individual. The constructivist model of learning acknowledges this active role of the learner and the fundamental idea that knowledge cannot be transmitted from a textbook or the mind of the teacher to the mind of the learner (Driver & Oldham, 1986; Wheatley, 1991).

Research done by the Center for the Learning and Teaching of Elementary Subjects at Michigan State University by Roth (1989) traced the development of elementary science instruction over the past decades and evaluated its philosophies and accomplishments. Roth's work laid an impressive groundwork for further analysis of the constructivist model.

Roth (1989) found the reform movement divided into three main camps—those advocating use of and the fine tuning of inquiry teaching methods; those focusing on changing the goals of science teaching; and a third group focusing on changing the methods of instruction in the development of conceptual understanding. Research into this theory of learning suggested one important curricular issue: The science curriculum should focus on developing deep understandings of a few concepts rather than

superficial coverage of many concepts (Roth, p. 61). Think of this as "putting down postholes," developing fewer in-depth topics at each grade level rather than covering a large number of topics with little depth and needless repetition as students progress through the grades. The constructivist teacher believes the primary goal of science education is to help students develop a meaningful, conceptual understanding of science and its value through descriptions, explanations, and predictions which come from the learner. Scientific processes and concepts become meaningful only when they are integrated with the learner's own personal knowledge and experiences. The central goal of the teacher is to help students develop their own explanation for the world around them in ways that incorporate concepts and thinking into their frameworks. These frameworks emerge as students explain their own experiences and make sense of their world through interaction and problem solving.

This conceptual change perspective is not a response to social/political conditions, but rather a research-based perspective which grew out of cognitive science studies of learning and knowing in complex knowledge domains (Roth, p. 65). The conceptual change perspective has attempted to look at both expert and novice knowledge and how that knowledge grows and changes. Glaser (cited in Roth, 1989), referring to several other studies of learning, has concluded that conceptual understanding is at the heart of higher level thinking, problem solving, and self-regulated learning. He suggested that changes in those understandings occur when theories are confronted by challenges and contradictions to one's knowledge. This is known as the constructivist view of cognitive development.

Constructivism emphasizes the role of the learner as an active participant in the learning process. A primary role of the teacher is to help the learner make connections between his/her perceptions and the consistent interactions governed by concepts and principles which predict how objects act and interact in the metaphysical world. The emerging models represent a synthesis of both theoretical and applied research, grounded in the work of Jean Piaget, Levi Vygotsky, Jerome Bruner, Gestalt Psychology, and John Dewey (Martin, et.al., 1997).

Three principles that make up the theory of constructivism are:

1. A person never really knows the world as it is. We each construct beliefs about what is real, and knowledge exists within the mind of the learner.

2. What a person already believes affects what a person brings to a new situation, what he/she filters out, and how he/she changes the information that the senses deliver.

3. People create a reality based on their previous beliefs, their own abilities to reason, and their desire to reconcile what they believe and what they actually observe. Constructed meanings are based on new experiences compared with existing schema.

Several views within the educational research community claim to embrace constructivist principles. Each view has a subset embracing a different interpretation of how to best transmit knowledge to the learner. Along the continuum are:

Radical Constructivists - do not believe the world is knowable and suggest that teachers provide opportunities for each student to gain an assortment of experiences that will enable him/her to construct meaning.

Conservative Constructivists - believe teachers should use activity-based learning with many problem solving opportunities for students. However, the teacher aids the student in promoting conceptual understandings and attempts to correct misconceptions.

Traditionalists - believe we should teach students about the metaphysical world and the principles which apply. Instruction should be more straightforward with laboratory and hands-on experiences that help students verify concepts embraced by the scientific community (Martin, et.al., 1997).

According to constructivism, the learner responds to sensory experiences by building or constructing in his/her mind schemata or cognitive structures which constitute the meaning and understanding of the child's world (Saunders, 1992). These schemata or structures can be viewed as one's beliefs, understandings, and explanations—i.e. one's prior knowledge of the real world. These structures are

used in two ways. First, the learner is empowered to make predictions based on these past experiences; and second, he/she is able to use them to develop explanations of these predictions. The predictions and explanations may or may not agree with others' perceptions and/or predictions. If agreement is recognized, then the schema remains intact and becomes more firmly believed. If disagreement is found, the learner becomes frustrated, surprised, puzzled, or in Piaget's terms (cited in Saunders, 1992), disequilibrated. The learner usually selects one of three options.

The "intact schema" option (Saunders, 1992) allows the learner to deny the existence of the sensory data, distrust it by seeing it as invalid or rationalizing it away. It is as if the learner says, "Don't confuse me with the facts, my mind is already made up." The learner chooses (probably unconsciously) to ignore, disbelieve, or explain away the contradicting experiences. Discarding or restructuring one's schema does not come easily. It requires tremendous cognitive energy to restructure the existing schema. For this reason, the learner chooses to retain the "intact" cognitive framework.

The "cognitive restructuring" option allows the learner to revise schema to agree with the experience. It requires a trust of the data or experience and a revision of the intact schema to facilitate agreement of harmony with the new experiences. It is felt that this is where meaningful learning occurs. Expressions are heard such as "Oh, now I get it" or the "Ah-ha" that Hilda Taba (1962) recognized. The light comes on, insight is gained, and understanding is attained.

In cognitive restructuring, the teacher does not convey insight through lecture, but rather the student must construct it within his/her own mind. The teacher can assist (facilitate) students with the cognitive restructuring by leading them into situations in which the predictions do not agree with their schema (disequilibration), but the teacher cannot transmit or convey meaning—only words. The meaning must be constructed and created by the student. Saunders (1992) and Yager (1992a) stressed that knowledge can never be observer-independent. It must be attained in a personal sense; it cannot be transferred from one person to another like the contents of a vessel. It requires a personal commitment to question, explain, and/or test explanations for validity.

Apathy, the third option for the disequilibrated learner, allows the learner to cognitively disengage himself, i.e., "I don't know why and I don't care why." Because cognitive structures are sometimes highly resistant to change and are a psychologically active process requiring the expenditure of much mental effort, the learner may choose not to accept the responsibility to understand. Similar categories of dealing with learning disagreement were also reported by Gilbert, Osborne and Fensham (1982). From their study they found that three possible outcomes of the learning process are: the undisturbed outcome (the learner holds on to the initial conception), the two-perspectives outcome (the learner retains both the preconception and the teacher' s explanation as a memorized version), and the mixed outcome (the learner learns some of the taught material but fails to integrate it into his or her conceptual framework).

Kinds of knowledge.

Kamii and DeVries (1977, 1978/1993) proposed three different contents of knowledge which are processed within the individual. When individuals respond to a question or situation their responses are affected by the context of where the knowledge is stored.

Content Knowledge, which includes:

- Social-Arbitrary Knowledge - consisting largely of knowledge derived through language (either spoken or written) or conventions (arbitrary learning of rules of and cultural mores).
- Physical Knowledge - derived from direct experiences and interactions with concrete objects. These can be described as MENTAL EXPERIENCE STORAGE STYSTEMS (MESS) Assimilative Learning-Information placed into memory with minimal transformation.

Conceptual - Process Knowledge, which includes:

- Conceptual Knowledge - input that is transformed and put together by the learner which can be utilized to process and respond to unfamiliar stimuli.

- Process Knowledge - the ability to use the "tools" of scientific inquiry (i.e. observing, describing, classifying, experimenting, formulating hypotheses) to affirm and modify existing schema.
- Conceptual and process knowledge can be described as MEMORY ORGANIZATION POINTS (MOP).

Accommodative Learning-Schema in the form of concepts and generalizations formulated in the mind of the learner.

Social Interactive Knowledge which includes:

- Social Knowledge - Understanding the rules and conventions for building and sustaining relationships.
- Interactive Knowledge -Complex process of adapting behaviors to disagree amicably, encouraging productivity from others, getting along, and maintaining pleasant group work situations.

Implications for teachers.

The school curriculum has historically evolved using a separate subject structure. As a result, strong influences are asserted to develop one isolated schema framework within the mind of the learner. Learning within each class is generally conceptualized as a separate entity, isolated from experiences outside of that class. Experiences from other classes, home, peer relationships, and non-school settings all exist in different schema. One could use the analogy of a large bundle of helium-filled balloons of different sizes. Each balloon is independent, and its size and shape depend upon the amount of learning that has been acquired in that schema. When reasoning, the learner tends to draw only from the knowledge and emotions within a single schema. Because of this isolation, it is logical to assume that experiences from outside of school are not drawn upon by the learners because those experiences exist in different schema. In school, students will demonstrate a different performance level and reasoning processes in reading and writing in a language arts or English class than in a science or social studies class.

Statements of Piaget (1972), which have been corroborated by other researchers including Epstein (1979) and Shayer and Arlin (1982), consistently revealed that relatively few learners in K-12 are at the formal operational level. When one considers the isolation of schema at this level, it is unlikely that even the brightest learners will be formal in multiple schema. It is also likely that students will have some schema at the preoperational level. The approximate percentages based on Piagetian Tests reported by Epstein (1979) are noted in Table 1.

TABLE 1

AGE	PRE OP	CONCRETE ON SET	CONCRETE MATURE	FORMAL ONSET	FORMAL MATURE
5	85	15			
6	60	35	5		
7	35	55	10		
8	25	55	20		
9	15	55	30		
10	12	52	35	1	
11	6	49	40	5	
12	5	32	51	12	
13	2	42	44	14	6
14	1	32	43	15	9
15	1	14	53	19	13
16	1	15	44	17	13
17	3	19	47	19	12
18	1	15	50	15	19

The contrast in schema development becomes much more profound when students from other cultures encounter an instructional setting established primarily on Northern European values. Soon after beginning school many students who come from cultures which do not reflect the European traditions make a decision that there is no relationship between what they learn at school and the world which exists outside of school. Therefore, everything that exists in the academic learning schema must be built within the framework of instruction. It is not surprising that these students become passive in educational settings. After the 2nd grade, most textbooks and instructional materials assume that students are reasoning at the concrete operational level. Even when new concepts are initially introduced, it is assumed that students can read with comprehension and apply logical thought processes. Given this information, for students to be successful, teachers need to lower the level of instruction to the point at which the student can become a successful learner. We can then progress to higher levels of concept development, often fairly quickly.

The terms MESS (Assimilation) and MOP (Accommodation) can be used to describe reasoning patterns of students. When the learner reasons using the Mental Experience Storage System (MESS), little information processing occurs. Information is assimilated into memory the same way in which it is received by the learner. A MESS system of reasoning dominates learning throughout the first seven years of life and provides an essential database for future learning and higher level thinking. When a new schema (concept) is developed, a MESS must be built before students can be expected to reason effectively. Learners also employ a system of Memory Organization Points (MOP), which becomes much more prevalent at the level of concrete operations. The MOP system allows one to bring together segments of information from several sources in a process of reasoning and comprehension.

The ability to draw from a number of schema in employing logical reasoning patterns begins to emerge with the advent of concrete operations, generally considered common in the reasoning of individuals after age 7. The depth and complexity of reasoning continues to mature as long as a person continues to actively seek new knowledge and new insights. The following paragraphs describe how students might respond to a newly introduced concept. There is a constant interplay between content, conceptual-personal, and social interactive knowledge (see Figure 1).

Looking back to the application of the theoretical base to practice, teachers could consider the following instructional approaches. When introducing a new concept, help students develop a MESS. This is information which is not processed but is assimilated in the same manner in which it is delivered. After we are assured that they have a MESS, some air in the balloon, we can do some MOP'ping, which is the shaping of the balloon into a conceptual schema. The process of instruction must be a continuous oscillation between MESSs and MOPs. If too much time is devoted to building a MESS, your MOP'ping efforts will just spread the MESS around. If you don't have a MESS, there will be nothing to MOP.

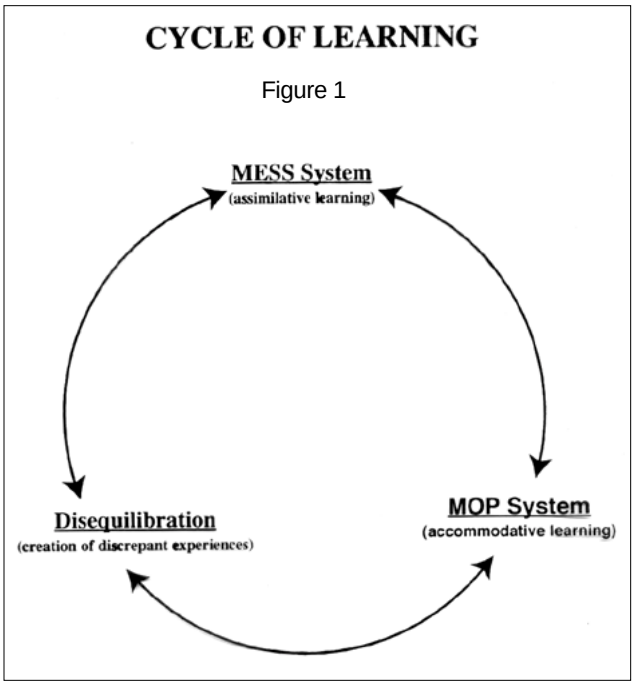


Figure 1

Figure 1 illustrates this continuing process of MESS'ing and MOP'ping.

Always remember that if the student is unable to equilibrate—participate in the learning process—instruction is of little value. Effective teachers must look at instruction through the eyes of the learner. Heredity, experience, and biological maturation must be considered when planning appropriate learning experiences for your students. Piaget consistently presented the position that we cannot demand thinking beyond the student's present stage of cognitive development. We must earn higher thinking through nurturing a series of successively more advanced learning tasks until the student reaches the desired level of performance. Before a student will be able to deal with a higher level of reasoning, she/he must be able to demonstrate mastery at the lower levels. Teaching must occur in an arena of active manipulation of concrete hands-on experiences. When a concrete experience is impossible, semi-concrete opportunities (i.e., films, simulations, games, illustrations) must be utilized. Teachers must reduce the time spent talking in front of a class with only a few students equilibrating. Keep in mind, there has never been an outstanding teacher. Rather, learning requires active participation on the part of the learner. If the student is passive (not equilibrating), learning does not take place.

Additional complicating factors in intellectual development are isolated schema frameworks within what would normally be considered to be a schema. When teaching a concept, it is natural for the teacher to assume that there is an integration of content, conceptual process, and social interactive knowledge. In the ideal process of healthy development the learner accommodates the different kinds of knowledge through schema integration and interaction into becoming knowledgeable about details with sound conceptual understanding and effective social interaction abilities.

However, there is evidence that this may not be the case for many learners. Figures 2 -6 illustrate how students may respond to learning and how this may contrast considerably from the teaching intent.

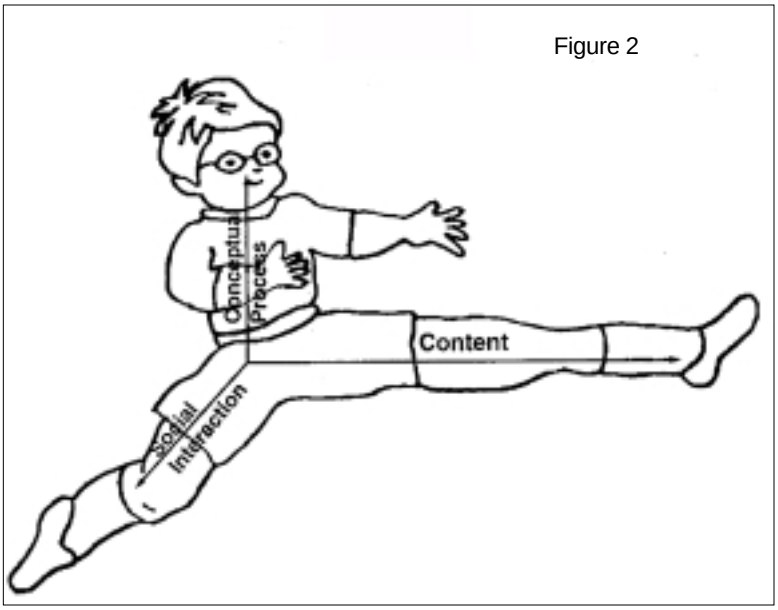


Figure 2

Figure 2 is a drawing of the focus on content. Learning is viewed only as the acquisition of knowledge. As an example, consider a typical student's perception of what is valued in school. Tests and graded projects are important. Homework is not regarded as a process to aid learning but simply something to complete. After a test is finished it is time to shut down that schema. Teachers are sometimes frustrated because students do not exhibit any interest in reviewing their tests. From the perceptions of the student, the knowledge has application only with context of a grade with little intrinsic worth.

Figure 3

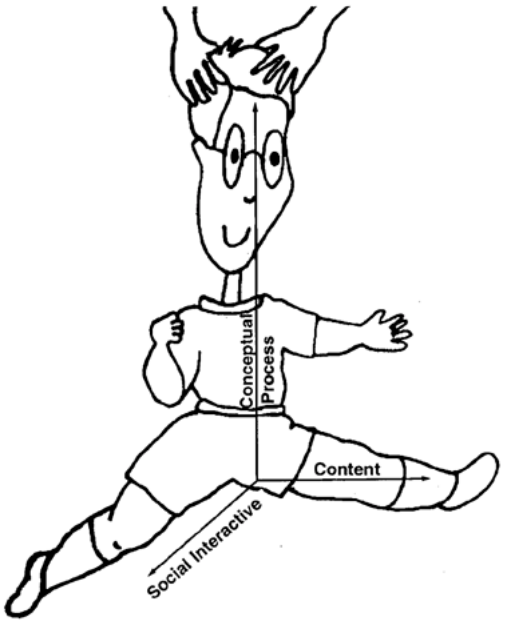


Figure 3 is an illustration of the conceptual process without content. This is often a problem in the skill subjects of language arts, reading, and mathematics. Students learn a pattern, i.e., division of fractions or labeling parts of speech in a sentence. They simply go through the process repeating the pattern on the worksheets without thinking about the experience as a valuable tool in the context of problem solving or rhetoric. Teachers often become frustrated because these students can have a perfect worksheet and come up with a blank stare when it comes to problem solving or composition. Units such as thinking skills or study skills are only considered when the student is engaged in the course or unit. The schema is shut down right after the specific class.

Figure 4

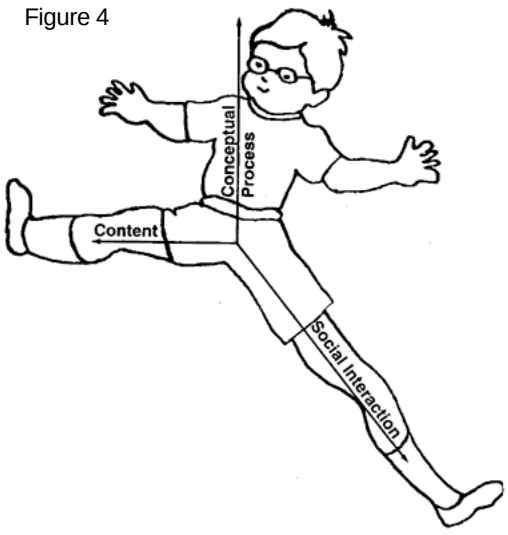
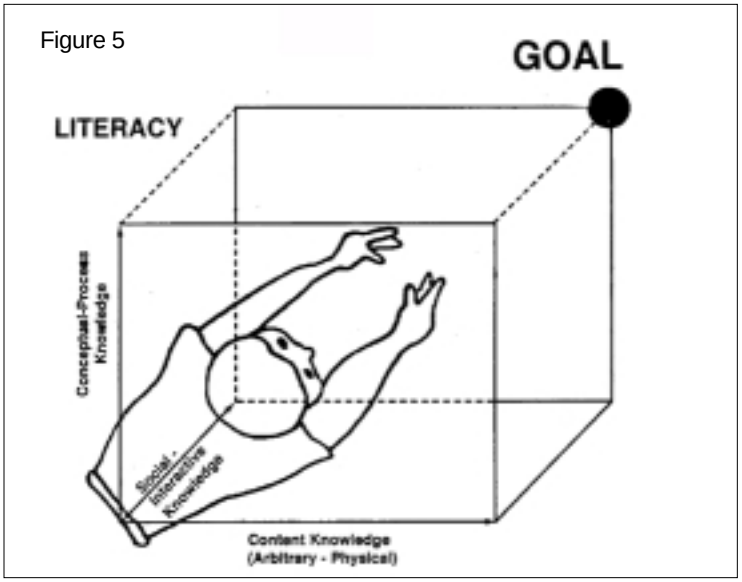


Figure 4 illustrates Attitudes and Values without considering the product or process. Cruelty or isolation of peers is a common example; students focus on the act from a personal perspective without considering the affect on the other individual. This may be a factor in the behavior of teen-age gangs. Actions are perceived only within the schema of the rules, rituals, and expectations within the gang. The members may be cognitively oblivious to the agony and pain of the victims and others affected by their actions. Other more common examples include statements like, "What is the difference with how I look as long as I do a good job?" or "Why should you care; it's my body?" Students often fail to consider future implications of personal acts, and do not see relationships which exist between personal behaviors and performance at work or in school.

Figure 5



Our desire is to create a balanced individual as depicted in Figure 5.

Figure 6

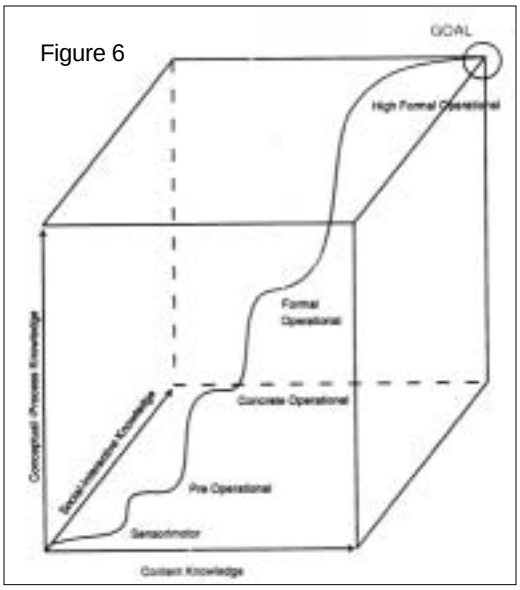


Figure 6 is an illustration of a desirable path of cognitive maturity. The student progresses following a diagonal course from the floor in one corner (reflecting the beginning point) to the opposite ceiling (reflecting a balance of content, process, and values). The steps or graduations in the degree reflect the processing changes associated within each level of cognitive development. If we are to accomplish outcomes of this nature, students must be guided through a balanced curriculum, blending product, process, and attitudes and values through a continuous, integrated curriculum consisting of small steps. This underscores the importance of interdisciplinary teaming, teacher empowerment, and collaborative dialogue.

Constructivist learning: Suggestions for teachers.

1. Encourage student autonomy and initiative. Seek ways to serve as a resource to help students access and utilize sources of information, rather than serving as a disseminator of knowledge.

2. Understand that learners have different learning styles, different abilities, and process experiences at different developmental levels.

3. Use concept maps to represent meaningful relationships between fragments of knowledge.

4. Allow students to direct the learning, shift strategies, and modify their own conceptual frameworks.

5. Inquire about students' understanding of concepts and provide numerous opportunities for them to share their ideas with peers and their teachers.

6. Withhold telling students. Rather, relate to their experiences before showing your knowledge and/or understanding about a concept.

7. Encourage student inquiry by asking open-ended questions.

8. Engage students in inquiry experiences through the use of discrepant events.

9. Become familiar with research on wait time and employ it in your teaching.

Learned Helplessness

Schools (educators) appear to be losing large numbers of students who disengage from their educational process and are inclined to become apathetic. The theory of learned helplessness provides some insights into this phenomenon. The phrase was first introduced by Seligman and Maier (1967) and Overmier and Seligman (1967) who reported responses of dogs whose failure experience was an unavoidable shock. This research has been replicated in school settings by Butkowsky and Willows (1980), Dweck (1975), Fowler and Peterson (1981), and Gentile and Monaco (1986,1988).

Gentile and Monaco (1988) described learned helplessness as a group of behaviors commonly noted after exposure to uncontrollable failure experiences. They stated:

> After initial exposure to such trauma, the subject tends to increase movement, to increase emotionality as adrenaline increases with the stress associated with discomfort, and to increase motivation to search for solutions which will bring relief. As repeated attempts to gain control do not produce the desired alleviation of suffering, subjects come to believe that the situation is uncontrollable: their fate is unrelated to their behavior. Should such subjects subsequently be placed in a different situation in which their responses might be instrumental in controlling outcomes, they nevertheless cannot perceive the possibility of gaining control due to their past history. (pp. 16-17)

It is likely that learned helplessness may be influenced by changes in physiology of the individual, or vice versa. In studies of rats and humans who have experienced high stress there are higher than normal levels of cortisol and enlarged adrenal glands. The stimulated brain can produce a cascade of hormones, each influencing specific centers of the brain which can signal physical responses in body organs. One hormone produced in the brain is called corticotrophin-releasing factor (CRF) which stimulates the adrenals to produce cortisol. When released into the bloodstream, the body's own cortisol affects mood, food intake, the sleep-wake cycle, and level of locomotor activity. Furthermore, hormonal stimulation

can affect receptor cells and thereby alter the neural architecture—the hard wiring—of the brain (Kramer, 1993, pp. 115-117).

Teachers' and parents' lack of understanding of learned helplessness leads to untold suffering by many students afflicted with this condition. These students feel less competent which results in performance deficits unrelated to actual skill deficits (Butkowsky & Willows, 1980, p. 411). Seligman and Maier (1967) noted further that learned helplessness has been found to be dehabilitating to the individual to the point of obstructing his/her performance in school, social settings, and later in life.

From a constructivist point of view, the notion of learned helplessness becomes more meaningful, indeed, for what really matters is what learners bring to the classroom. And what they bring is not only their prior ideas about how the natural world works, but also their fears, anxienties, hopes, and expectations. It is all these that make the difference between failure and success and not just what students believe about electric current, action and reaction, or the greenhouse effect. Teachers should bear in mind that the central idea of the theory of personal constructs is that the individual "is neither the prisoner of his environment nor the victim of his biography" (Kelly, 1955, p. 560).

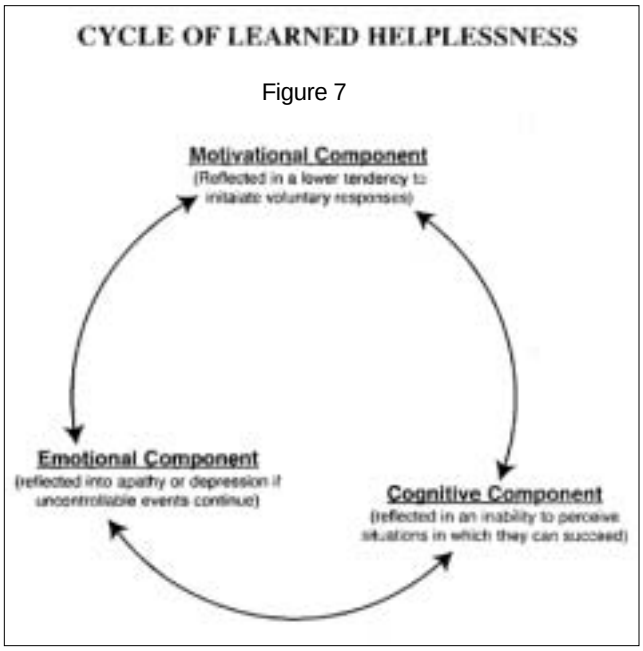


Figure 7

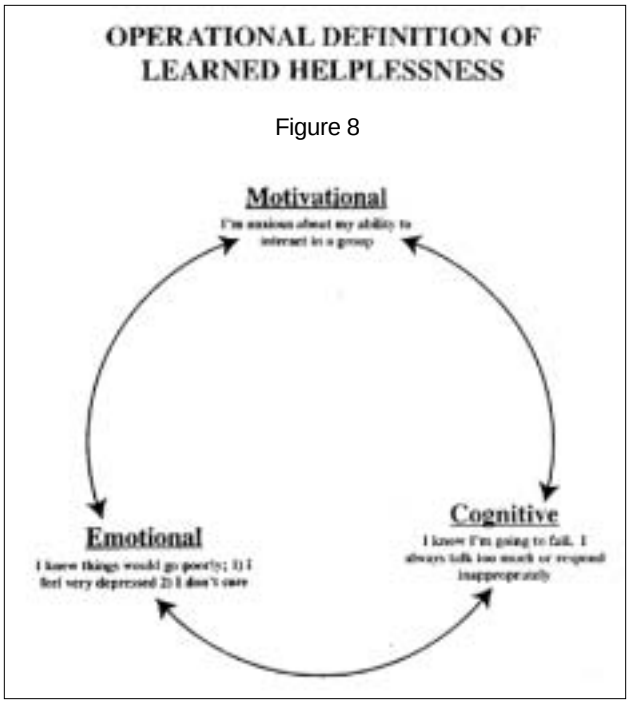


Figure 8

Figure 7 displays the components reflected in the cycle of learned helplessness. An example of how this may be reflected in the behavior of an individual is shown in Figure 8. This leads to the apathy and depression so often found among the students.

Addressing learned helplessness: Suggestions for educators.

What can we do to help? Twelve suggestions follow:

1. Rigidity causes problems for students afflicted with learned helplessness. The process of visualizing an activity and providing advanced organizers is often helpful.

2. Students afflicted with learned helplessness often have difficulty with verbal instructions. Providing each student with a written sequence of steps accompanied with verbal directions can be effective.

3. Limit the number of new vocabulary terms and provide sufficient context clues for students. Employ strategies which lend multiple exposures to new terms (Wood, 1990).

4. In helping students acquire a better sense of self-worth, present assignments which allow a number of refinements with teacher feedback. Provide frequent opportunities for assistance and work on short-term deadlines (Cheatham, 1989).

5. Work collectively with other teachers in interdisciplinary teams. Share ideas and develop uniform strategies for working with students who are reluctant learners. Develop interdisciplinary units to help students recognize the relationships among subjects. Through presenting instruction in an integrated manner, a schema develops as a multidisciplinary concept.

6. Use formative rather than summative evaluation. Avoid closing a topic with a test. Instead, after testing, provide students with a high interest culminating activity.

7. Try to find a creative outlet which the student can perform without criticism. This will relieve stress and may lead to a locus of positive association.

8. Develop the ability to laugh at one's mistakes. Laughter is therapeutic both physically and psychologically.

9. Bibliotherapy is an effective method for helping the student learn more about himself or herself. Students who experience learned helplessness are often coping with dysfunctional families. They can also associate with others who are experiencing difficulty with academic, physical, and social-emotional adjustment.

10. Help students develop skills of self-regulation and self-direction. Making a videotape of students who are not responding to learning tasks during independent or group work provides an excellent vehicle for engaging in conversation which will foster higher levels of self-regulation. We must continue to nurture students toward developing an internal locus of control. Don't only provide opportunities for students, expect responsibility from them.

11. Be less than perfect yourself. Make a conscious decision to seek help in those areas in which you lack sufficient skill. Solicit assistance of students in meeting a desired goal.

12. When possible, structure learning experiences based on cooperation rather than competition. Students afflicted with learned helplessness are often unwilling to try because they expect failure (Tyrell, 1990).

Summary

Teachers must become active vanguards against student apathy. The constructivist perspective on teaching and learning can provide food for thought to teachers who want to do something about student apathy. If the main message from the constructivist perspective is that understanding and meaning are constructed by the learner, then attention should be paid to what the learner brings to the classroom. Every effort should be made so that teachers find out what students believe about themselves, about school and education, about their expectations, hopes and fears, and, of course, their ideas about the various natural phenomena. But it would be too narrow a way to approach learning solely in terms of prior (erroneous) ideas and then concentrate on how to help students revise these ideas. Student apathy and failure can, indeed, be approached through the ideas of constructivism. Opportunities are needed for teachers to approach and get to know every student as a person, and not just as a mind that needs to experience disequilibrium or a mind with some ideas that need to be reorganized and revised. This means that communication and collaboration among teachers, students, parents, and administrators becomes imperative.

It appears that we have relieved ourselves for too long through the administration of failing grades, through disassociation of students with behaviors of apathy, and through disassociation by referral to other professionals (i.e., special educators). Students must be provided with educational challenges with a high possibility of success. Every effort must be made to elicit participation from students. Schools and families should work together. We must communicate to students and parents that schools are not only places that provide opportunities for students to learn. Good schools hold students accountable and require personal responsibility. Conditions must be developed to intervene to the degree necessary to ensure active student participation in the school setting. If students can experience success, the heightened emotionality will subside. If not, it is likely that their problems will intensify and a stronger disassociation towards continued learning will result.

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Chapter 3
Historical and Legal Foundations

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Schools historically have been a battleground for the rights for students with disabilities. The passage of the Education for All Handicapped Children Act (EAHCA) (PL#94-142) in 1975 opened the door for a free and appropriate public education (FAPE) for more than 4 million children with disabilities in the U.S. who were not receiving "appropriate education services which would enable them to have full equality of opportunity" (Tucker & Goldstein, 1991, 1992).

> In 1975 parents of youngsters with disabilities brought lawsuits to win the first federal guarantee that their children would go to school. Before then, a million children in this country received no education—almost every one a child with a disability. Today there are approximately 6 million special education students. (Shapiro, 1994)

These children represent approximately 13% of the student population (U.S. Department of Education, 1997). Passage of the amendments to the Individuals with Disabilities Education Act (IDEA) in 1997 has increased the responsibilities of the regular education teacher and school personnel to provide instruction for these children in the regular classroom with appropriate modifications.

Special Education History

Special education in the United States has a complex historical tapestry, with roots in the 1700s and 1800s. Research has indicated that inclusionary settings were rare, but some did exist in the early years of our country. Nora Ellen Groce (1985) reported a unique situation on Martha's Vineyard in the 18th and 19th centuries, where the population had a 200-year history of a high incidence of hereditary deafness. The communities adapted to the situation by creating a sign language, and most residents learned and used it successfully. The Vineyarders did not see deafness as a handicapping condition. They made modifications and lived full and meaningful lives.

Other means of helping people with disabilities have occurred in U.S. history. As early as 1817, Thomas Hopkins Gallaudet began the American Institute for the Education of the Deaf and Dumb, later changed to Gallaudet University for the Deaf. The House of Refuge was founded in New York City in 1825, the first refuge for juvenile delinquents and those with behavioral maladies in the United States. Samuel Gridley Howe started the New England Asylum for the Blind in 1832. In 1848 Howe also founded the Massachusetts School for Idiots and Feebleminded Persons. Edward Sequin founded the first professional organization, the Association of Medical Officers of American Institutions for Idiots and Feebleminded Persons, in 1876 (Barr, 1913; Smith, 1998). This title evolved into the American Association on Mental Deficiency, and today exists as the American Association on Mental Retardation. The Cleveland Public Schools were the first in the nation to open two special education day classes in 1878 (Sarason & Doris, 1979). Philadelphia claims the first hospital for the physically disabled, Home of the Merciful Savior, in 1884. The National Education Association (NEA) began a division for persons interested in children with special needs in 1897, but it disbanded in 1918 to allow for reorganization. Elizabeth Farrell started ungraded classes in New York City in 1898 to serve "backward students" in a settlement house setting initiated to serve the poor, unskilled, and less able, and also to assist immigrants (Smith, 1998).

Special education found its present profile and substance through federal law, civil rights movements, and resulting court cases, as well as the evolutionary influences of politics and society (Friend & Bursuch, 1999; Smith, Polloway, Patton, & Dowdy, 1998). Elizabeth Farrell, New York City teacher in the 1920s, joined forces with the city superintendent of schools to foster the cause of students with special needs. After initiating ungraded classes in 1898 to include students who did not meet grade level criteria for one reason or another, she founded the Council for Exceptional Children, a professional

organization still in existence today. Some of the first publications on teaching children with disabilities came out in 1912 when Montesson published research on teaching children with disabilities (Smith, 1998).

By the early 1900s most states had at least one residential institution for persons with disabilities. Until the 1950s most persons with disabilities were kept at home, not educated in any formal way, or sent to institutions or private facilities for custodial care.

In the 1950s, the country experienced civil rights movements as minorities demanded equal treatment under the law and in society. These movements represented a major catalyst for questioning and examining the rights of persons with disabilities who emerged as a powerful faction of American society (Friend & Bursuck, 1999; Rothstein, 1995). Effective parent organizations gathered impetus in the 1950s, joining forces with concerned professionals in education, medicine, and the social sciences. Power yielded influence. As confirmed by the outcome of *Brown vs. Board of Education* in 1954, the Fourteenth Amendment of our federal Constitution was cited to protect the right of all citizens against discrimination of any kind (Rothstein, 1995; Yell, 1995). This decision confirmed that practices which discriminate against children of color, forcing separate schooling, are against the law. Soon after, the same law was applied to protect the rights of persons with disabilities. The courtroom became the emancipatory field, and to date, the stage where the rights of those with disabilities are championed and formed to preserve civil and educational rights.

In 1975, the Education for All Handicapped Children Act was passed by the United States Congress as PL94-142. The law required that children with disabilities be provided a free and appropriate public education (FAPE) in the least restrictive environment (LRE):

> The state has established procedures to assure that, to the maximum extent appropriate, handicapped children, including children in public or private institutions or other care facilities, are educated with children who are not handicapped, and that special classes, separate schooling, or the removal of handicapped children from the regular environment occurs only when the nature or severity of the handicap is such that education in the regular classes with the use of supplemental aids and services cannot be achieved satisfactorily.

The passage of this law mandated integration of students with disabilities into regular classes with non-disabled peers. The very name of the law reflected the language of the day, and required states to educate all students regardless of disability (Lipsky & Gartner, 1997). The major components of this landmark legislation included guarantee of free and appropriate education (FAPE) for all ages 6 through 17; mandates for the creation, review, and revision of an Individual Education Program (IEP) for each student receiving special education services; a guarantee of placement in the least restrictive environment; and details outlining parents' rights (Sherwood, 1990; Tiegerman-Farber & Radziewicz, 1998; Ysseldyke, Algozinne, & Thurlow, 1992). Public Law 94-14L, a turning point for those with disabilities, addressed the issue of *where* this population would be educated, not simply *if* they would be educated, as was the case a quarter of a century earlier.

As a result of PL 94-142 passage, many students with mild disabilities began a new era in the regular classroom and saw success. The non-disabled setting became known as the least restrictive environment (LRE) (Power-deFur & Orelove, 1997; Smith et al., 1998, Takes, 1993). School districts created accommodations in the form of separate classes and separate schools for those with more severe disabilities, which, at the time, was considered a move forward because these students with greater needs had previously been denied public education in any form. This law set the groundwork for the inclusion movement, even though the term *inclusion* does not appear in the law itself (Power-deFur & Orelove, 1997).

Normalization was a growing philosophy in the United States in the 1970s, and the educational trend to move away from separate classes for those with special needs was gaining favor with many educators. Normalization was viewed as an essential dimension of special education. Nirge referred to a normal life pattern, normal day, year, and life rhythms (Smith, 1998). Tiegerman-Farber and Radziewicz (1998) explained normalization for the child with disabilities in terms of "identification of

activities, educational experiences, and social interactions that simulate realistic and ongoing environmental events" (p. 4). The means and the end were the same in efforts to provide the most normal experience for persons with disabilities, achieved by placing these students into the regular education classroom.

The Regular Educator Initiative (REI) is viewed by some as a major first step in the inclusion movement (Fuchs & Fuchs, 1994; Schumm & Vaughn, 1991; Will, 1986). REI launched the inclusion phase of students with special needs into the arena of regular education. The difference between the integration phase and the inclusion phase was that under inclusion it was assumed that students with disabilities *belonged* there. Although the students who benefited were primarily those with mild disabilities (Lipsky & Gartner, 1997), a great step had been successfully taken, a major milestone achieved.

A significant number of education researchers and practitioners challenged the dual system of special education and regular education in the 1980s. Supporters of the inclusion movement cited such claims as basic rights of all individuals to have equal opportunity to live normally and attend school with non-disabled peers, to participate as fully as possible (Ferguson, 1996; McNulty, Connolly, Wilson, & Brewer, 1996). Many researchers claimed that *all* students would benefit from having students with special needs in the regular classroom (Ferguson, 1995; Fuchs & Fuchs, 1995; Lipsky & Gartner, 1998; McLeskey & Waldron, 1996; Ryndak, Downing, Morrison, & Williams, 1996; Stainback, Stainback, & Stefanich, 1994; Vaughn & Schumm, 1995). It was found that teaching methods and strategies utilized in special education classrooms did not differ so drastically from those used in regular classes (Mercer, Lane, Jordon, Allsopp, & Eisele, 1996). Service models which required the students to leave the classroom for prescriptive services denied the students much valuable instructional time and socialization in the regular classroom (Sapon-Shevin, 1996). Leaving the class to attend resource or pullout programs put a label or stigma on students, a further handicap for them (Want & Reynolds, 1996).

Professional organizations have voiced their concerns over the inclusion issue. The spectrum of support for inclusive education ranges from total and unrestricted support from the Association of Persons With Severe Handicaps (1991), to cautious regard for continuum of services while supporting inclusion (Council for Exceptional Persons, 1993), through concern for the provision of needed services (Learning Disabilities Association, 1993), to the guarded caution of the American Federation of Teachers (1993) and the National Education Association (1994) supporting appropriate inclusion (Lipsky & Gartner, 1997; Vaughn, Schumm, Jallad, Slusher, & Saumell, 1996). The areas of science and mathematics have been especially subject to neglect and omission when teaching students with disabilities. Because of the discriminatory prejudgements and practices earlier mentioned, students with disabilities are rarely given any opportunity for participation or success in the sciences. They are frequently divided into two large categories that can overlap.

One group consists of individuals with physical impairments who seem to have the cognitive, social, and intellectual capabilities to become scientists, mathematicians, or engineers. About 23% of the 5,573,000 [1,310,000] students with disabilities would fall into this group. Approximately 78% (1,022,000) of these students have speech and language impairments that require minimal accommodation in a science classroom or laboratory. Historically, only members of this group were likely to succeed in science.

The other 72%, 4,291,000 students with disabilities, manifest cognitive, social-personal, or intellectual disabilities and often experience difficulty with science in secondary and post-secondary education. The goal for these students is science literacy. Some do have potential for the highest levels of science achievement but need assistance in overcoming their disabilities in order to have a science, mathematics, or technology career. Seventy percent of school-age children with disabilities have learning disabilities, serious emotional disturbances and/or behavior disorders, mild mental retardation, and attention-deficit disorders. For each of these categories, if the input-output processing deficit can be alleviated, we should expect achievement commensurate with others in the regular population of students. Women and/or minorities with disabilities face even more obstacles to obtaining quality

education because of the compounding effect of the disability with other actions of discrimination and/or low expectations.

Contemporary Legislation Covering Rights of Persons with Disabilities

Congress has enacted many laws designed to deal with the rights of people with disabilities, but it's taken a long time to get there. A postpolio quadriplegic who began classes at the University of California at Berkeley in the fall of 1962 and fellow disability rights leaders challenged "widely held myths that people with disabilities were incapable of being educated, working, caring for themselves, or becoming contributing members of society." They challenged the notion that persons with disabilities were deserving of lesser lives. It took almost another 30 years before this new self-identify was reflected in law with the passage of the Americans with Disabilities Act (ADA) (Shapiro, 1994).

Sections 501, 503, and 504 of the **Rehabilitation Act of 1973** Prohibits federal agencies, federal contractors and recipients of federal financial assistance from discriminating against otherwise qualified persons with disabilities solely on the basis of disability (Tucker & Goldstein, 1991, 1992).

Section 02 **Amendments**, 1978 & 1979 affects on universities: (1) Authorized federal agencies to provide grants to any designated state unit overseeing work with people with disabilities to establish and operate comprehensive rehabilitation centers to provide a broad range of services, and made the remedies, procedures and rights (of Title VI, Civil Rights Act, 1964) available to section 504 discrimination victims. Remedies include payment of attorney's fees, payment of expert-witness fees, injunctions, backpay for intentional discrimination, and other equitable remedies at the trial court's discretion.

Section 504 Amendment, **Civil Rights Restoration Act of 1987** [CRRA] Amended the definition of "program or activity" to mean all of the operations of a college, university or other postsecondary* institution; or a public system of higher education. When federal financial assistance is extended to any part of the afore mentioned, all of the operations of the institution or educational system are covered. [*Postsecondary is a term for any institution—vocational, business, or secretarial—which offers education beyond the twelfth grade.]

Individuals with Disabilities Education Act [IDEA] 1973 Public Law 94-142 (PL 94-142) Guarantees all youth with disabilities to a free, appropriate education in the least restrictive environment. Accountability was to be demonstrated through individualized education plans, nondiscriminatory evaluations, support services, parental involvement, and due process.

Education for All Handicapped Children Act [EAHCA] 1975 Requires states to provide all children with disabilities with a free, appropriate public education.

President George Bush signed into law the Americans with Disabilities Act of 1990. This law required employers to make certain accommodations deemed reasonable and necessary for persons with disabilities to work and use public transportation and facilities (Friend & Bursuck, 1999). The act is considered a landmark decision and provided another major stepping stone in the journey of those with disabilities for equal and fair treatment under the law (Rothstein, 1995; Yell, 1995).

Americans with Disabilities Act [ADA] 1990. In 1990, PL #101-476 reauthorized, amended, and renamed PL #94-142 as the Individuals with Disabilities Education Act (IDEA). Its primary developments were to initiate the inclusion movement, to change terminology from "handicapped children" to

"children with disabilities" and to confirm two new categories of disability, traumatic brain injury and autism, as eligible categories for special education services. Service provision for those in preschool and in post secondary transition were outlined and mandated into law (Tiegerman-Farber & Radziewicz, 1998; Ysseldyke et al., 1992). For the regular education teacher, this law meant that students will be served as much as possible in the regular education classroom (Smith et al., 1998). Goals of the law are to end discrimination against individuals with disabilities and bring this group into the economic and social mainstream of American life, to provide enforceable standards addressing discrimination and ensure that the Federal government plays a central role in enforcing these standards on behalf of this group. Title I Employment, Title III Public Accommodations, and Title IV Telecommunications are important elements of advocacy that teachers should communicate to all students that might be impacted. **Title I**-Employment: "Employers may not discriminate against an individual with a disability in hiring or promotion if the person is otherwise qualified for the job. Employers can ask about one's ability to perform a job, but cannot inquire if someone has a disability or subject a person to tests that tend to screen out people with disabilities. Employers will need to provide accommodations that impose 'reasonable accommodation' to individuals with disabilities. This includes steps such as job restructuring and modification of equipment. Employers do not need to provide accommodations that impose 'undue hardship' on business operations…" (Americans with Disabilities Act Requirements Fact Sheet, U.S. Dept. of Justice). **Title III**-Public Accommodations: "Private entities such as restaurants, hotels, and retail stores may not discriminate against individuals with disabilities…Auxiliary aids and services must be provided to individuals with vision or hearing impairments or other individuals with disabilities, unless an undue burden would result. Physical barriers in existing facilities must be removed, if removal is readily achievable. If not, alternative methods of providing the services must be offered, if they are readily achievable. All new construction and alterations of facilities must be accessible" (ADA Requirements Fact Sheet). **Title IV**-Telecommunications: "Companies offering telephone service to the general public must offer telephone relay services to individuals who use telecommunications devices for the deaf or similar devices…" (ADA Requirements Fact Sheet.)

Individuals with Disabilities Education Act [IDEA] 1997. The IDEA Amendments of 1997 contained many provisions concerning the IEP, IEP Team, and LRE. The following review will examine those requirements which affect the roles and responsibilities of both special and regular educators to create, implement, and monitor the IEP. Discipline of students with disabilities, assessment procedures, and procedural safeguards to the students and parents will be discussed briefly. Federal Law citations from IDEA 1997 are identified by (20 U.S.C.). The proposed Code of Federal Regulations are cited as (34 C.F.R.). Both U.S.C. and C.F.R. citations appear in numerical order.

The IDEA Amendments of 1997 are presented in four parts. The four areas and primary components are the following:

Part A: General provisions: Definitions, specific terms, current, and related research findings/general purposes of the IDEA Amendments of 1997.

> **Part B: Assistance for the education of all children with disabilities:** Eligibility of students as defined by the SEA (State Education Association) and LEA (Local Education Association). Grant opportunities and details are included, as well as procedural safeguards to protect the rights of students with disabilities in that state.
>
> **Part C: Infants and toddlers with disabilities:** Specific measures and programs for states to best meet the needs of infants and toddlers with disabilities. Incentives for these proposed programs are outlined.
>
> **Part D: National activities for improvement of education for children with disabilities:** Discretionary or support projects and programs, responsive to areas of concern for improvement of education and qualifying for state education grants toward this improvement of educational opportunities for students with disabilities include research, personnel inservice programs, technical assistance, parent inservice and training, information dispersal, and development of technology (IDEA, 1997; Yell & Shriner, 1997).

The IDEA of 1997 reaffirmed the educational rights of individuals with disabilities in educational settings:

> Disability is a natural part of the human experience and in no way diminishes the rights of individuals to participate in or contribute to society. Improving educational rights for children with disabilities is an essential element of our national policy of ensuring equality of opportunity, full participation, and independent living, and economic self-sufficiency for individuals with disabilities. (20 U.S.C. & 1400 ©(1)).

The education of children with disabilities can be more effective by:

> (A) Having high expectations for such children and ensuring their access in the general curriculum to the maximum extent possible:
>
> (B) Strengthening the roles of parents and ensuring that families of such children have meaningful opportunities to participate in the education of their children at school and at home:
>
> (C) Coordinating this Act with other local, educational service agency, state, and federal school improvement efforts in order to ensure that such children benefit from such efforts and that special education can become a service for such children rather than a place where they are sent. (20 U.S.C. 1400 (A)(1)(c)(5))
>
> (D) Providing appropriate special education and related services and aids in the regular classroom to such children, wherever appropriate. (20 U.S.C. & 1400 ©(5)(D))

"Service rather than a place" implies dynamic planning, review, revision, and evaluation of education efforts for students with special needs. This is the thrust of the new law, encompassing the drive and impetus of the laws which preceded it in the history of special education since mid-century, as noted earlier in this review of the literature. The law reaffirmed the assumption that the students *belong* in the regular classroom, as espoused by Will (1986) and others throughout the late 20th century history of special education legislation.

Least Restrictive Environment (LRE) stated that to the maximum extent appropriate, children with disabilities, including children in public or private institutions or other care facilities, are educated

with children who are not disabled, and that special classes, separate schooling, or other removal of children with disabilities from the regular educational environment occurs only when the nature or severity of the child is such that education in regular classes with the use of supplementary aids and services cannot be achieved satisfactorily (20 U.S.C. & 1412(A)(5))a)).

The words *to the maximum extent appropriate* have been the target of attack by several national professional organizations representing parents and teachers since IDEA 1990 in their opposition to blanket inclusion for all students (American Federation of Teachers, 1996, 1997; Council for Exceptional Children, 1993, 1997; Crockett & Kauffman, 1998; Learning Disabilities Association, 1993; National Education Association, 1994; Shankar, 1994). A continuum of alternative placements for students with special needs is strongly urged by these organizations and individuals. For LRE, the law required:

> (E) high quality, intensive professional development for all personnel to ensure skills and knowledge necessary to enable them –
>
> > (i) to meet developmental goals and, to the maximum extent possible, those challenging expectations that have been established for all children; and
> >
> > (ii) to be prepared to lead productive independent adult lives, to the maximum extent possible.

This component of the law reflected concerns from many researchers and educators as an area which has not been adequately addressed and implemented by national, state, and local education efforts to date. Negative attitudes of teachers were cited regarding feelings of incompetence, fear, anger, and frustration about being forced to accept included students (Tiegerman-Farber & Radziewicz, 1998; Vaughn & Schumm, 1995). Some teachers have qualified their negative feelings toward this movement, citing the fact that the choice they made was to teach regular education, not special education (Vaughn, et al., 1996).

A study done in a Texas school district where most of the students with special needs attended regular classes indicated that this practice altered the content and scope that teachers could teach, methods they used, and nature and duration of student-teacher interactions (Baines, Baines, & Masterson, 1994; Villa & Townsend, 1995). The American Federation of Teachers (1994) called for a moratorium on inclusion in response to expressed concerns about lack of teacher preparation addressing the needs of students with disabilities in a regular classroom. The need for inservice opportunities to promote successful inclusion for both students with special needs as well as effects on non-disabled peers is consistently cited by practitioners (Sapon-Shevin, 1996). Research has indicated that the need for teacher inservice and skill development in serving students with disabilities through collaborative efforts is one of the most important aspects of the regular educator's role in serving identified students as well as non-disabled peers (Stainback et al., 1996; Sapon-Shevin, 1996).

Many teachers believe that they are skilled, accommodating, and willing to serve on IEP Teams in all aspects of planning and implementation of appropriate education for students with special needs (Friend & Bursuck, 1999; Power-deFur & Orelove, 1997). However, mechanisms are lacking to capitalize on their skills and respect their professional talents and limitations. They find themselves to be fringe players on IEP staffings when they do participate. In addition, times of staffing meetings frequently conflict with other responsibilities or duties limiting their participation.

The Individual Education Plan (IEP)

A priority in the IDEA 1997 legislation lies in the improvement both in the performance and achievement of this population of children with disabilities now to be served primarily in the regular curriculum in regular classrooms of the public schools (Yell & Shriner, 1997a, 1997b). Reflecting this finding and guiding principle, Congress has addressed major changes in the IEP process, the IEP Team, and LRE.

At all levels, federal and state, the IEP components are consistently listed and described. The IEP is a written statement for each child with a disability that is developed, reviewed, and revised by the IEP Team no less than annually to include; (a) present level of educational performance, (b) annual measurable goals and objectives (c) special education and related services, (d) description of the least restrictive environment and the plan for participation in the regular curriculum with non-disabled peers, (e) dates, frequency, location, and duration of services, (f) assessment methods, (g) transition plan for those over 14 years of age, and (h) process monitors and parent reporting procedures.

IEP Team

The IDEA of 1997 required that the IEP Team would include:

1. the parents of the child with a disability;
2. at least one regular education teacher (if the child is, or may be, participating in regular education);
3. at least one special education teacher or, if appropriate, at least one special education provider of the child;
4. a representative of the local education agency (LEA) who meets certain specified requirements such as ability to represent the agency and local school authority to justify the team recommendations and maintain compliance to the law;
5. an individual who can interpret the instructional implications of evaluation results;
6. at the discretion of the parents or agency, other individuals who have knowledge or special expertise regarding the child, including related services personnel;
7. and, if appropriate, the child.

Most state and local agencies define the role of the special educator on the IEP Team as the person responsible for implementing the IEP. This participant may be the teacher qualified to deliver special education in the student's area of suspected disability or another special education provider of service. The regular educator is required to assume an active role in educating students with special needs. Legislation is lacking in how schools are going to provide inservice and time necessary to accomplish successful collaboration in the regular classroom (Lipsky & Gartner, 1998; Crockett & Kauffman, 1998).

Studies have indicated that many teachers do not attempt to meet IEP guidelines, modify or adapt any classroom procedures or expectations for any students with disabilities (Ysseldyke et al., 1990). Others indicated that adapted techniques may be highly desirable, yet practice does not follow the belief in some classrooms with mainstreamed students (Lipsky & Gartner, 1987, 1997; Reynolds, Wang, & Walberg, 1987; Turnbull & Turnbull, 1998).

The IEP Team is obligated to assess whether or not the child's behavior impedes learning and propose intervention strategies. They must propose and implement behavioral accommodations and:

> (i) Consider special factors for behavior; IEP Team shall in the case of the child whose behavior impedes his or her learning, or that of others, consider, when appropriate, strategies, including positive behavior interventions, strategies, and supports to address the behavior. (20 U.S.C. & 1414 (d)(3)(I))

If the child's behavior is a major concern and need, the IEP Team must consider legal and appropriate options to address this need of the child, which must then be documented by a statement in

the child's IEP. Behavior considerations are causing school systems to follow the law closely to ensure the rights of all students (Yell & Shriner, 1997a, 1997b).

Studies at the secondary level indicated that while the majority of regular education teachers felt successful in teaching students with disabilities in the regular classrooms, over one-third of them received no prior or ongoing preparation or professional development for this collaboration, and less than one-half had been involved in development of the IEP (Rojewski & Pollard, 1993). Other findings indicated that teachers did willingly make specialized adaptations when the IEP Team advised them to do so and supported the teachers (Fuchs, Fucha, & Bishop, 1992; Sapon-Shevin, 1996). The role of the regular educator in the development, implementation, and evaluation of IEPs has become a critical issue in response to compliance efforts of schools to IDEA 1997 (Fuchs & Fuchs, 1994; Sapon-Shevin, 1996).

IEP Meetings

The regular education teacher's role in these meetings is clearly required and defined:

> The regular education teacher of the student with disabilities is a member of the IEP Team, and shall, to the extent appropriate, participate in the development of the IEP of the child, including determination of appropriate positive behavioral intervention strategies, and the determination of supplemental aids and services, program modifications, and support for school personnel.

Once the IEP Team has been assembled and the IEP has been developed, IDEA 1997 directs that… "children with disabilities are educated with children who are not disabled, and that special education, separate schooling or other removal of children with disabilities from the regular education environment occurs only when the nature or severity of the disability is such that education in regular classes with the use of supplementary aids and services cannot be achieved satisfactorily."

These supplementary aids and services may include other supports to be provided in regular education classes or other regular education-related settings. The purpose of these would be to enable children with disabilities to be educated with non-disabled children to the maximum extent appropriate. Least restrictive environment considerations require that five pertinent questions regarding the student's participation in the regular curriculum be addressed. These are reflective of those required in IDEA 1997 and include the following:

- What accommodations, modifications, and adaptations does the individual require?
- Why can't these accommodations, modifications, and adaptations be provided in the general classroom?
- Is there a potential detriment to the individual if served in the general classroom?
- How will the individual's participation in the general classroom impact other students?
- What specific/systemic supports are needed to assist the teacher and other personnel to provide these accommodations, modifications and adaptations?

This last question provides opportunity for the regular education teacher to receive relevant and necessary information and support to assist students with special needs in their classroom. Research has identified lack of time to collaborate as one of the major barriers to the success of collaboration in schools. Lack of communication, limited or nonexistent planning time opportunities, and lack of administrative support were identified as primary barriers to collaboration success (McCrory & McLeskey, 1997; Reeve & Hallahan, 1994; Vaughn, et al., 1996).

Legal Summary

In summary, the IDEA Amendments of 1997 affected the roles and responsibilities of the regular educator as a member of the IEP Team in several ways:

1. Regular educators are members of the IEP Team. This requires them to be an active participant in the development, review, and revision of the IEP of students with disabilities served through collaborative measures.

2. Regular educators will help develop, review, and revise the IEP as members of teams comprised of parents, administrators, and students themselves in collaborative interactions. This requires them to maintain open lines of communication, participate in IEP Team meetings, and implement interventions and adaptations recommended by Team members.

3. Placement in the regular education classroom with access to the regular classroom and regular curriculum is strongly mandated by law from federal, state, and local level. This requires the regular educator to adapt and modify classroom expectations to meet the needs and ability levels of the students with disabilities in the regular classroom.

The requirements of legislation are clear. Federal and state regulations will add specific details to these regulations. The issue which is less clear is how local school districts plan to implement the law and how educators' reported beliefs and reported practices will impact the implementation of the new law in local schools.

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Chapter 4
Addressing Educational, Employment, and Transportation Issues

Mary Anne Schroeder & Greg Stefanich

The educational goal for every student is that the student master the essential educational material or physical skills in question. Educators must examine learning and the evaluation of learning via the framework of input, mastery, and output. This will facilitate determinations of what is **variable** and subject to individualization, academic adjustments, and auxiliary aids; and what is **invariable** and essential. All students should be accountable for content mastery and the requirement to demonstrate mastery, although the format and structure may need to be modified to accommodate the uniqueness of the individual. This chapter will review survey results concerning issues and concerns K-12 and post-secondary educators have on teaching science to students with disabilities.

Also contained within this chapter are sections on post-secondary accommodations including employment and transportation. Post-secondary faculty have a responsibility to act appropriately in interactions with students with disabilities and to be knowledgeable of their rights concerning equal access. Typical roles of academic faculty are multi-faceted with many administrative responsibilities. Advocacy, through collaborative partnerships with the students, is also important in providing educational equity for a student with disabilities who "doesn't want to make waves" or is unaware of the processes of communicating a need within the complex administration structures of a college or university.

The following are frequently cited as obstacles to learning that students with disabilities face along with those who guide and direct their learning and development:

1. Negative attitudes of parents and other gatekeepers (teachers, counselors, rehabilitation staff, special education teachers, health personnel, and academic faculty) about the ability of a student with a disability to do science, mathematics, engineering, or science education.

2. The virtual invisibility of the role models in science, science education, and engineering for children with disabilities.

3. More limited participation in educational and/or professional activities than non-disabled peers due to the extra challenges a disability may require.

4. Time and energy expended by the student with a disability to develop skills to counteract the system's negative attitudes and to accommodate to inaccessible environments.

5. Internalized negative stereotypes that the student will not fare well in any sort of competition with non-disabled counterparts.

6. Additional and ongoing costs associated with a disability.

7. Lack of information about the availability of the technology which would help people with disabilities.

Issues & Concerns

Education is the difference between a life of dependence and unemployment or a life of independence and productivity for persons with disabilities. An appropriate education for students with disabilities depends upon **schools** with proper and adequately trained staff (administrators, regular

classroom, special education teachers, and support staff), plus **parental involvement** in the educational process. Research supports that strong parental involvement in their children's educational career results in better performance by the students (Tucker & Goldstein, 1991, 1992). These two factors, school and parent, are paramount in making a positive difference in the life successes of these children.

Most parents fail to understand their legal rights and the safeguards available, and few systems take the time to help ensure that the parents understand. Less than 1% of parents whose children have disabilities have requested administrative hearings to challenge the placement of their children in the school systems (Tucker & Goldstein, 1991, 1992). It may be the parents' "blind trust" of those in authority that precludes their actions.

The public schools' educational process for students with disabilities has shown that the system continues to exclude many children with disabilities, with greater likelihood of exclusion in schools with large numbers of students with special needs. Public school exclusions were facilitated by a number of means: placing the students on long waiting lists; removing students from classrooms due to behavioral problems; poor identification methods; choosing to educate one student group with disabilities over another; providing no educational program for children in institutions; or denying education to some children with disabilities (Tucker & Goldstein, 1991). Children are often misclassified due to evaluation procedures based on racial and cultural biases, untrained or inadequately trained personnel, and poor assessments (single criterion rather than multiple criteria).

The Education for All Handicapped Children Act (EAHCA) assures the provision of appropriate education and ensures a system of procedural safeguards which protect the parents' role in their child's education. The EAHCA also assures resolution procedures for **parent** versus **school district** disputes through an administrative hearing process. Unfortunately, success in meeting the goals of the EAHCA has not occurred (Tucker & Goldstein, 1991, 1992).

Problems affecting students with disabilities in public classrooms include the different treatment of these students; stereotypical categorizing; deficient evaluation, classification, and placement procedures; high student dropout rates; inequity of service; and poor preparation for competency in the work place and job placement following school completion (Tucker & Goldstein, 1991, 1992).

The education of students with disabilities has long been viewed and treated as separate from regular classroom education and thus, special education has evolved as a separate entity. This division has not served to strengthen the ability to meet these students' needs. Stereotypes that students with disabilities are low-achieving have been perpetuated along with the system's low expectations for these students (Tucker & Goldstein, 1991, 1992).

Evaluation procedures, disability classification, and resulting placement decisions are often not related to the student's learning characteristics. Labels assigned to students tend to stick throughout their school career and often play a role in preventing students from being returned to mainstream classrooms. Additionally, disproportionate percentages of minority students are classified as disabled and this disproportion is greatest among black students. The National Council on Disability noted that 16% of the student body are black students, yet over 29% are classified as mentally or educably mentally retarded or seriously emotionally disturbed. Thirty percent of all public school students are minority, yet 39% are within these disability classifications. Rural areas are problematic to serve due to large distances between communities and the relatively small populations (Tucker & Goldstein, 1991, 1992).

In a survey of teachers and science educators concerning the teaching of science to students with disabilities, Stefanich and Norman (1996) presented the following summary.

Educators at all levels – elementary, middle, high school, and university – said some of their concerns focused on logistical arrangements, instruction, support, sensitivity, and communication. Educators also expressed concern about time issues, including planning time and instructional time, devoted to students who have disabilities.

Concerns often mentioned by elementary, middle school, and high school science teachers included the following:

1. Inadequate preparation and training to teach science to students with disabilities;

2. limited knowledge about methods and adaptations for students with disabilities;
3. lack of time for planning and individualized instruction for students with disabilities;
4. large class sizes and inadequate space and materials;
5. lack of ability to handle classroom management and discipline, especially with students with emotional disabilities and behavior problems;
6. concerns about safety and liability issues;
7. lack of support from administrators and other teachers, especially special education teachers; and
8. little information/knowledge about expectations, assessment, and grading for students with disabilities.

Other concerns mentioned by these teachers included how to communicate with students who have disabilities, bias against these students, modifications needed for field trips, and extra compensation for teachers.

The survey of regular and special education teachers brought specific comments from teachers that were eye-openers and cries for assistance. Although elementary teachers deal with greater numbers of mainstreamed children than middle school or high school teachers, some of their comments are worthy of extra attention: "Teachers are not trained to work with students with disabilities. I have no training. Train us!!!" From another elementary teacher: "Special children take valuable teacher time away from the other 20-30 children in the room. Their education should not be so casually compromised. Lower class size will be needed—a costly item!"

Other comments from elementary teachers included, "Some teachers don't believe that students with disabilities can learn science. In my experience, most of the time they do just as well as the other students." Unsettling comments from another elementary teacher: "I've taught for 27 years and have been the staff development person in my building. The biggest problem is that few students, special education or otherwise, are being taught science at all. That is the main problem. Second, teachers are unable or unwilling to give up their prejudices regarding special education students. They perceive them as more work and the teachers don't want to be bothered."

Comments on the survey from middle school science teachers were equally revealing: "More effort needs to be put in training of teachers to prepare them for teaching students with disabilities." Another middle school teacher stated, "More funding needs to be available for staff development, science materials, and additional staff to meet the needs of students with disabilities." And another: "There's an inadequate amount of time to collaborate with on-staff colleagues to get assistance in obtaining methods to provide a quality education for all students." "Sometimes the special education teacher should be in the science classroom to deal with the non-science problems. Just as the science teacher would not expect the special education teacher to be a science specialist, the science teacher shouldn't be expected to be a specialist for students with disabilities." Other comments focused on the children without disabilities: "Cognition disabilities, seen more frequently due to 'inclusion,' detract from the 'normal' child's education in that, in the words of a colleague, 'We spend 95% of our time/energy dealing with 3% of our student population.' I'm waiting for a parent revolt to treat the normal child equally." From a teacher uncertain as to strategies to use in cooperative learning, "Can they follow directions? With whom do I pair them in lab to ensure a successful experience?"

Many high school teachers were concerned with time, support, and funds: "Time and support-Help! Will this be in addition to everything else? Where will the money come from? We don't have what we need for regular students." One of the high school teachers voiced concerns about safety: "Students who lack motor skills cannot manipulate lab equipment properly and pose a hazard for themselves in the case of spills." There were also controversial comments, such as, "There is too much

'worry' about so-called special students; the mainstream kid doesn't even exist anymore." On a more positive note, one teacher stated, "A lot of energy is often invested in students with disabilities and I don't find them any different from my other students."

Collaboration with special educators was suggested: "Dealing with severe disabilities is difficult for a subject area teacher – especially when there are 20-30 other students in the classroom. Team teaching with a special education teacher may be the only solution. IEPs are also a problem for regular classroom teachers. They don't have time due to large numbers of students per day."

Another high school teacher discussed empowering students versus preparing them for failure: "Teachers, within reason, should be expected to work harder to help students with special needs. However, these students and their parents must be made aware that with this extra effort on the part of schools, standards will not be compromised (you don't build high self-esteem by lowering standards!) and we expect both the student and parents to also put in much more time and effort. We want to empower students, not prepare them to fail in the real world. If teachers perceive that students with disabilities are working very hard to overcome their challenges, they will be more receptive to putting in more time for the student."

Post-Secondary Education

Postsecondary education has three major roles relating to science teaching: 1) adequate preparation of preservice teachers, 2) professional development of practicing educators, and 3) responsibility for accommodating the students with disabilities pursuing a post-secondary education.

Many university science educators surveyed voiced their own concerns: "Every student is different and it is unrealistic to expect precious time devoted to a broad preparation for all 'special' circumstances. Time is limited and there is so much to do as it is now. What do we omit? I'm not willing to discuss add without subtract." Another science educator focused on funding: "Funds are needed to provide college faculty inservice training and time to work in special education and inclusive classrooms." One instructor focused on the make-up of college classrooms: "Convince university content and methods faculty to consider the needs of students with disabilities in their teaching."

University science educators had many of the same concerns as K-12 teachers, plus some additional ones:

1. lack of training related to teaching students with disabilities in undergraduate programs for preservice teachers;
2. overcrowded methods courses and science teacher education programs leave little time for additional topics and coursework;
3. lack of space, material, equipment, and funds to use in teaching students with disabilities;
4. limited research regarding science instruction for students with disabilities;
5. need for university faculty inservice training and time to work in special education and inclusive classrooms;
6. need for field experiences in inclusive classrooms for preservice teachers;
7. need for modeling of science lessons for teaching students with disabilities;
8. lack of role models in science educators who have disabilities.

In a synthesis of both objective questionnaires and open-ended responses it remains unclear about who will assume responsibility for preparing science teachers in the implementation of IDEA 1997

(Stefanich, et al., 2000). Special educators perceive their role as providing support through assistance with basic skills, testing accommodations, personal growth, and compliance documentation. Few science teachers have the knowledge base and commitment to develop an in-depth understanding of diversity and accommodation strategies for students with disabilities. With the target date for full implementation of IDEA designated as 2002, it appears that there will be a less than adequate response concerning accommodations for students with disabilities in science classrooms. There is little likelihood that students with disabilities will receive the full range of services necessary for them to have an equivalent experience in science classes as those students without disabilities.

Anti-Discrimination Legislation

The ADA extends the anti-discrimination prohibition to all private and public colleges and universities, whether or not they receive federal funds. However, the provision of services to disabled students in postsecondary education places legal obligations on the disabled student (rather than parents), postsecondary institution, and sometimes the state vocational rehabilitation agency (Frank & Wade, 1993, p. 26). A qualified student with disabilities must meet all academic and nonacademic criteria for admission and continued participation in spite of the disability. This language serves to protect both the student and the institution.

Title 34, Code of Federal Regulations, Part 104, has the effect of implementing Section 504 of the Rehabilitation Act of 1973. (1) The institution may not make preadmission inquiries as to whether an applicant for admission is disabled. Confidential inquiries about disabilities may be made, after admission, in order to provide accommodation for the student. (2) The institution may not make use of any test or criterion for admission that has a disproportionate, adverse effect on applicants with disabilities. If the applicant has impaired sensory, manual, or speaking skills, the test will actually measure the applicant's aptitude or achievement level, rather than reflecting the person's impairment.

Steps of Identification

(a) The postsecondary institution has the obligation to inform students of the availability of academic adjustments and auxiliary aids; (b) the student must then identify and document the disabling condition, provide current (less than 3 years old) professional evidence documenting the disability, and request of the instructional staff appropriate academic adjustments and auxiliary aids on a timely basis; and (c) the postsecondary institution must then determine what, if any, academic adjustments and auxiliary aids are appropriate for the disabling condition considering the nature of the educational program (Frank & Wade, 1993). The academic requirements shall be adjusted as necessary to ensure that these requirements do not discriminate or have the effect of discriminating against the qualified applicant or student.

Academic Adjustments and Auxiliary Aids

Postsecondary institutions legally must provide academic adjustments and auxiliary aids, yet it is not discriminatory to not provide these when they are the same as essential course content. (Example: Should a reading-related academic adjustment or auxiliary aid be provided when the major course content is reading?) Decisions concerning the appropriateness of specific academic adjustments and auxiliary aids for students with certain disabilities, especially learning disabilities, depend upon detailed knowledge of the specifics of the disabling condition and of the essential skills and subskills that comprise the course content. The primary decision-makers are the disabled students and responsible institutional officials. Each decision must be on a case-by-case basis (Frank & Wade, 1993).

Academic Adjustment Examples

Students with visual impairments must be provided readers when taking exams; students with severe hearing impairments would be provided sign language interpreters in classrooms; and students in wheelchairs must have physically accessible programs. Less straight-forward examples may need to have

a student affairs official determine the most creative accommodation which best suits the individual (Frank & Wade, 1993).

Auxiliary Aids

The auxiliary aids will ensure that students with impaired sensory, manual, or speaking skills are not subject to discrimination. "Camenisch v. University of Texas (1981) involved a deaf graduate student who sought to compel the university to provide him with a sign-language interpreter for his classes. The Fifth Circuit affirmed the lower court's grant of a preliminary injunction in Camenisch's favor, ordering the university to procure and compensate a qualified interpreter to assist Camenisch in his classes" (Tucker & Goldstein, 1991, 1992). Wynne v. Tufts University School of Medicine (1991) involved a dyslexic student who was dismissed from medical school after failing several courses of his first-year program. Wynne claimed that the medical school was obligated under Section 504 to alter the examinations to accommodate his cognitive difficulties. The district court ruled in Tufts' favor stating that Wynne was not otherwise qualified for the medical school program since he was not able to meet the school's requirements. This decision was reversed by the First Circuit Court stating that Tufts "offered no evidence explaining why multiple-choice examinations, as distinguished from all other written examinations, test a student's ability to assimilate, interpret and analyze complex written material. In particular, we find it hard to understand why essay examinations would not meet the same objective." Tufts had not shown that multiple-choice tests were so vital that it could insist on using such tests to the detriment of dyslexic students. The First Circuit Court agreed that the decisions of academic personnel deserve deference, but held that Section 504 required courts to scrutinize academic decisions to ensure that they did not mask even unintentional discrimination against people with disabilities (Tucker & Goldstein, 1991, 1992).

Non-academic Programs and Services

No qualified student with disabilities shall, on the basis of the disability, be subjected to discrimination under any academic, research, occupational training, housing (shall be comparable to the nondisabled, convenient, and accessible), health insurance, counseling, financial aid, physical education, athletics, recreation, transportation, other extracurricular, or other postsecondary education program or activity (Tucker & Goldstein, 1991, 1992). Employment opportunities shall be made available in a manner that does not discriminate against the student with disabilities.

Accommodations at Postsecondary Institutions

"The ultimate expression of the independent-living philosophy is the Americans with Disabilities Act. This sweeping piece of legislation…not only banned outright discrimination against people with disabilities but also made providing accommodations, like ramps and wheel-chair desks in the workplace, the law" (Shapiro, 1994).

The law is complex and has many conditions that must be carefully examined. For example, it is *not* discriminatory for postsecondary institutions *not* to have all types of aids available at all times. Flexibility is permissible in choosing the methods by which academic adjustments and auxiliary aids will be supplied. The institutions do not have to provide attendants, individually prescribed devices, readers for personal use or study, or other devices or services of a personal nature. Personal needs are the responsibility of the student or state vocational rehabilitation agency if the student is sponsored by that agency.

Payment of Accommodations

The question of who must pay for the accommodations provided may cause dispute. If the vocational rehabilitation services are available to the student under Title I of the Rehabilitation Act, the state Department of Rehabilitation rather than the educational institution is required to pay. The institution is required to provide and fund auxiliary aids when funds are not available from the state

Department of Rehabilitation. It has been ruled that the institution may not deny the provision of auxiliary aids to students with disabilities based on their ability to pay or their enrollment in specific programs. The university is required to be the primary provider of these aids for students, faculty, or staff with disabilities, and cannot require students or employees to request technical assistance from vocational rehabilitation centers (the university must take this action) (Tucker & Goldstein, 1991, 1992).

Academic or Nonacademic Standard

Modification Section 504 imposed no requirement on a postsecondary institution to lower or to substantially modify academic or nonacademic standards in order to accommodate disabled students. Where a disability directly relates to and limits essential skills and abilities, the disabled student will not be considered qualified. If auxiliary aids and academic adjustments will facilitate learning without interfering with the student in developing essential skills and abilities, the student will be considered qualified (Doe v. New York University, 1981; Klin v. County of Los Angeles, 1985; Martin, 1980; Puskin v. Regents of the University of Colorado, 1981; University of Texas v. Comenisch, 1981.) When a student with disabilities is qualified and the academic adjustments and auxiliary aids are provided, it is not required that the results or achievement level be identical to nondisabled students. The focus of these services is to afford students with disabilities equal opportunity to obtain the same results or achievements (Frank & Wade, 1993).

Although education can assume many forms in affecting one's quality of life, the vocational element of education is held in high regard by many. Through a quality education many persons with disabilities can assume a more active role in establishing self-worth and self sufficiency.

Employment

The laws have not corrected the problems of discrimination against persons with disabilities in all walks of life. Discrimination continues into the adult world of employment for a person with disabilities. Only one-third of Americans with disabilities who were able to be employed had jobs, plus many of those employed were working in positions below their abilities. Sixty-six percent of those not working desired to have employment. A U.S. Census Report (1989) substantiated this problem and showed a decrease in the numbers employed (Tucker & Goldstein, 1991, 1992). The employment problem of persons with disabilities is compounding rather than improving.

Table 2
Full-time Employment of Persons with Disabilities

Year	% Men	% Women
1981	29.8% 77%*	11.4% 69%*
1988	23.4% 64%*	13.1% 62%*
*=Earnings of what all workers made (Tucker & Goldstein, 1991, 1992)		

Employers may have a stereotypical illogic that hiring individuals with disabilities is excessively costly. Section 503 of the Rehabilitation Act of 1973 found that only 22% of workers with disabilities required special accommodations (31% of this 22% required no costs, 30% of this 22% required less than $500 per worker costs). The costs of insurance or of workers' compensation fees do not increase when hiring workers with disabilities. Plus, these employees are often found to be better workers than non-disabled employees (Tucker & Goldstein, 1991, 1992).

Discrimination Guidelines

The ADA seeks to ensure equal employment opportunities based on merit. The law is an equal opportunity law, not an affirmative action law (Ingram, 1995). ADA Title 1 provided that employers

cannot exclude persons with disabilities from job opportunities unless they cannot perform the job. "No employers, employment agency, labor organization, or joint labor-management committee shall discriminate against a qualified individual with a disability" (ADA, 1990). Procedures are designed to assure this protection contains the following guidelines.

1. Persons with disabilities may not be disqualified because of the inability to perform non-essential or marginal functions of the job.

2. Any selection criteria that screen out or tend to screen out must be job-related and consistent with business necessity.

3. Employers must provide reasonable accommodations to assist persons with disabilities to meet legitimate criteria. (*Reasonable accommodation may include making existing physical facilities readily accessible and usable; and job restructuring, modifying work schedules, acquiring or modifying equipment, adjusting or modifying examinations, training materials or policies, providing readers or interpreters, and other **similar** accommodations for the persons with disabilities.)

The employer's ability to choose and maintain qualified workers is protected with the inclusion of the phrase "qualified individual with a disability." Title I allows an employer to require that every employee be qualified to perform essential job functions. Title I protects a qualified individual with a disability from discrimination on the basis of the individual's disability. A broad range of employment decisions are included in this legislation. The employment decisions with prohibited discriminations include: job application procedures; the hiring, promotion, demotion, or discharge of employees; employee compensation; job assignment and the inherent terms, conditions, and privileges of employment; and fringe benefits available by virtue of employment. An example of this discrimination would include limiting, segregating, or classifying a job applicant or an employee in a way that adversely affects the opportunities or status of such applicant or employee because of their disability. Employment decisions must be based on facts applicable to the individual applicants or employees, not on presumptions of what individuals with disabilities can or cannot do.

The hiring entity may not hire an employment agency to interview applicants for jobs if the agency uses unlawful, discriminatory methods against individuals with disabilities. The hiring entity may not utilize standards, criteria, or methods of administration that have the effect of discrimination on the basis of disability. Further, they may not perpetuate the discrimination of others who are subject to common administrative control.

A qualified individual may not be discriminated against by denial or exclusion of equal jobs or benefits because they have a known relationship or association with a person with disabilities. An employer may not discriminate on the assumption that the employee would have to miss work frequently or leave work to care for the person with disabilities. However, if the employee violates an attendance policy and the employer does not know of the employee's association with the person with disabilities, the employer may fire the employee.

Employment Interviews

Employers may ask questions which are related to the job applicant's ability to perform job-related functions, but may not ask questions in terms of the applicant's disability. Employer's application forms and interviews may not request information concerning an applicant's physical or mental condition. The ADA prohibits medical examinations or inquiries before an offer of employment. A House Report noted: "Employers may ask questions which are related to the applicant's ability to perform job-related functions, but may not ask questions in terms of disability." The employer can require a confidential medical examination after a conditional job offer has been made if the employer subjects all entering employees to such an examination, regardless of disability. The medical examination results cannot be used against the person with disabilities unless the results disqualify the individual for the job.

Job Descriptions

"Though the ADA does not require employers to have job descriptions, when job descriptions are used, they should specify the essential functions of the job. Marginal functions may also be listed, but they must be labeled as such and cannot be used as the basis for hiring or rejecting an applicant with a disability" (Ingram, 1995).

Employment Accommodation

An accommodation is any modification or adjustment provided by the employer to enable the qualified applicant or employee with disabilities to overcome certain limitations in the ability to perform the essential job functions. The ADA outlines a four-step process for employers to use in providing reasonable accommodations to applicants and employees with disabilities: (a) Identify barriers to performance, (b) identify possible accommodations, (c) assess reasonableness, and (d) select appropriate accommodations. The employer is only required to make reasonable accommodations to *known* disabilities; thus it is the responsibility of the job applicant or employee to *disclose* his or her disability to the employer (Ingram, 1995).

Disclosure

If a job applicant has a disability that is evident, the employer may *not* ask about the disability, or even ask if you have a disability (Ingram, 1995). The ADA's purpose is to eliminate discriminations against persons with disabilities. However, some exclusionary practices are non-discriminatory. The hiring entity can set qualification standards, tests, or selection.

Transportation

The Senate Committee on Labor and Human Resources (1989) recognized that "access to transportation is the key to opening up education, employment, [and] recreation." An "accessible public transportation system in this country" is imperative. This public transportation problem continues to be a serious discrimination against persons with disabilities.

Public transportation is the key to mobility for persons with disabilities and is often their only available option. Persons with disabilities are three times more likely to fall into a low income bracket and thus necessitate their living in rural areas which then compounds the problem of their need for reliable transportation. Low income precludes affording private vehicles and this problem may be further complicated by the need for expensive special equipment. Additionally, the person's disability may prevent that person from driving him/herself.

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Chapter 5
A Collaborative View of the Science Classroom

Mary Jean Blaisdell

For many years, a segregated pullout special education model has been utilized for students with disabilities. In recent years, this practice has come into question due to a number of problems associated with pull-out programs. Many educators express concerns that include the following: negative social effects of labeling; the difficulty special education students have when attempting to transfer skills learned in a pull-out setting to the regular class setting; the lack of time for regular education teachers to communicate effectively with special education teachers regarding provisions needed for special needs students in the regular classroom; the lack of curricular coordination between regular and special education programs; and the social difficulties students experience when integrated into subject areas such as science and social studies due to math or reading disabilities (Johnston, 1994). Due to its activity-based nature, however, science has often been an area considered for integration of students with disabilities where possible.

Science teachers, like many other regular education teachers, have concerns regarding the wide range of needs already in a classroom. An increasing number of students have behavioral concerns, including hyperactivity, and cause disruption to the learning process. Many students with high needs do not qualify for special education assistance and remain in the regular classroom where overburdened teachers struggle to accommodate for these difficulties. Yet, recent trends in education indicate that inclusion of special needs students into the regular classroom has become more of a priority. This expectation, coupled with the wide range of abilities existing in classrooms, overcrowding, and a general lack of time to develop or find materials well-suited for these students, presents a stressful situation in schools.

Under these conditions, it is no wonder that more school districts are initiating collaborative partnerships between regular and special education teachers as a method of reaching students with and without identified special needs in the regular classroom setting. Such collaboration can exist in several different forms and usually requires a different perspective for viewing the educational process.

The Collaborative Viewpoint

Since the Education for All Handicapped Children Act (EAHCA) was enacted in 1975, students receiving special education services have increasingly been served in the regular education setting. Mainstreaming, integration, and more recently, inclusion, have all been used to describe this movement. Inclusive schools are those in which students with and without disabilities are educated together within one educational system (Stainback, S. & Stainback, W., 1990). This concept represents a radical departure from the typical school setting and involves, among other things, cooperative and collaborative efforts. Although an integral part of the inclusive school concept, collaboration in and of itself is a practice recommended among school professionals as a whole (Pugach & Johnson, 1990), and is described as a supportive system where teachers utilize the expertise of other educators to solve problems. While there is no one standard model of collaborative service, Bauwens (1991) described three common models: Teacher Assistance Teams, collaborative consultation, and cooperative teaching. Of the three basic models, cooperative teaching seems to be a more frequently implemented practice in many school districts (Reeve & Hallahan, 1994). Cooperative teaching, also generically referred to as "collaboration," involves regular and special educators coordinating efforts to jointly teach heterogeneous groups of students in integrated settings to meet the needs of all students (Bauwens & Hourcade, 1997). Of course, the approach taken by educators involved in cooperative teaching may vary from classroom to classroom. In one approach, the regular class teacher may provide primary content instruction while the special education teacher provides survival skills instruction on such study skills as note-taking, outlining, or finding the main idea. These survival skills might be taught to a small group or the entire class, but it is all done within the regular class setting.

In another approach, both regular and special educator share all the planning, preparation, and instruction for the classroom. Both teachers in team teaching situations have equal responsibility and alternately present content at various times.

In yet a third approach, the regular class teacher provides all instruction essential to the content of the course, and the special educator provides enrichment activities which support the content instruction. For instance, the regular class teacher might present initial content and lead a discussion about this content while the special educator presents application activities such as experiments or hands-on activities.

While the variations can be numerous, cooperative teaching generally implies sharing responsibilities between both regular and special class teachers. These responsibilities include not only the instructional aspect of the arrangement, but the evaluation of students, parent contact, and instructional planning and design.

A cooperative teaching partnership can benefit both students and staff. In some cases, some of these extensive benefits have been cited (Braaten, Mennes, Brown, & Samuels, 1992):

- a shared ownership and responsibility for meeting student needs
- more special educator involvement in day-to-day activities
- more teachers working on curriculum modification
- a greater willingness to share materials
- better monitoring of the learning process of low achieving students
- prereferral interventions more easily implemented
- reduction in the number of students referred for special education services
- suspensions dropped
- more parent contacts made

But the view isn't always rosy either. Time management is most frequently indicated as a problem to effective collaboration. Since cooperative teaching requires coordinated planning and preparation, this often takes time outside the contract day (Braaten, Mennes, Brown, & Samuels, 1992). Class size and student-to-teacher ratios can be misunderstood and cause ill feelings among staff members as well. Not all regular and special educators are willing and/or prepared to be collaborators. Mandating this form of service delivery may result in strong objections from those involved. It is also difficult at times to describe a collaborative service delivery model in a student's Individual Education Plan (IEP). This may require much discussion regarding how this will be handled accurately.

Conflicting viewpoints are likely to come forth in any discussion on implementing a collaborative model. Often, the concept and its development in a school setting comes from the teachers involved. Special and regular education teachers talking informally may lead to a proposal for one or more collaborative partnerships within a building. There will be little success to such actions, however, if there is no existing support from administration.

A View from the Top: Invested Administration

A collaborative partnership is not simply an act of combining two certified people together in a classroom with needy students. Two heads are not always better than one. It takes a great deal of planning, preparation, and cooperation before the partnerships are formed, and then, more planning, preparation, and cooperation during the collaboration for its success. Many issues need to be considered which may have a major impact on the success of such a program.

The underlying belief system within a building must be examined thoroughly before embarking on a mission of collaborative change. The building administration must embrace the theory and concept behind collaboration, support the teachers initiating such a change, and also provide structural supports

which will allow the collaboration to occur. Walter-Thomas, Bryant, and Land (1996) suggested that administrators provide administrative support and leadership, select capable and willing participants, provide ongoing staff development, establish balanced classroom rosters, provide weekly scheduled co-planning time, facilitate the development of appropriate IEPs, and pilot test classroom and school collaborative efforts.

A belief system within a school which promotes open sharing among colleagues would be most beneficial to a collaborative model. Traditionally, educators have not always been prepared to share and work in a collaborative fashion with other teachers. They have been taught to be autonomous and self-sufficient, for the most part, within their classrooms (Leithwood & Jantzi, 1990). Due to the physical separation of individuals within a building, teachers historically have learned to accept this isolation as the norm, or, the existing condition of work in the education field. Many teachers, however, see this condition as isolation from the peers who can provide professional support badly needed within schools filled with so many high-need students. A collaborative environment may help provide the support teachers feel is needed under these conditions. Many schools are thus turning towards the establishment of collegial norms.

Administrators interested in establishing these norms must also increase awareness of a need for change towards collegiality. So often, in education, the very idea of change in general can cause a small conflict to erupt into full scale warfare among the most rational adults. Communicating a positive attitude about change is perhaps best exemplified in the motto, "You don't have to be sick to get better."

An additional constraint which may be viewed as an immediate blockade when getting a collaborative model off the ground is scheduling the specials (art, music, P.E., etc.) and assigning students with needs to classroom teachers (Walter-Thomas, Bryant, & Land, 1996). These are likely handled differently at the elementary versus middle school/high school levels.

At the elementary level, it is extremely important to have scheduled chunks of uninterrupted time when a number of students with needs can be served in a collaborative classroom and when teaching partners are free to work together in that classroom. For example, if a second grade teacher is interested in collaboratively teaching with a resource teacher, that second grade class must have a chunk of time when the students served in that class will have no specials scheduled to interrupt this instruction. In addition, depending on the number of students served by that resource teacher at the second grade level, these students may need to all be assigned to that regular class second grade teacher. If there are too many students at the second grade level requiring resource services, then, these students may be split up and assigned to several classroom teachers. These students may, however, still be able to participate in one regular class teacher's collaborative classroom for a subject if all teachers at that grade level have a time which is uninterrupted and designated as collaboration time for that subject. Under these conditions, for example, students who will be involved in a collaborative model for reading will leave their individual classes during reading (all second grade classes will have reading time set aside as an uninterrupted block of time) to go to the collaborative classroom. If this presents a problem in terms of class size, other students from the collaborating teacher's class might be assigned to go to other sections for reading instruction.

At the middle school or high school levels, blocks of time for instruction are usually more evenly distributed and signaled by a bell system. With today's technological advances in place, many schools have scheduling software packages which distribute students as evenly as possible within grade level, subject area, and teacher availability parameters. Under these conditions, for example, if an eighth grade science teacher wanted to collaboratively work with a resource teacher during a particular period of the day, the students designated as those whose needs would be met in a collaborative setting might be hand-scheduled into that period's section prior to the electronic scheduling of students (Nowacek, 1992). In this fashion, after-the-fact rescheduling of students to make collaboration happen and the resulting hassles can be avoided. Of course, this means that the resource teacher must also be free during the scheduled collaborative time so that the partnership in teaching can occur. This is not always easy. One idea to accomplish this task is to determine the special education teacher's schedule first. This should be based on student need and the resulting integration possibilities which, in turn, may

free the special educator from chunks of previous pull-out times which can now be utilized for collaborative classroom time.

The next hurdle in the approach towards collaboration is the availability of time to plan (Johnston, 1994; Walter-Thomas, Bryant, & Land, 1996). Teachers forming partnerships will need time, at first, to become more acquainted with each other's teaching styles and vision for instruction. As the partnership progresses, time will be needed to develop joint instructional plans and to collaborate on direction, evaluation, and student issues. This time is not always readily available and often takes the form of brief conversations in the hallway between classes or late afternoon meetings well beyond the contract day. If carefully planned, some of this time can be planned around specials time and in conjunction with personnel resources existing in the building. This planning time, in whatever form it takes, needs to be arranged in advance—an administrative task which requires advance organization when scheduling.

A significant concern when initiating any change in an educational setting is the effect of that change on student performance. Current issues of accountability in education have prompted the trend towards establishing standards and benchmarks for student achievement. As a part of the collaborative change process, such issues may lead administrators to establish the means for student achievement assessment which might provide evidence of student performance in the collaborative setting.

Pursuing a collaborative environment may seem to be an overwhelming task. To assist with this process, consider the following steps adapted from a collaborative model plan proposed by Reisinger, Allbaugh, and Battersby (1991):

1. Establish a planning team or steering committee consisting of administration, special and regular education teachers, and parents.
2. Take stock:
    a. Where are we now versus where do we want to go?
    b. Is there a need to change?
    c. What's favoring change? What's resisting it?
    d. Develop belief statements
3. Identify key issues:
    a. Legal aspects such as IEP's and rules of special education
4. Identify needs, priorities, and resources
5. Visit other sites and debrief about procedures, strengths, and issues of concern
6. Start small and think big
7. Enlist support of administrators, counselors, special education personnel, parents
8. Build partnerships
    a. Do not mandate
    b. Allow teachers to select if possible
    c. Keep selections a private matter between administrator and teachers
    d. Consider traits such as teaching and personality styles, flexibility, and sharing when matching partners
9. Build supportive schedules which include
    a. Available time for special education teacher to collaboratively teach in the regular classroom
    b. Common planning time
    c. Special education and/or at-risk students scheduled to common section for designated block of time (try not to schedule more than one-third of the class as students having needs met in a collaborative setting)
10. Encourage partners to determine "Ground Rules" for the relationship

Once the proper groundwork and structural support systems are in place, hopefully removing immediate barriers, teaching partners will likely feel more comfortable in developing effective collegial partnerships which serve the students needs. These partnerships require a different perspective than the autonomous view which is commonly experienced by non-collaborating teachers.

A View from the Trenches: Invested Teachers

Marriage, it is said, should not be entered into lightly. So, too, collaborative partnerships. Effective partners will likely experience many of the trials and triumphs of relationships in general. It is important, as in marriage, to make sure that co-teaching partners have some things in common and communicate effectively. For this reason, it is suggested that collaborating partners take the time to establish "Ground Rules" (see Figure 9) by discussing the questions Blaisdell (1994) suggested.

Figure 9
Setting Ground Rules

1. SCHEDULING
   a. When will the special educator be scheduled in sections?
   b. How many students with special needs will be placed in this section?
2. CLASSROOM MANAGEMENT
   a. What system of rules/rewards/punishments will be used?
   b. Who will be responsible for instituting/enforcing this system?
3. PLANNING TIME
   a. When will teachers plan together?
   b. What will this planning time consist of?
   c. Who will be responsible for this planning?
4. ASSESSMENT
   a. How will students be graded?
   b. Will students with special needs be handled differently?
   c. Who will be responsible for grading papers and report cards?
5. CLASSROOM ENVIRONMENT
   a. Whose classroom will be used? One teacher or both?
   b. How do the teachers feel about being able to have access to such things as supplies, filing cabinets, instructional materials, personal belongings in the classroom, gradebooks, pencils/pens, etc.?
6. TEAMWORK
   a. How will the teachers communicate to the students that they are a team? (List as many ways as you can think of)
7. BELIEFS
   a. What do each believe to be true about all students?
   b. What do each believe to be true about students with special needs?
   c. What methods need to be in use to meet the needs of special students?
   d. What methods need to be used to meet the needs of advanced students?
   e. What do each believe to be true about collaborative teaching as a method for reaching students with special needs?
8. PROBLEM-SOLVING TOGETHER
   a. If a conflict arises between the teachers, how is this handled?
   b. What kinds of input does each teacher expect from the other?
   c. Pet peeves: How does each feel about the other . . .
      1. being on time to class?
      2. running errands (for other or self)?
      3. taking restroom breaks during class?
      4. contributing to class discussion (and how should it be done?)
      5. explaining to a student during teacher presentation?
9. ROLES AND RESPONSIBILITIES
   a. What roles will each teacher take in this partnership?
   b. What responsibilities will the special educator have?
10. PARTNERSHIP GOAL SETTING
    a. What goals do the teachers have as a partnership in terms of:
       1. curriculum?
       2. student achievement/success?
       3. professional growth?

Setting ground rules can encourage communication to help teaching partners get off to a good start. Despite best efforts to communicate on these issues, however, there are a number of influential factors which can emerge in cooperative teaching partnerships. These include issues of philosophical differences, input and role flexibility, degree of trust and/or power, degree of conflict relationship and relationship development, and overall commitment to professional growth (Takes, 1993).

Philosophical differences.

Partners' philosophical viewpoints may either present opportunities for effective collaboration or may represent immediate barriers (Reeve & Hallahan, 1994). Some partners may share a commitment to cooperative teaching as a method of meeting the needs of all students. In other partnerships, individuals may have a level of uncertainty regarding this issue. Some teachers may feel that collaboration is merely another one of the many educational initiatives which will pass in time, or they may have even felt coerced into participation (Walter-Thomas, Bryant, & Land, 1996).

Input and role flexibility.

Some teachers may feel that their sense of autonomy is threatened by a collaborative teaching model. Others, who feel that teaching is often done in isolation, may welcome the opportunity to receive input from others and share the roles and responsibilities of a classroom with another teacher (Nowacek, 1992).

Trust and power.

Issues of trust and power play an important role in the collaborative partnership. The degree to which each teacher trusts the other's skills as a teacher and one's ability to carry through a task to completion can greatly affect the cooperative relationship. Partners may also need assurance that integrity will prevail within the relationship and that neither partner would resort to gossip regarding the relationship. In addition, the degree to which power is shared between partners in the relationship may also play a critical role in the perceived success of the partnership. This includes the power to share in the decision-making process such as when determining grading standards, curriculum, disciplinary measures, or acceptable modifications.

Conflict or relationship development.

Teachers may feel a strong need to develop the partnership relationship more fully since they are working closely together. This may include establishing with students the idea of the partners as a "team" through their interactions with each other. Sooner or later, one or both partners will likely have a conflict of some degree with the other. The degree to which conflicts - both large and small - are addressed and resolved seems to be vitally important to the overall success of the relationship (Reeve & Hallahan, 1994).

Professional growth.

A last factor which may emerge as influential in the partnership is how much partners agree on the importance and direction of professional growth as collaborating partners. Professional growth can be individual in nature, perhaps in the form of increasing awareness of a topic or advancing skills. Growth could also be demonstrated as partners, including attempts at new teaching strategies or techniques or planning for future curricular or methodology adjustments.

When examined as a whole within a collaborative partnership, these factors may help determine the type of partnership between two teachers. Takes (1993) developed a model for looking at such relationships. This model uses four basic levels of partnerships which take the previous factors into consideration. These levels include parallel, collateral, convergent, and transformative partnerships (see Figure 10).

Figure 10

A Classification of Influential Factors in Cooperative Teaching

Level of Cooperative Teaching	Description	Philosophical Viewpoint	Forms and Acceptance of Assistance	Issues of Trust and Power	Relationship Development & Conflict Resolution	Commitment to Professional Growth
TRANSFORMATIVE	partners have similar philosophies, work together in a constructive fashion toward an agreed upon purpose which exceeds limits of existing classroom structures, and are both satisfied within the partnership	• very similar philosophies • shared commitment to integration • shared commitment to cooperative teaching • no strong beliefs in teacher autonomy	• planning time used well • flexible roles for each • input given and accepted	• no turf problems • decision making almost wholly shared or divided reasonably • partners trust each other on personal and professional levels	• partners already know each other or spend time getting to know one another • good preconceptions confirmed or negative ones voided • partners present themselves as team • conflict successfully addressed	• new teaching strategies attempted (beyond what traditionally existed in classroom) • new curricular and methodology goals set
CONVERGENT	partners have similar philosophies, work together in a constructive fashion toward an agreed upon purpose within existing classroom structures, and are both satisfied within the partnership	• basically similar philosophies, but some differences may exist • shared commitment to integration • shared commitment to cooperative teaching • no strong beliefs in teacher autonomy	• planning time used well • flexible roles for each • input given and accepted	• may have some problems with turf • decision making mostly shared • partners trust each other on personal and professional levels for the most part	• partners already know each other or spend time getting to know one another • good preconceptions confirmed or negative ones voided • partners present themselves as team • conflict left unaddressed	• some new, agreed upon strategies may have been tried but mostly within limits of existing classroom practices • few to no new curricular and methodology goals set
COLLATERAL	partners work compatibly, at least on the surface, and with common purpose but one partner holds a subordinate position to the other especially with respect to decision-making power, and one or both partners are dissatisfied within the partnership	• philosophies similar in some regards, not in others • commitment to cooperative teaching and/or integration may not exist for both teachers strong beliefs in teacher autonomy	• planning time not used well • roles not flexible or shared • input not always asked for or given	• issues of turf and class ownership exist • decision making not shared much • partners lack a trust in each other on personal and professional levels	• partners do not spend time getting to know one another • preconceptions likely negative and not voided • partners may falsely present themselves as a team • underlying conflict avoided or left unaddressed	• few to no new, agreed upon strategies tried; some individual growth may be evident • little to no evidence of new curricular and methodology goals being set
PARALLEL	partners work in the same room—but almost always in a separate fashion, separate goals may have been achieved by individuals despite little cooperation or communication between partners, one/both partners are dissatisfied	• philosophies likely different • shared commitment to cooperative teaching and/or integration likely nonexistent or to small degree • strong beliefs in teacher autonomy	• planning time not used • roles not shared or flexible • little to no input asked or given	• issues of turf and class ownership exist • decision making not shared at all • partners lack a trust in each other on personal and professional levels	• partners do not spend time getting to know one another • preconceptions likely negative and not voided • partners do not present themselves as a team • underlying conflict avoided or left unaddressed	• few to no new, agreed upon strategies tried; some individual growth may be evident • no evidence of new curricular and methodology goals being set

In a parallel partnership, partners may work in the same room but separate in fashion. They typically have separate goals which may have been achieved by individual teachers. This relationship is marked by the fact that cooperation and/or communication is minimal between teachers and by either or both partners have expressed dissatisfaction within the partnership. The teachers may have entirely different philosophies and likely do not share a commitment to cooperative teaching as a successful means for reaching needy students. Feelings of autonomy often interfere with the ability of the partners to share input and effectively communicate. Trust is often lacking in these partnerships and little time is taken to develop a better relationship.

A collateral partnership is one in which both partners seem, on the surface, to work compatibly with one another. One person, however, is ultimately subordinate to the other, especially with respect to decision-making power. Often, one or both teachers are dissatisfied within the partnership. Roles are likely inflexible due to the autonomous nature of one or more of the partners. Issues of autonomy may also affect the degree to which supplies are shared as well as the degree to which trust is exhibited between the partners. Conflicts which arise will often go unresolved and, not surprisingly, professional growth occurs in very small amounts or not at all.

A convergent partnership is characterized by partners who have mostly similar philosophies, who work together in a constructive fashion towards an agreed upon purpose within the existing classroom structures, and who both are satisfied within the partnership. Some degree of departure likely exists, however, with regard to one or more factors. For the most part, the teachers are able to productively work around the differences and probably share a commitment or even excitement about cooperative teaching as a viable alternative to educating students with special needs.

Transformative partnerships consist of partners who have mostly similar philosophies, work together in a constructive fashion towards an agreed upon purpose which exceeds the limits of existing classroom structures, and are both satisfied within the partnership. Both are effective communicators that resolve conflicts and pursue common goals of professional growth.

Transformative partnerships, then, would seem to be the desired norm in a collaborative model. A successful relationship should consist of partners who share a commitment to meeting the needs of students through a collaborative effort; who prefer to give and receive input from others with regard to the teaching job; who can trust one another with regard to their teaching skills, efforts, and integrity; who can share decision-making power; who take the time to develop the relationship to the degree that each feels part of a "team" who can resolve conflicts between one another effectively; and who promote professional growth between partners.

Collaborative partnerships will likely not all fit neatly into one of the four levels of cooperative teaching described in this model. Often, relationships may be difficult to define or may evolve over time (Nowacek, 1992). Several of the critical factors are often difficult to discern because they are beneath the surface within a collaborative relationship. Shared philosophy, issues of trust and power, conflict resolution, relationship development, and a commitment to professional growth may all be hidden from immediate view to the outsider. In any given classroom, however, closer inspection of a collaborative partnership should immediately reveal the roles of the teachers involved.

Microscopic View: A Collaborative Science Classroom

A collaborative partnership in any subject area classroom will require the partners to plan carefully not only for the needs of the students taught, but also for the needs of the subject area. Instruction in science may require some additional planning due to the active, inquiring nature of the subject and the degree to which concepts taught are easily understood by all students.

Since science classrooms often involve hypothesis development, research, experimentation, data collection, analysis, and conclusion-drawing, a high degree of organization is needed. Organization of materials, procedures, and data are all important parts of a science classroom. Often, students are required to do large amounts of reading and comprehension, apply mathematical concepts, handle equipment, and recall and communicate concepts. This places a burden on the cooperative teachers when planning for effective accommodations for students with special needs.

Today's at-risk or special education student may have a variety of needs which require specific modifications (see Figure 11). Some of these accommodations are easier than others to provide in the regular classroom, but with the assistance of a collaborating partner, are more likely to occur with regularity (Braaten, Mennes, Brown, & Samuels, 1992).

Figure 11:
Sample Accommodations

A child who has difficulty . . .	May benefit from these accommodations . . .
following multiple step instructions	Simplify, repeat, or clarify directions; call attention to key words in directions; have student repeat or paraphrase directions
understanding concepts	Provide additional activities (which accommodate for multi-sensory learning styles) and which help to clarify content information; extend background information
with organization of materials, thoughts, data	Provide charts and graphs which might help to organize collected data
reading and comprehending material	Extend background information; provide audio tapes, outlines, and/or study guides of reading material
with language and/or vocabulary	Suggest advanced organizers which help students focus on necessary vocabulary or help them utilize previous knowledge; reduce content information and vocabulary required to critical items only
recalling and communicating information learned	Provide mnemonics to aid in prompting memory of concepts taught; provide additional review (in game format to motivate)
applying math concepts	Limit math skills required to functional concepts only; allow use of calculator
completing tasks on time	Provide additional reminders of due times/dates; help students organize tasks by setting small goals leading to accomplishment of task
staying in seat, focusing on task	Organize activities into smaller chunks, limiting the number of materials in front of a student and limiting the number of multi-step procedures to follow
hearing	Allow preferential seating, outlines of information provided in class, and visual cues from teacher to signal key events such as class transitions
with vision	Provide alternative procedures which allow for greater use of the other senses - especially the sense of touch
performing gross and fine motor tasks	Provide for use of additional or alternative materials which are increased in size, are of lighter weight, do not require fine motor skills, or provide greater safety

On a regular basis, lesson plans can be modified to include methods, materials, motivational activities, study skills, and/or learning strategies which will provide more opportunities for learner success. Instructional methods should include a wide variety of activities – hands-on experiences as well as reading information from a textbook. Students should be actively engaged in activities which reinforce concepts presented in a number of ways. For instance, building models of animal cells using the ingredients for making a pizza could call students' attention to sizes and numbers of cell parts and their functions.

Experiments can be "retooled" to include materials that students can more easily use. Students with visual or motor difficulties may need to use larger instruments or materials. Students with difficulty attending to task for long periods of time may benefit from structuring the timing and placement of materials used.

For students with learning difficulties, providing study guides, study sessions which emphasize the use of mnemonic devices, and other learning strategies should increase their likelihood of success.

Formatting tests to meet the needs of students who are easily confused by information is generally a good idea as well. For those students who have difficulty remembering large quantities of information and distinguishing between individual bits of information, chunking tests into smaller sections usually helps.

Providing these kinds of accommodations may take a great deal of time. Working as a collaborative team, a regular class science teacher can provide the expertise needed to develop content lesson plans and appropriate activities. A special educator can provide the expertise needed in modifying lesson plans to include learning strategies and needed materials/activities to better ensure the success of needy students. A small sample set of lesson plans from an eighth grade unit on the solar system included in Figure 12 demonstrates the roles and activities planned through a collaborative partnership.

Figure 12:
Sample Science Activities

Activity	Regular Educator Role	Special Educator Role
Planet order in solar system, distances from the sun	Students holding planet signs on football field are placed at proportional distances from the "sun" (goal post)	Development of mnemonic for order of planets, creation of chart for organizing information regarding distances
Individual planet characteristics	Student groups research basic characteristics of planets, build "to-scale" models of planets (or portions if needed due to size constraints)	Brainstorm with students basic characteristics list for research activity, guided walk through fact-finding example with one planet, introduce research skills
Rotation of planets and their revolution around the sun, same with moon around earth	Definition of rotation and revolution. Demonstration of phases of moon and its rotation/revolution using ball with "man in moon face" on it	Students review positions of planets, moons, sun, and demonstrate "rotation" and "revolution" movements on command in "Simon Says" fashion
Review and test	Test items developed from narrowed, critical objectives. Test chunked into small sections.	Study guide created containing information covered on test. Game activity such as "Jeopardy" created to review concepts and information.

Conclusion

Science educators today face a number of challenges in the classroom. The range of abilities in one class section makes it difficult to plan activities which will capture both the interest and the learning capacities of all students involved. While collaborative partnerships between regular and special educators can pose interesting questions regarding belief systems, and cause additional burdens in terms of scheduling and time constraints, the combined expertise involved in such a partnership has great potential for meeting the wide range of needs in any given classroom. Science tends to be, as it should, a more hands-on experience. It also tends to be a subject that presents great difficulties for students with disabilities due to the need for conceptual thinking and higher reading ability at times. Because of these issues, it seems to also lend itself well to the collaborative effort. While it cannot be touted as a panacea of any kind, a collaborative partnership between individuals who have similar belief systems and who are willing to communicate and work together as a team to solve problems, set goals, and share roles and responsibilities will likely see great gains in student achievement in the science classroom.

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Chapter 6
Assessment and Evaluation

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Assessment is a major and necessary component of education. After all, it is beneficial to receive an appraisal of the results of your work. But assessment in the world of education typically leads to controversy. Some believe assessment can serve as a stimulus for education reform while others think it's a deterrent to educational programs sensitive to individual differences. In this chapter the implications of assessment and evaluation when you add in the inclusion of students with disabilities will be discussed. We'll look at the problems when you use test results, the purposes of tests, the advantages and disadvantages of several kinds of assessments, and recommendations for the future use of assessment and evaluation.

Much of the controversy swirling around educational assessment exists because groups involved have different: 1) agendas, 2) widely different views on the validity and reliability of standardized assessments, 3) concerns about how the results of assessment will impact the students being tests, 4) concerns about how the results of assessment will be used to evaluate those giving instruction or delivering programs, 5) concerns about how legislative bodies will use the information from assessments in funding and evaluating schools, 6) concerns about the use of assessment in labeling and categorizing students, and 7) concerns whether the test(s) accurately assess the knowledge of the individuals and their ability to perform in tasks relating to qualifications.

While the question of how test results are used is the newest controversy in assessment, questions concerning assessment go back a long way. In fact, many perceive that American schools have become increasingly less accountable over the past 40 years, allowing casual students to receive diplomas and casual teachers to sustain employment. As one result, high stakes testing has emerged in the last decade. For instance, some state agencies and/or independent school districts require certain performance levels on standardized or criterion-referenced tests before students receive a grade advancement or diploma. Many in education see such high stakes testing as a positive, necessary means to hold professional educators and students accountable for responsible and attentive actions to their duties. High school teachers in states with student competency exams perceive that a larger percentage of students demonstrate a more serious approach to their studies when performance level assessment is involved.

However, there's a flip side to such potential benefits of testing. High stakes testing initiatives have not been in place long enough time to bring to light their political, financial, and social consequences to students who are unsuccessful, or to determine how those students' subsequent choices may affect society in general. For example, we know that where there is high stakes testing, educational agencies and families have incurred increased costs for remediation and supplemental instruction. The negative consequences to students who do not pass these tests and are retained are consistently noted in the educational literature. The social costs to students who choose to drop out and not continue school will need to be evaluated. The greatest threat to arbitrary enforcement of standards may be the ability to withstand political challenges. The rhetoric of "leave no child behind" is especially formidable.

There are ongoing discrepancies between results of testing shared with the public and the professional interpretations of the data. For example, for dropouts there is no data and often scores for students with a special education label are not included in group reports. Students with disabilities are over-represented in schools with lower expectations and content deficits. If this results in diminished funding and/or increasing threats, the school climate is destined to become more punitive and demanding, putting more pressure on those least able to handle intimidation.

Along with the well-intentioned rush toward accountability has come a tendency to define the performance of a child to a single number, or series of numbers. Empirical investigations of standardized tests consistently find that socioeconomic status, broadly defined, accounts for 85-90 percent of the variance in test scores (Kohn, 2001). Upon close scrutiny the validity of the screening tests to identify students with disabilities is suspect. These same numbers often go further to interpret the

quality of teaching and the performance of the school. The meaning of education for teachers and students cannot be reduced to one single number for any purpose. It is important to look at the broader implications regarding the purpose of schools and the impact of schooling on each individual student.

As parents and community members become more familiar with high stakes testing and standardized tests, they become more critical and more disenfranchised. However, school testing is currently being driven by a top-down, heavy-handed, corporate style version of school reform which threatens the basic premises of school improvement (Kohn, 2001). It suits the political appetite for rapid quantifiable results (Thompson, 2001). Innovations supported by best-practice research become overlooked particularly in communities where the need for developmentally appropriate practice is most needed.

Perhaps the greatest danger of high stakes testing is the tendency to narrow the curriculum for those who most need a variety of educational experiences. Sometimes the tests themselves are used to define the boundaries of the curriculum. In such cases, teachers spend excessive time preparing students and modifying their curriculums to conform to test items that appear on the mandated achievement tests. The result can be a substantial long-term cost for minimal short-term gain. Students in low performing schools often face an increased focus on basic skills with less attention to the broad fields of science, social studies, humanities, and the arts. Yet, an exposure to these content areas is critical in developing higher order thinking skills which become ever more important as students progress through the educational spectrum. Eisner (2001) expressed concern that when there is only a limited array of areas in which assessment occurs, students whose aptitude and interests lie in other areas become marginalized. The importance of active participation by informed educators in establishing appropriate parameters cannot be overemphasized.

Science is particularly vulnerable where one of the best ways to raise test scores may well be to teach badly—to fill students full of dates and definitions and cover a huge amount of material in a superficial fashion (Kohn, 2001). Well-prepared teachers and in-depth teaching makes a difference. NSTA Reports (2000-2001) noted that when comparing the results of the Third International Mathematics and Science Study conducted in 1995, Minnesota eighth grade students scored significantly higher than other eighth graders in the United States and were second only to students from Singapore. Internal investigations show Minnesota teachers introduce fewer topics and devote more time to developing them in-depth. They embrace hands-on teaching and are better prepared in science. While 74% of science teachers as a whole hold a major in science or science education, the figure in Minnesota is 97%.

Students with disabilities present a particular challenge concerning assessment and evaluation. Under the requirements of IDEA 1997, students with disabilities are eligible to have testing modifications to enable them to demonstrate their learning. This has been done successfully for students with visible disabilities (physical, visual). But students with invisible disabilities often get caught in a dilemma. Specialists in identifying disabilities often disagree with classroom teachers about whether the poor performance of a student is because of a cognitive processing impairment, or student apathy and defiance of the learning opportunities. In some disability categories, the primary criteria is performance at a certain level below average classmates. Therefore, if a perfectly normal learner chooses not to study and learn, he/she may get a disability label. This mix and match of students with bona fide learning disabilities and those who choose to ignore or disrupt the educational process presents a formidable challenge for valid assessment.

The increase in using minimum competency testing to determine whether a student has attained mastery of skills and competencies implied by the certificate (i.e. diploma, degree, and licensure) becomes a complex, controversial topic when students with disabilities are considered. When minimum competency tests or testing procedures are modified, questions arise about the coherence, quality, and accuracy of the modified test. Does the test adequately determine whether the individual has the needed skills and knowledge implied by the score or certificate? If there is not a uniform standard of proficiency, the certificate loses its significance as a representation of competence. On the other hand, if students with disabilities are not given a certificate, they face social stigma, embarrassment, increased likelihood of dropping out of school, and reduced job opportunities (Wolman, Bruininks, & Thurlow, 1989).

Relevant sources of information about testing accommodations for students with disabilities are available. Guidelines about accommodations are usually developed in conjunction with standardized tests or minimum competency tests in order to award high school diplomas. A partial summary of state written guidelines on testing accommodations is in Table 2 (adapted from Thurlow, 1993, B1-B18). Often policies that states adopted for their assessment programs are insufficient and end up embroiled in controversy. The available literature reveals little consistency in assessment policy and little empirical research on how assessment practices have impacted students with disabilities.

TABLE 3

Written Guidelines on Testing Accommodations

Alternate Presentation	Student Response
Large print	With computer
Braille	Language board
Magnification	Writing template
Amplification	Speech synthesizer
Noise buffers	Exemption from written portion of examination
Templates	Exclusions included in the IEP, and indicated on the "Roster of Exclusions and Modifications"
Thermoforms	Oral response
Computer interface options	Answers recorded by proctor or assistant
Administration by a person Familiar to the child	Voice input
Oral presentation	Marked response in test booklet
Tape presentation	Sign language
Sign language	Mechanical aids
Avoided interruptions	Calculator
Tactiles	Word processor
Use of place markers	Augmented communication
Use of interpreter	Dictated answers
Modality modifications	**Alternate Timing/Scheduling**
Content modification to student's IEP	At time most beneficial for the student
Revision of test format rereading and review of directions	Administered with breaks
Simplify language of directions	Intermittent administration based on physical ability or attention span
Provide additional examples	Extra time
Highlight verbs in instructions	Testing over several days
Alternate Setting	
Administered in small group	
Administered in a carrel	
Administered in a special classroom	
Administered at the student's home	
Selected seating within the classroom	
Administered individually	
Administered with teacher facing student	
Administered by special education teacher or other approved personnel	
Adapted or special furniture	
Special lighting	
Special acoustics	
Color transparencies	

This issue of who takes minimum competency tests and when can be somewhat simplified if students with disabilities are placed into two groups: (a) those who require modifications in the instructional goals and curriculum, and (b) those who have the knowledge and can demonstrate adequate understanding with appropriate modification of the learning/testing environment. For students with disabilities in the

first group, there could be: (a) a test exemption, or (b) use of a different proficiency standard depending upon the instructional goals in the student's IEP, or (c) a different level of acceptable test performance. However, there are implications about how such competency certificates (i.e. diploma, licensure) are interpreted when the data is used to make life decisions (i.e. admissions, employment.)

An exceedingly complicated and more fundamental equity issue concerns students with disabilities in the second group. Is it possible to make testing accommodations that remove irrelevant sources of difficulty but still measure the same construct? When the test form, mode of administration, language, extended time, and omission of certain types of items are applied, is the technical adequacy (predictive, content and construct validity, reliability, coherence, comprehensiveness) compromised? Do the scores have the same meaning as those from standard administrations? If there are differences in the constructs being measured, can admissions officers, or employers make decisions expecting equivalent performance?

In some states that use high stakes testing, students with a disability label are eligible for graduation whereas non-labeled students with the same performance scores are not. As a result, rather than holding students accountable as the tests were intended, the ploy becomes one of maneuvering to get a disability label for certain students to forego their personal accountability. It becomes a game of seeking an advantage for those with resources and/or influence to challenge the decisions implied by the test scores.

Testing accommodations for students with disabilities is not a new issue. Empirical studies, policy reports, and legal judgments are shaping decisions regarding the application and use of assessment tools for students with disabilities. Unfortunately, individuals far removed from educational practice are making many of the most influential decisions. In many states, professional education communities (administrators, teachers, and professors) are deeply involved; in others, mandates emerge from a state department of education containing requirements for compliance which are frequently compromised; and in other cases, groups of educators representing as much diversity as possible are brought together for a short period, but are not given time to develop group concensus or a common platform. In the vast majority of instances the testing agenda is implemented, and the resulting problems which inevitably emerge become enthralled in controversy.

Purpose and Use of Assessments

Assessment and evaluation serve many purposes and these frequently become confused in implementation. Internally, many states are working for an alignment of education standards and assessment. The standards are intended to convey expectations about what is important to learn and the assessment is designed to determine the degree to which the students have acquired the learning expectations. Policy makers and administrators see the scores being used internally to help guide and improve instruction. The scores can also be used to differentiate between students and certify those who have met a standard. There are also external purposes. One may be to provide information for teacher accountability and administrators' performance. If schools are viewed in light of a business model, productivity is reflected in the amount of student learning that has taken place as a result of the professional educator's interventions. Assessment then can be used to guide school policy decisions and to gain information for program review and for effective resource allocations.

These distinctions between internal and external assessment purposes are not precise, and it is important to clearly communicate the format and purpose of assessment. Good assessments in school settings should not only measure student progress, they should also provide opportunities for student learning. Tests can increase student responsibility, motivation for learning, and provide feedback on what students know and are able to do.

Educational testing is a big business in the United States. The average student spends between 10-20% of his/her time at school taking tests. According to a study reported by Stiggins and Conklin (1992), about one-fifth of the testing time in elementary school mathematics involves standardized or commercially published tests. In most cases, students are in a passive role of answering questions rather than thinking about ideas and posing problems. The tests exclude many types of knowledge and

performance contained in most schools' mission statements and goals. The simple recall of facts and information is emphasized rather than higher order thinking skills (Madaus, et al. 1992). Standardized and commercially published tests are often used for inappropriate purposes—to track students and allocate awards and sanctions (Darling-Hammond, 1999).

Types of Assessments

It is important to align assessment tools with their intended purpose and use only the information which is congruent with that purpose. The selection and use of assessments has special significance for students with disabilities and schools with a large percentage of students from segments of the disenfranchised population. Four types of assessments are described: criterion referenced, standards based, management oriented, and program oriented.

1. Criterion Referenced Assessment

The primary purpose of a criterion referenced assessment is to support instruction and facilitate learning. This type of assessment plan should be coherent, comprehensive, equitable, and engage all students. It should also be integrated with instructional strategies and curriculum materials to promote effective student learning and provide information that will yield valid information about student learning.

One advantage of criterion referenced assessment is that it does not have the threatening implications of some other types of assessments. The criterion referenced assessment strives to help teachers determine desirable outcomes for every student who demonstrates effort and initiative. Some other forms of assessment (standardized tests, for example) tend to pit students against each other, using rewards and consequences. However, criterion referenced assessment uses several methods of gathering accurate student data without pairing students against one another. Conversations, questioning, signaled responses, discussions, hands-on assessment, and portfolios are all tools that work effectively. Brief overviews of each of them follow.

Conversation is an important informal way to gain information about what students have learned. Just asking children to describe what they did and what they have learned can give valuable information. If students respond with some misconceptions, they can be clarified or the student can be redirected. The conversation itself requires that the children reflect on what they have done and thereby serves as a learning tool. Enlisting value judgments such as what they have confidence about and questions that they still have can be used to guide their learning.

Through questioning, a teacher can often determine if a student's understanding is secure or vague. When teachers inquire, students are more likely to be motivated to find solutions and answers. Through guidance and facilitation, students can be encouraged to apply their prior knowledge or research to solve a problem. The well-developed art of questioning, as illustrated by Socrates, may be one of the most valuable instructional aids any teacher has in his/her repertoire of teaching strategies.

A group or signaled response can give teachers a lot of information about instructional effectiveness, without singling out an individual student. Working with instructional techniques that allow students to display what they have learned in non-threatening situations can go a long way in improving instructional effectiveness. Students with disabilities are often aware of the social implications associated with responses to teachers' questions. Individual questions force students to respond in a situation where peers are making value judgments about the quality and depth of their understanding. It is not surprising that some students choose inappropriate actions rather than embarrass themselves in front of their peers.

Discussions enable students to model democratic processes in the classroom. Through discussions students become familiar with the ideas of others and develop skills to clarify positions that reflect their own ideas. Van Zee (2000) reported that a teacher's role should be to guide discussions, to help students organize and facilitate knowledge, and to encourage students to stimulate the thinking of others rather than give information to transmit knowledge. To facilitate learning, teachers can increase their skills by

listening more carefully, waiting longer for an answer, and using questioning to draw the concepts from the students.

Hands-on assessments allow teachers to observe the quality of students' performance in using science tools and science thinking. During inquiry-based investigations, students have higher satisfaction and less conflict with the other classmates. In addition they feel more familiar with the science education principles and are more able to share results of their work with audiences (Canton, 2000). Hands-on assessment activities engage students in actively doing science: they are encouraged to design investigations, collect their own data, gather information, and demonstrate outcomes of their investigations.

A portfolio allows students to tell a story about what they have done and what they have learned. The concept of portfolios was borrowed from the disciplines of art and architecture. The portfolio is an ongoing assessment strategy; teachers and students add and delete items all year long to reflect the student's progress throughout the year. They provide opportunities for students to assess and reflect on their own work. Because students help develope their own portfolios, they are able to represent their own efforts and accomplishments in a concrete form. Another important element of a portfolio is the student-written proposal. It should provide a depiction of a student's instructional goals, learning interests, and performance on a variety of learning tasks.

2. Standards Based Assessment

A standards oriented approach to evaluation involves all affected constituents agreeing on the purposes and uses of established goals, standards, benchmarks and/or objectives which can be measured and assessed. Forty-eight states have adopted state standards in some form, all based on the assumption that the educational context is the same for each child (Pilotin, 2001). The evaluation becomes a closed-system, a way of thinking which defines the outcomes of instruction as immediately observable and ideally the same for everyone.

Maeroff (1998) stated that high stakes testing ignores what is known about the 20% of students who live in poverty and the majority of students with disabilities. Many of these students do not have an understanding of the academic system and cannot imagine how it connects with their lives. Enrichment is perceived as a better alternative. Furthermore, objectives relating to values, such as helping individuals gain perceptions and sensitivities to human diversity, are not articulated simply because they are not easily measurable. Qualitative objectives so important to the success of disenfranchised populations (i.e. creating a sense of belonging, developing a sense of academic initiative, giving the child a sense of success and of knowing) are generally given little attention.

One strength of the standards based minimum competency test is its simplicity. All parties involved in the process can understand expectations and monitor their progress. Parents and community constituents are clear about the common expectations for all students and are more likely to become involved in helping students meet the standards of performance. In practice, the assessment tools focus largely on student understanding and application of the basic skill areas of reading, mathematics, and writing. At higher grade levels, reading tests and application questions in mathematics depend heavily upon student exposure to experiences in a variety of contexts or settings. Increased potential can be developed through interactive hands-on experiences in the sciences, multi-modality experiences in social studies, and in-depth experiences in the arts and humanities. In each of these fields, children of poverty and students with disabilities are likely to receive fewer opportunities than those from advantaged settings.

Students in low-performing schools often have a high turnover of both students and teachers. What is most important is how the same individual students are doing as we follow them over time. However, this becomes an almost impossible task in many of our schools with a large percentage of poor and disenfranchised families where there is high student mobility. It is not fair to assess teachers and administrators on their effectiveness with a revolving door student population.

What the law says about testing.

Standards oriented approaches to evaluation can and should have a place in education. If tests are reliable and valid, the data can be useful to decision makers. The information is generally less susceptible to biases than more qualitative approaches. Some information can be used for increased accountability. There appears to be higher public confidence if the measurement results are reported in common metrics, that is, test scores that are convertible to standard scores.

Standards based reform aims to hold high expectations and provide high levels of support for all students. It is fundamentally concerned with equity and improving student learning across the board. It shifts from a focus on inputs to a focus on improving the quality, content and delivery of instruction through a variety of assessments. According to Thompson (2001) under a system of authentic standards: stake holders are participants in the process of determining the standards for their school, there are professional development opportunities for teachers and administrators in supporting their work to teach to the standards, student assessments are aligned with the standards, students have numerous opportunities to demonstrate that they have met the standards, and there is high-quality individualized support to help and guide students in their learning.

A concern noted by Thompson (2001) is that test-based reform, as it is currently being implemented, is effectively sabotaging the authentic standards movement. He stated:

> In the case of test-based reform, the purpose of education is raising test scores. In the case of authentic standards-based reform, the purpose is enabling all students to achieve as much of their creative, intellectual and social potential as possible.

Care must be taken when standards oriented tests are used in decision making for students with disabilities. Policy and legal considerations relevant to assessment and the use of assessment data have been shaped by both constitutional and statutory law.

The due process and equal protection clauses in the 14th amendment set forth two constitutional rights: (a) guarantee of equal protection under the law. In education, this translates into a guarantee of equal educational opportunity (not equal outcomes); and (b) due process when state action may adversely affect an individual.

Section 504 of the Rehabilitation Act of 1973 mandates that admissions tests for persons with disabilities must be validated and reflect the applicants' aptitude and achievement rather than any disabilities extraneous to what is being measured. The Education for All Handicapped Children Act (PL 94-142) mandated that all children with disabilities receive a free, appropriate public education. It also mandated due process rights, responsibilities of the federal government in providing some financial assistance, and the requirement that special education services be monitored. In testing, according to Suran and Rizzo (1983):

> The tests used to evaluate a child's special needs must be racially and culturally nondiscriminatory in the way they are selected and the way they are administered, must be in the primary language or mode of communication of the child, and no one test procedure can be used as the sole determinant of a child's educational program. (p. 175)

The passage of the Americans with Disabilities Act in 1990 (PL 101-336), although intended mainly for industry, has many implications for education, specifically about the licensing/certification/credentialing process. This act requires that the test application process and the test itself be accessible to individuals with disabilities. Although a person may not be able to meet other requirements of the credentialing process, he or she may not be barred from attempting to pass the credentialing exam. The agency or entity administering the test must provide auxiliary aids and/or modification and may not charge the individual with a disability for the accommodations made.

Accommodations that may be provided include an architecturally accessible testing site, a distraction free space, an alternative location, test schedule variation, extended time, the use of a scribe,

sign language interpreter, readers, adaptive equipment, adaptive communication devices, and modifications of the test presentation and/or response format (Thurlow et al., 1993).

Concerning performance examinations in science, the facilities must be accessible and usable by individuals. There must be the acquisition or modification of equipment or devices, appropriate adjustment or modifications of examinations, qualified readers or interpreters, appropriate modification in training materials and/or policies, and other similar modifications must be made for individuals with disabilities (42 USC 12/11, Section 101(9)). A person with a disability must provide documentation of the disability.

If there is to be any valid accountability for teachers to use from the standardized tests, information must not only be identified, but should also be quickly retrievable. Use of a multivariate design with disaggregated data analysis is critical. With advances in technology comes the promise of developing a computer-based system where data elements can be retrieved and matched with other data and used in multi-varied ways.

3. Management Oriented Evaluation

Many educators consider accountability one of the elements most lacking under the current model of American public education. While the increased use of high stakes testing may hold students accountable, there is also public concern about accountability for administrators and teachers. All too often mediocre performance is common practice and the protections offered through tenure, teacher unions, and vague accountability standards sustain that model.

Yet, any teaching/evaluation approach will come under question for several reasons. If you look at it from a management point of view, it's not possible to have consistency in the raw materials (students), there are insufficient controls to relate the treatment (teaching) to the students' learning, and there is no agreement on the desired educational accomplishments of schooling. Still, teachers and administrators can find help using the research on effective schools and best practice to formulate a plan for administrator and teacher accountability using a management oriented evaluation. The information in Chapters 7 and 8 can provide a foundation for decision making regarding professional performance of teachers and administrators.

The importance and value of the effective administrator (manager) is strongly supported in the literature. Research originating in the late 1970s described characteristics or practices used in highly effective schools. Practices found in schools that demonstrated higher levels of student performance were disseminated widely in educational journals. But, since the 1970s, we've seen that when administrators arbitrarily implemented these practices to improve their schools, the desired improved performance outcomes were seldom realized. The research findings on effective schools may be a delineation of the artifacts of effectiveness rather than the conditions that produce effectiveness.

What the administrators/managers needed to see was that effective schools have a positive culture that is facilitated and nurtured rather than imposed. Effective leaders generally find the best practice research to be a valuable guide to gaining a positive school culture, but they do not manage or impose elements found in the literature onto teachers or students like a medical prescription. The desired culture must be nurtured through a consistent and supportive transition period.

Healthy and sound school cultures correlate strongly with increased student achievement and motivation and with higher teacher job satisfaction and productivity (Stolp & Smith, 1994). Fullan (1992) wrote that administrators are often blinded by their own vision and are inclined to manipulate the teachers and school culture to conform to it. Cheng (1993) reported that strong school cultures have shared participation, charismatic leadership, intimacy, shared vision, and school-wide goals.

Fyans and Maehr (1990) presented five dimensions that must be considered as influences on school culture: academic challenges, comparative achievement with similar students in similar settings, school-community commitment and participation, shared commitment to school goals, and recognition. All of these dimensions should be part of an evaluation if there is to be a level playing field when high stakes judgments are made relating to administrator, teacher, and student performance.

A first step in any accountability plan must include an accurate evaluation of the school administrators' credibility. Without this, all other evaluations are suspect. Such a plan needs to determine the following:

- Do the administrators know and understand the context of the setting they are evaluating?
- Are they trusted by their constituency?
- Are they consistent in implementing policies?
- Do the individuals in the organization perceive the administrative structure as one that encourages success and accomplishment for all participants?

Effective schools have administrators who display strong professional behavior, reflect the mission and renew and revise goals annually, regularly observe the classroom setting, make suggestions to improve instruction and teaching, and involve staff in the planning and decision making process.

Managers are generally in control of structure and resource allocation decisions within any organization. In such a critical role, evaluative information is an essential part of any good professional practice. The information collected, what it tells about the audience it is directed to, and the way the information is applied are all critical elements in evaluation.

School administrators/managers also need to serve as the instructional leader. Their duties must include personnel and process decisions involving program planning, program implementation, and both formative and summative program evaluations. The decisions of the manager affect both internal (students, faculty and staff) and external (community, state, and national) consumers.

Yet, little information is typically available on administrative evaluation. When conducted, the evaluation often consists mainly of survey data followed by a conference with an administrative superior, a committee, or a school board. It is rare to have a credible, objective, professional evaluator who spends sufficient time in the educational context to gain a thorough understanding of the principalship. It is only through a deep and rich familiarity with the school context that credible recommendations can be forwarded to improve the administrators' skills and the quality of the school.

Management oriented evaluation models do exist (i.e. Stufflebeam, 1983) Context, Input, Process, Product) that present a process which can be followed to provide information about how a program is functioning, and to make a value judgment on the worth of the program and its potential use in other contexts. The following are noted as strengths and weaknesses of the management oriented evaluation model.

Perhaps the greatest threat of management oriented evaluation is that the power resides in the decision makers. Those in power can manipulate resources, legislate policies, manage structure, and make personnel decisions without the accountability found in the free enterprise system. Raw materials (students) and social structures (family and community) are highly varied and multi-faceted. A behavioral approach of rewards and consequences based on achievement will likely have a negative impact on those students who most need support and cooperation.

Administrators and teachers providing admirable service in the most difficult conditions are likely to be victimized, as are students with disabilities and students of color. High student mobility, community support, and high staff turnover all make it difficult to establish a positive culture which has a powerful influence on school effectiveness.

The charter schools movement is one illustration of the power of management in such a system and its potential to victimize teachers and students. Almost without exception, charter schools require some type of contract of commitment from both the child and guardians. Then, if the child (and often the family) does not live up to the contractual commitments and responsibilities, the school retains the power of removal. Any school that possesses such power by administrative dictate cannot be compared to a public school which must work to educate all students regardless of their dispositions and unique learning needs.

Management oriented evaluation then heavily favors such schools that can be selective in their student population. This idea runs counter to the foundation of public education in this country where

managers and decision makers must respect the special challenges of marginalized groups if any form of education equity is to evolve.

Management surveys indicate that over 80% of our nation's students are inclined to be compliant when instruction is appropriate for their needs. On the other hand, 2-5% of students come to school with devious intent. These students are a formidable challenge. And, any evaluation or educational model that increases the concentration of non-compliant students in one setting, where administrators are powerless to remove them, is bound to be inequitable. Jonathan Kozol's (1991) book *Savage Inequalities* spelled out the inequities and challenges faced by schools not within the mainstream culture and schools located in settings with limited tax base.

The utility or failure of assessment processes rests largely upon decisions made by management. They alone possess the power, the capacity to structure programs, and the ability to allocate resources in efforts to maximize school effectiveness.

It is important that administrative decisions are fair and equitable. Administrators must be informed about assessment results, the context from which the data was derived; the objectivity, reliability, and validity of the data; and the utility of the information relative to the decisions that are being made. They have a responsibility to communicate to all affected parties an awareness about the evaluation information and hold themselves accountable for inappropriate application and misuse of assessment data.

Along with power comes accountability. Administrators must be accountable to those affected and to the public they serve for decisions they make. The right of individuals to appeal decisions they feel are unfair needs to be protected and due process procedures need to be developed.

4. Program Oriented Assessment

The most common form of program evaluation throughout the United States is conducted through national or regional accrediting agencies that grant approval of educational institutions based on quantitative and/or qualitative standards. In most states, organization accreditation is supplemented or duplicated by state department of education accreditation.

Three major facets of the accreditation process include: 1) a reporting process with some minimal standards to insure that the facilities and educational materials are adequate, there is sufficient breadth in the curriculum, and that the educators' qualifications will lead to students receiving education that meets certain quality standards. This report is usually an annual requirement, but sometimes more frequent. 2) A second facet usually required on a 5-7 year cycle involves a self-study component where the institution is required to define the mission and goals, explain how the institution is meeting the students' needs, delineate strengths and aspirations, both short-term and long-term, and denote the tools of data collection and how the information will be used to guide school improvement. 3) A third accreditation aspect, also on a 5-7 year cycle, involves an external review, usually done by a team of peers who evaluate the alignment between the information reported in the self-study and the operational effectiveness of the program. It is critical to select evaluators who are credible, objective, reliable, and committed to help the organization improve. Site visitation is an important part of the evaluation process. Without an understanding of the context of the environment, it is unlikely that the evaluation will provide the depth necessary to improve the institution(s).

However, many educational critics view this oversight as being weak and ineffective. Some cite it as inherently incestuous. The standards and criteria are developed primarily by members of the educational community and the visiting team members are drawn from the professional ranks whose work they will judge. Other criticisms come from the selection process itself. Usually the institution being accredited is involved in the selection and determination of members of the visiting team. Programs with weaknesses can "color" criticism by selecting reviewers who are "team players" and will forward only "soft" criticism.

Another criticism is that the public education monopoly makes closing a school almost impossible. Therefore, even when weaknesses are noted, the corrective steps to regain accreditation are minimal rather than systemic.

When it comes to program review for students with disabilities, the degree of oversight in the program quality of regular education is generally minimal. It is not cost effective to bring in reviewers with expertise in all disability areas represented in the student population. Low incidence disability categories, for example all areas of physical disability, are slighted. Special education reviewer expertise is more likely to be in areas such as learning disabilities or mild developmental delays.

There is very limited awareness of discipline specific assistive technology or learning aids. Therefore, shortcomings in the regular educational program concerning included special education students are rarely brought to light through a broad formal review system.

This presents a special challenge for those committed to educational equity and the conceptual framework of leaving no child behind. The public, for good reason, is questioning the credibility of accountability in education and perceives it as an incestuous system that generally fails to police itself adequately. Without substantive oversight by objective credible reviewers, mediocrity sustains itself. The system is immune to the isolated challenges by critics. Passive compliance is seen as the best way to protect one's status within the educational arena. This is true for parents, teachers, and the students themselves.

The United States Department of Education has established a huge bureaucracy to monitor compliance of services to students identified with special needs. This compliance system and its policies have come under severe criticism after nearly three decades of implementation.

As one example, the system of Individualized Educational Programs (IEPs) with requirements for careful delineation of measurable student outcomes has resulted in teaching practices that more closely approximate "training" rather than "educating" students with disabilities. Such a demand to communicate quality or progress in the form of number(s) often inhibits, rather than advances, educational quality for students.

Complying with IEP requirements means there must be regularly scheduled staffings, and careful reporting of the proceedings are monitored. Student performance on the IEP objectives must be presented, along with the interventions and indicators of progress in meeting the objectives. Part of the difficulty is the time it takes to meet all of the compliance requirements. Every minute spent on compliance recording and in staffings is a minute taken away from instructional services for the child. Plus, this complicated accountability process inherently focuses on a student's lower order skills rather than helping the student acquire higher order conceptual reasoning.

Another example is the use of basic skills testing that has become the primary tool of student performance and accountability for schools because of our culture's inherent trust in this type of testing. Therefore, the special education teacher becomes another teacher of basic skills, focusing instruction on reading, writing, and arithmetic. The broad fields of science and social studies, which are critical for the development of higher order thinking abilities, are largely ignored. If the special education teacher does help with these classes, often his/her role is to assist in reading, assignment modification and completion, and test taking. With time taken up in these tasks, the more substantive accommodations are largely ignored, such as alternative instructional delivery, modifying laboratory apparatus, discipline-compatible assistive technologies, and assistance in learning general principles and their application. Modifications for science class when the child is included are often left to the regular classroom teacher who has little training in disability accommodations.

Responsive evaluation.

Responsive evaluation has emerged during the last decade as a means to gain greater insight into investigating concerns, issues, and consequences integral to the educational enterprise. In this type of evaluation the researcher/evaluator is a highly knowledgeable observer or someone with astute skills in collaboration, or both. The approach, although subject to criticism as being costly, time-consuming, and

lacking in explicit data, holds great promise for improving educational services for students with disabilities.

An important concern in responsive evaluation is working to understand the issue from the participants' perspective. This involves fieldwork. The researcher must physically go to the people, setting, and institution to observe behavior in its natural setting. The research strategies used are inductive. The researcher must build concepts, theories, hypotheses, and abstractions relating to the elements being studied. The researcher becomes the primary instrument for data collection, often using multiple data sources.

The researcher provides a descriptive account or portrayal of the situation being studied. This includes rich observations, coupled with the researcher's understanding of the complex relationships observed and their significance. Data collected may include field notes from observations; interviews; documents; records; interactions between students, teachers, administrators, and parents; anecdotal accounts; and verbal and non-verbal cues.

To be effective, responsive evaluation requires a staff commitment to participate in all phases of the study, participation by school leaders, and sufficient organizational stability to provide a support structure for the evaluation process. Technical assistance and staff support is needed to help in data entry, developing and refining questions and data collection instruments, summarizing data, and assisting with documentation.

Responsive evaluation is beneficial as a formative evaluation when program staff need help monitoring a program and improving its effectiveness. It is valuable as a summative evaluation to help audiences comprehend all program activities, their value, and the pursuit of improvement. The very lack of structure is what makes responsive evaluation appealing as it allows the researcher to adapt to unforeseen events and change direction in the pursuit of meaning (Merriam, 1998).

Addressing the needs of all students in a common educational setting is an emerging enterprise. Studies of students with disabilities indicate that segregated learning settings limit opportunities for students with disabilities regardless of the nature and severity of the disability. Because of its on-site observational basis, responsive evaluation can help generate the deep insights for improved practice in this important initiative.

Recommendations

While no one assessment tool is perfect, assessments that make connections between school tasks and tasks with skill applications for the real world can help students with disabilities. Educators must always keep the optimal goal in mind – to upgrade the learning of all students; to leave no child behind.

Educational evaluation may offer both great promises and great challenges if we are to make adjustments in the educational system to meet the learning needs of all students. The evaluation technique of ranking schools based on student performance gains is short-sighted and punitive towards many of the most hard-working professional educators. However, an emerging science in education evaluation has evolved that presents correlates of best practice for educational administrators and teachers. Implementing the knowledge base from this emerging field is critical if we are to improve schools. It has the potential to move education from a field which is largely intuitive and artistic to one which applies a scientific foundation.

Accountability through accreditation and state department review is minimally effective with a high likelihood that the review of program quality for students with disabilities will be minimal for students mainstreamed in science classes. Current cumbersome practices of reporting requirements for special education compliance are inhibiting the quality and amount of educational services for students with disabilities.

Several measures must be implemented to provide accurate evaluation data relating to the effectiveness of instruction on student learning:

1. The academic gains must be tied to each individual student. Group data does not tell

the story. Many of the schools marked by the lowest performance scores have highly mobile student populations. Often, over half of the students in a class at the end of the year were not there at the beginning of the year.

2. The evaluation data must be disaggregated for the variables that affect student performance. Comparisons must be made on like students. For example, one of the most significant correlates on student performance is parental and community support. Because of this, it is inappropriate to compare charter schools which require a contract of parent and student commitment to public schools with an established attendance area.

One example of the inequity in doing this is the KIPP Academy, a charter school in Houston, TX, highlighted during the 2000 Republican convention. Fifty students are selected for the school from a waiting list of 300. Students, parents, and teachers attending the 5-8 middle school must sign a contract pledging total commitment. Several hours of homework are assigned each night, school days start at 7:25 a.m., and students stay until 5:00 p.m. every day but Friday. Saturday and summer sessions are mandatory. Teachers are on-call 24 hours a day. KIPP pays a college student and school alumni to stay late at night so students can work at the school. KIPP may be the best little school in Texas, but it does not reflect the conditions offered to the students attending other Houston schools (McCafferty, 1999; Manno, et al., 1998).

3. A level playing field is needed. Students with disabilities must be proportionally distributed among all educational institutions. It is unacceptable for private or voucher schools to say we cannot accept this student because we cannot address his/her special physical accommodations or learning needs. As well, it is inequitable for a private school official to tell a student, "For some reason there is not a compatibility between your educational needs and the educational services we offer, therefore we are sending you to another school that may be more effective." Public school administrators should have equal opportunities to seek out the best school to serve the needs of a challenged student.

4. All aspects of educational performance must be presented. Evaluations tend to purport that educational quality can be reflected through a number. This places an overemphasis on basic skills, slighting science, social studies, and the expressive and practical arts.

5. Very serious attention should be given to equity of outcomes. If there is to be educational fairness across the United States, perhaps there should be a public commitment to level the playing field for all citizens at the age of 18. This will require a greater financial commitment to those schools in which student performance is substandard. More educational resources (i.e. smaller class sizes, stronger support services, extra hours for science and computer laboratory accessibility, extra hours for libraries and media services, extended student services, family and parental support, extended school years, summer programs, enrichment opportunities) would go a long way to support educators working in the most challenging conditions.

6. Measures of school climate should be reported with a vigor equal to that of academic outcomes. Diversity should be valued as the essence of equity. The values of respect, understanding, acceptance, appreciation, equal worth, mutual benefit, and belonging need to be made our most important educational priorities. All students should gain an understanding that disability is not a deficiency but a vital part of the diversity of the human community (Kunc, 2000).

7. The effectiveness of the educational program should be evaluated for the full spectrum of student diversity with an equal commitment to fully developing the learning

> potential for each student. The public needs to understand that tracking in any form detracts from educational opportunity; the victims are often marginalized groups such as minorities and students with disabilities. The public also needs to understand that many urban districts have abandoned the average student and students with disabilities through the creation of "academy high schools" for the academically talented and a marginalized substandard curriculum for all other students.

If school reform is to occur in the 21st century, the focus must be on administrator and teacher accountability. Recent efforts at educational reform have targeted students as the primary victims of accountability. The imposition of performance criteria for grade level advancement and graduation have increased the power of educators to make students responsible for learning. When learning does not occur at the desired level, it is unfair to assume that the student is solely to blame. Learning is a shared responsibility, the instruction must be appropriate for the learner and the learner must assume responsibility for learning. Improved student learning outcomes should be an artifact of accountability rather than the imposition of accountability. Good teachers accommodate instruction so that all students can have a successful learning experience if they use responsible learning behaviors. It is unfair to expect all students to perform equally or to meet a predetermined standard. All one can offer is the skills and ability that the person has. These should, and will, vary greatly.

When using assessments, educators must be careful when interpreting student scores. Poor instruction can occur in instances where all the students pass the competency examinations. This can result because of the innate abilities of the student, the capacity of the student to accommodate his/her learning to the material being taught, or community and parental support which overcome ineffective teaching practices. On the other hand, teachers may be working incredibly hard in conditions where there are few supports for student learning outside of the school, where students have significant experiential deficits, where there are limited supplies and resources, where the instructional materials contained in the curriculum are developmentally inappropriate for the learning level of the majority of students, and where there are community elements that interfere with the students' educational experiences.

The educational arena is rampant with excuses for poor evaluations. Teaching has always been a very independent profession, with little monitoring and oversight outside of the purview of management and control of the students. It is commonplace for a teacher to assume a teaching style, to prepare instructional materials for convenient delivery, and to retain the same teaching posture for many years. Assumptions are made that his/her teaching is appropriate and when a student doesn't learn it is because of apathy, lack of initiative, or something is wrong with the student. Students with disabilities are perceived as having a defect. Helping them has previously come under the responsibility of special education personnel or other clinical staff. It is not uncommon for secondary teachers in advanced science courses to perceive that they have a sorting responsibility. Statements such as, "Not everyone can be an engineer; we can't have bridges falling down" or "If I teach to the slow students my better students will not be prepared for their college or university classes" are commonplace. These concepts violate the basic premise of inclusive education for all students.

Marsha Saxton (1985) summarized the human degradation faced by so many students with disabilities, particularly those with physical impairments. She stated:

> All of those people trying so hard to help me. All of them hoping for me to do well, all wanting to be kind and useful, all feeling how important helping me was. Yet, they never asked me what I wanted for myself. They never asked me if I wanted their help….I do not feel entirely grateful. I feel, instead, a remote anger stored beneath my coping pattern of complacent understanding. People do the best when they can help in meaningful ways, I know. I just wish all students with disabilities would say to their helpers: "Before you do anything else, just listen to me."

Instructional leadership must encompass a strong commitment to instructional improvement. It cannot be piecemeal, consisting of two or three observations which go into an evaluation file or a board

report. Areas of improvement need to be identified, and then supports are needed to help teachers develop the skills. Surveys conducted in 1995 and 2000 indicated that few regular classroom teachers felt adequate in their knowledge about teaching science to students with disabilities and had little understanding of resources, adapted instructional materials, alternative laboratory tools, or alternative instructional strategies for meeting student needs. In an attempt to survey special education teachers about instruction in science, the response rate was very low (under 20%). Their knowledge and familiarity of resources was as lacking as the regular classroom teachers. In interviews, it was found that few special education teachers taught science and they seldom interacted with science teachers during instruction. They perceived their primary role as helping students with reading, assisting with assignments, and modifying and administering tests (Stefanich, et al., 2000).

A multitude of inventories for observing and evaluating teacher performance exist. However, all have their limitations and should be used several times with many interactions to accurately reflect a teacher's abilities. The evaluation must be context driven; the evaluator must be familiar with the students and the setting. Plus, the actions suggested from the evaluation should be supportive and include professional development opportunities to help teachers gain the competencies necessary to meet the needs of all of their students.

Evaluation is not a one-time process of collecting and assessing data. Rather, it is a continuing process that provides the foundation for all teaching and learning. Evaluation of teacher performance is very difficult because the public believes you are evaluating skills, competence, and function. Instead, it is an appraisal process focusing on counsel, advice, suggestions, and help with classroom demands.

Information collected in a teacher evaluation must not only be identified, but should also be quickly retrievable. Data must be collected so it provides longitudinal information that can be matched with other data and compared in multi-varied ways. The data must be accurate, credible, and have high utility. Equally important is the propriety of the teacher evaluation process: it must be done legally, ethically, and protect the rights of those involved.

Assessments of school administrators are also needed. There is clear and abundant evidence that the principal has a great influence on the climate and culture of a school. Yet, as with teachers, there is little oversight of administrators' performance after their initial employment. Instead, the primary evaluative criteria for adequate performance often relate to the political and technical functions of the principalship rather than to a principal's critical leadership role in the school improvement process and instructional leadership.

Too often we neglect to look at an administrator's leadership skills. Instead, the school becomes a political structure with an emphasis on maintaining convenience and comfort for the adults. The principal becomes more concerned with playing the party line, serving as a buffer to appease external challenges and supporting those perceived as loyal to the organization. The political functions and role become administrative: focusing on communication of school policies, supporting teachers, managing discipline, and maintaining fiscal accountability. Thus, the principal's critical role in the area of instructional leadership becomes secondary.

But, if schools are to undergo substantive improvement, leadership must come from the principal. The effective schools correlates identify instructional leadership as one of the most important qualities of the principalship. Administrative guidance is needed to focus the mission and goals towards meeting the educational needs of all students. Decisions regarding program structure and allocation of resources must be accountable and relate to improving student outcomes. These are the kinds of qualities and skills of a principal that need to be assessed on an ongoing basis, not just when the principal is first hired.

However, few principals have an understanding of their role as an instructional leader and receive little training in the skills needed for effective instructional leadership. Much of their education focuses on a managerial role, whereas effective instructional leadership is facilitative in nature.

Effective principals possess the knowledge and ability to describe and analyze instruction and learning outcomes. They can assess teacher performance and relate the assessment to the instructional context. They can relate teaching to the diversity of learning needs of the students and seek out

opportunities for professional development that are compatible with the school improvement process. They must be knowledgeable and current about research in teaching and learning.

Principals must be able to interact using a supportive approach to human resources. Their evaluation feedback to teachers should accomplish two major purposes: 1) provide reinforcement for practices which are working well, and 2) offer suggestions for remediation which will improve teacher performance. The arena of administrative and teacher accountability and evaluation brings forward one of the greatest challenges in school improvement: the ability to identify situations, conduct evaluations, and make judgments to improve the quality of the learning experiences students receive.

Another area of evaluation requiring attention is public oversight – both accreditation and compliance. Current accreditation procedures are criticized as being soft-headed and communicating a false sense of excellence in the midst of mediocrity.

Institutional accreditation tends to be broad and communicates little except that the educational institution meets acceptable standards of quality. Few institutions are willing to put forth the expense for more rigorous introspection by credible outside reviewers.

In fact, very often there is an inverse relationship between education quality and the depth and review undertaken by the school staff. High quality programs engage in a self-study process with considerable vigor. Site visitors are selected based on academic credibility, objectivity, and willingness to share deep insights. However, institutions with weaknesses are less likely to seek accreditation. If they do, site visitors might be selected who are not politically threatening (protectionist) and the self-study process may be shallow with limited outside participation in the number of reviewers and the amount of time devoted to the review.

Few outside reviewers possess the expertise to collect and summarize a substantial body of evaluative information in a short time span, and there is always a question of reliability where the conclusions are colored by the individual biases of the reviewer. The result of such an accreditation review is that a school can sustain its existence for decades without addressing major educational shortcomings.

However, even with such limitations as depth and reliability, the accountability of accreditation agencies offers great promise. Such agencies offer published standards, periodic self-study, external review by site visitors, and a review of the process by an accrediting body. When done well, such an accreditation can identify strengths and weaknesses, highlight what is good about a school, and enlighten the staff and consumers about future directions and needed resources.

On the other hand, program accountability for students with identified disabilities is generally monitored through detailed compliance policies from federal and state legislation. Some educators criticize this compliance because they say it involves too much paperwork requiring too much time, thereby depriving children of direct educational services to support their learning needs. Yet, some fear that without such monitoring, special education resources would be dissipated and educators would not provide needed attention to students with special needs.

Some perceive that many of the best special education teachers leave the field not because they're dissatisfied with their work with students, but because they have to divert so much of their attention to administrative tasks. Others perceive that less committed special education teachers can use administrative tasks as a means to spend less time with students, therefore diluting the educational services to the clients. With advances in technology, there may be opportunities to establish a better balance between instructional services to students while providing sufficient records to demonstrate compliance with regulations and policies.

Evaluation can be used to enlighten consumers and expose shortcomings. However, it will not correct problems. For instance, there is considerable evidence that many students with disabilities are not afforded equitable access to high quality science education. Equitable access is commensurate with seeking out and using available accommodative materials and supplies, using assistive technologies to enable greater participation, making laboratories accessible and modifying the environment to allow active student participation, employing multi-modality instructional techniques, and having a teacher willing to modify instruction to the unique learning needs of the student.

With all of the complexities regarding evaluation, it is important that advocates for equitable opportunities for students with disabilities lend their support to the process. Evaluation, when used appropriately, has great potential for improving educational practice. Since educational evaluation is a very immature science, the most effective and valuable applications are those specifically tailored to the needs of the client. Both the data and the context need to be considered. Either in isolation distorts the promise in providing educators with badly needed information that can be used to improve the process of education.

Evaluation data must be used with discretion. It must lead to improved services for all students, not as a toll to sort and marginalize students with disabilities. The evaluation process must be flexible and redirected to serve the needs of all students in our schools. Creating a culture that provides appropriate opportunity for each student and enlists responsibility from that student is the essence of education.

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Chapter 7
Best Practice: Curricular and Instructional Adaptations for Special Needs Students in the General Education Setting

Kelly Bohning & Greg Stefanich

Special education students are present in most general education settings, so educators today need the skills to teach students with diverse learning needs. This often presents a challenge for teachers as they strive to create adaptations to meet the learning needs of *all* students. The research focus of this chapter is to help general education teachers assess when and what kinds of curricular and instructional adaptations to make for students in the general education.

This chapter links curricular and instructional adaptations to the research on effective schools. Steps for setting up an inclusive science classroom are presented. Various adaptations in the science classroom are discussed. The findings of this research report indicate that there are a variety of instances where it is appropriate for teachers to make adaptations for students in the general education setting. Teachers can follow certain processes to help determine when these adaptations should be made, as well as choose from a menu of adaptation types.

This chapter addresses five questions in adapting curriculum and instruction for students with diverse learning needs.

1. What does the effective schools research say about curricular and instructional adaptations?
2. When do general classroom teachers need to make adaptations for students?
3. What types of adaptations do these teachers need to implement to meet the needs of diverse learners in the general education setting?
4. What are teacher attributes that create an effective inclusive science classroom?
5. What specific adaptations can be made for students in an inclusive science classroom?

When Do Adaptations Need to be Made?

Students in our schools are educated in inclusive settings now more than ever before. With the reauthorization of the Individuals with Disabilities Education Act (IDEA) in 1997, many general educators now need to make adaptations for students with special learning needs in the general education setting. General and special educators must work collaboratively to design these adaptations. However, teachers also need to make adaptations for students who are at-risk or who have diverse learning needs. These students may not be served in a special education program, yet teachers are also faced with making adaptations for these students.

Teachers in the general education setting are expected to implement both curricular and instructional adaptations in an effort to meet the needs of diverse learners. Two definitions of adaptations are addressed in this chapter. Curricular adaptations are defined as: any adjustments or modifications in learning expectations, curriculum, content, the environment, instruction, or materials used for learning that enhance a person's performance or allow at least partial participation in an activity (Baumgart et al., 1982; Udvari-Solner, 1992). Deschenes, Ebling, and Sprague (1994) defined instructional adaptations as: "The practice of changing the manner in which instruction is delivered in order to meet the needs of individual students including grouping strategies, formats for evaluation, and methods of presenting lessons " (p. 7).

Effective Schools Research and Adaptations

The research on effective schools can be linked to making curricular and instructional adaptations for students. Mauer (1996) stated:

> An effective inclusive school is a diverse, problem-solving organization with a common mission that emphasizes learning for all students. It employs and supports teachers and other staff members who are committed to working together to create and maintain a climate conducive to learning. The responsibility for all students is shared. An effective inclusive school acknowledges that such a commitment requires administrative leadership, ongoing technical assistance, and long-term professional development. (p.1)

The research on effective schools has generated a list of correlates that exist in these schools. Salivone and Rauhauser (1988) cited the following correlates of effective schools:

- Clear school mission
- Instructional leadership
- Safe and orderly environment
- High expectations
- Home-school relations
- Monitoring student progress
- Opportunity to learn and time on learning

Teacher Attributes in Effective Schools

Stefanich (1983) indicated that some characteristics of effective schools are directly related to the classroom teacher. These characteristics can also be linked to teachers who effectively adapt curriculum and instruction to meet the diverse learning needs of students in inclusive settings. Teachers in inclusive classrooms strive to create a sense of community and belonging. Creating this type of an environment is an essential element of effective schools (Salivone & Rauhauser, 1988).

The attributes of teachers in effective schools, as summarized by Stefanich (1983), are:

- Maintain a clear focus on academic goals;
- Select instructional goals;
- Perceive the students as able learners;
- Implement an evaluation system based on individual student learning, rather than on a comparison with other students' achievements;
- Accurately diagnose student learning needs to foster high student achievement;
- Prepare lessons (including adaptations) in advance;
- Meet students' needs in both academic achievement and socialization;
- Be readily available to consult with students about issues and problems;
- Attend staff development courses to continue your professional development; and
- Keep parents informed and involved.

Effective schools create instruction that meets the individual needs of all students, including those with special needs (Weber, 1971). Stellar (1988) indicated that in an effective school, a climate exists where all children can learn. Providing curriculum and instructional adaptations is a valid way for teachers to effectively reach all students. Squires, Huitt, and Segars (1983) stated:

> Our review of the research on effective classrooms indicates that teachers can have an impact on student behaviors and student achievement. And teachers do that by planning, managing, and instructing in ways that keep students involved and successfully covering appropriate content. (p. 15)

Teachers often need to make curricular and instructional adaptations in their efforts to keep students actively engaged in content that is rich with meaningful lessons. School improvement endeavors which center around the effective schools research are based on the notion that all students, including those with special needs, can learn (National Council on Disability Report, 1989). General education teachers need to know when to make adaptations in curriculum and instruction in order to meet the needs of diverse learners in inclusive settings.

In many instances it is appropriate and necessary for teachers to make curricular and instructional adaptations for students. However, when teachers are making decisions regarding instruction, the effective school correlate of high expectations for all students should be remembered. This includes having high expectations for students with disabilities (Scruggs, Mastropieri, & Sullivan, 1994).

Adaptations are often needed if special education students are to receive appropriate instruction in the content areas. In fact, Stainback, Stainback, and Stefanich (1996) reported that learning core subjects such as social studies, science, and math with peers is beneficial in the long-term for students with disabilities, including those with severe disabilities.

Effective classroom teachers provide opportunities for all students to participate in a wide variety of content-related lessons (Stellar, 1988). In inclusive settings, instruction can be adapted to ensure the academic success of all students (Smith, Polloway, Patton, & Dowdy, 1998). So, when the course content is relevant and meaningful to students with disabilities, curricular and instructional adaptations should be made to facilitate learning. But to do this in content areas, such as science, a match needs to exist between the student's abilities and learning style and the curriculum and instructional methodologies. Stainback et al. (1996) stated: "Some students exhibit learned helplessness when there is not a good match between learning objectives and student attributes " (p. 14). In these cases, it is important for that match to exist, and making adaptations for students is one way to create that match. Salisbury et al. (1994) noted:

> The reality of today's society is that each child, on any given day, can be a child with special needs. It is therefore important that schools tailor curriculum and instructional practices to fit the diversity of students' needs and abilities represented in their classrooms. Adapting the "standard" to fit those who may not fall within expected margins is a necessary strategy for effective teaching and learning, one that enhances the likelihood that all children will feel like they belong and feel successful. (p. 311)

Some research has generated questions about serving mildly disabled students via pull-out programs because of their limited growth abilities (Epps & Tindall, 1987; Idol-Maestas, 1983; Leinhardt, Bickle, & Pallay, 1982; Polloway, 1984). Other research has indicated that providing adaptations within the general education classroom instead of pull-out programs may prove to be more effective (Baker & Zigmond, 1990). Current research on effective schools and effective classroom practices supports the integration of special education students into general education classes (National Council on Disability Report, 1989). As special education students are more fully included in general education classes, teachers will be required to determine when adaptations are warranted to meet each individual student's learning needs.

Determining When to Make Adaptations

Using individual assessment data is one way for teachers to determine when adaptations are needed. When diagnostic assessment occurs, research has shown the students learn significantly more (Fuchs, Fuchs, Hamlett, & Ferguson, 1992). When making adaptations, the needs of the student should drive the process, not the student's label or the specific curriculum standard (Cousin & Duncan, 1997).

There is such a great difference in students' learning styles and needs that teachers must carefully examine the instructional requirements of individual students and the variety of instructional methodologies when designing lesson adaptations (Mercer, Lane, Jordan, Allsopp, & Eisele, 1996).

Special and general educators can work collaboratively on making adaptations, using the student's Individual Education Plan (IEP) as a framework and reference (Golomb & Hammeken, 1996). Myles and Simpson (1989) found that adaptations are most successful when general education teachers are involved in making decisions about designing and implementing the adaptations for students with disabilities. General educators teach students with a wide variety of abilities and background in inclusive settings. For the special education students often included in general ed classrooms for content instruction, the teacher needs to adapt both instructional methods and curriculum (Schumm & Vaughn, 1991).

If teachers are given structures and supports for implementing adaptations, they will use them effectively in the general education classroom (Fuchs, Fuchs, Hamlett, Phillips, & Karns, 1995). Scott, Vitale, and Masten (1998) also reported that when these support systems are in place, teachers will make the necessary adaptations for students. Staff development courses can offer supports for teachers in their efforts to design effective adaptations for students. However, instructional leadership from administrators and special educators is needed to secure staff development opportunities for teachers to learn about effective teaching practices and how to make adaptations for students with special needs. The need for instructional leadership can be linked with the research on effective schools (Salivone & Rauhauser, 1988).

Udvari-Solner (1996) found that when teachers decide what adaptations need to be implemented, they engage in a personal, reflective dialog with self-questioning. This leads to these same questions being posed when they meet in a group setting with other educators and parents. Parents often desire the opportunity to work collaboratively with teachers when determining appropriate adaptations for their children (The National Council on Disability, 1989). This collaboration can foster positive relations between home and school, one of the effective school correlates (Salivone and Rauhauser, 1988).

Udvari-Solner (1996) stated:

> Using questions as a heuristic structure best depicts the personal scrutiny and internal dialog engaged in by teachers. A question-oriented approach also promotes joint inquiry, which in turn invites dialog among team members. (p. 247)

Udvari-Solner (1996) suggested that when teachers use this process of asking questions as a structure to determine when adaptations should be made, it produced the framework for best changing how lessons are developed, structured, and implemented. These questions are summarized below:

1. Can the student actively participate in the lesson without any adaptations and achieve the same outcome?
2. Will student-specific learning objectives need to be written?
3. Can the student's participation level increase by altering the modality of instruction?
4. Can the student's participation level be increased by altering the structure of the lesson?
5. Can the student's participation and comprehension be increased by altering the instructional methods or teaching styles?
6. Can the physical environment be altered to help facilitate participation?
7. Will the student need individual help to ensure participation?

8. Will an alternative activity need to be implemented?

Teachers may choose to implement a more structured process when determining whether adaptations are necessary for student success. Winter (1997) developed a process for implementing adaptations entitled SMART. SMART is an acronym for Select, Match, Adapt, Relevant, and Test, the five central planning elements used to determine the adaptations needed. These five elements can be used in isolation or together. In this process, teachers compare curricular content with student learning styles and capabilities and then make appropriate selections. The selection of curriculum and instructional approaches should be flexible and create a setting that is suitable for various learning styles and capabilities.

Another element in Winter's process is to match the student's educational opportunities with the student's strengths, not his or her weaknesses. Yet another component of the SMART structure asks teachers to determine any appropriate adaptations for the student. The goal is for teachers to focus on a student's capabilities instead of his or her disabilities when making adaptations (Deschenes et al. 1994). The final element of Winter's process is testing. Teachers need to develop testing measures that test the whole child, not isolated skills and concepts. When making adaptations for testing tools, teachers can implement alternative assessment techniques. Such assessments are tailored for students who may need to document progress over time (Winter, 1997).

Following a structured process such as SMART could benefit teachers who are determining when to make adaptions for students in the general education setting. When teachers determine if adaptations should be made, the goals of the adaptations need to be considered. Curriculum adaptations should achieve two main goals: to promote positive student outcomes, and to optimize the physical, social, and instructional inclusion of the student in ongoing classroom lessons and activities (Salisbury et al., 1994).

What Types of Adaptations Can Teachers Make?

Many types of adaptations can be implemented in the general education setting, although general education teachers tend to implement routine adaptations such as varying materials or adjusting groups (Fuchs et al., 1995). Adaptations made in the general education setting often include four main categories: time, learning styles and instructional delivery, environment, and adjustments in content (Murphy, Meyers, Oelson, McKean, & Custer, 1995).

Teachers in effective schools where students consistently achieve, adapt instruction to meet students' individual needs (Spartz, 1977). In two effective schools in Pittsburgh, Sizemore, Brossard, and Harrigan (1983) found that teachers actively made adaptations in printed materials such as basal readers and their corresponding assessments. Yessledyke and Algozzine (1990) found that one way teachers adapt instruction is to use specific strategies such as peer tutoring, cooperative learning, behavior management systems, and technology. Class-wide peer tutoring provides each student with chances to work at his or her own instructional level, work as a tutor and tutee, communicate with students with various skill and ability levels, and be engaged in arrangements that center around a collective performance (Delquadrie, Greenwood, Stretton, & Hall, 1983).

Another instructional adaptation is the use of advanced organizers. The use of such specific adaptations can be especially beneficial for students with disabilities. In a study of teachers, King-Sears and Cummons (1996) found that when the teachers used advanced organizers at the beginning of the day and at the beginning of lessons to show the sequence and flow of content, students with learning disabilities had fewer questions than when the organizers were not used. The organizers were on the board and often had picture icons to correspond with the text.

Curricular adaptations are often varied according to the content and grade level expectations. They can be designed for groups of students and for individual students. Booth and Ainscow (1998) suggested that one type of curricular adaptation is allowing students to participate in setting their own learning and social objectives combined with the teachers' objectives in the same areas. The students can then evaluate their progress on their goals as well as the teacher's goals. However, Stainback et al.

(1996) suggested that writing separate or varying learning outcomes for one student or small groups of students can foster a sense of isolation and separateness in the general education setting.

Scott, Vitale, & Masten (1998) presented eight types of adaptations:

1. Modifying instruction. This includes classroom demonstrations, adjusting lesson pace, and instructor employing multiple instructional modalities.

2. Modifying assignments. This includes providing models, shortening assignments, and lowering difficulty levels.

3. Teaching learning strategies. This includes teaching study skills, test-taking skills, and learning strategies.

4. Altering instructional materials. This includes providing alternate materials, taping books, and reformatting worksheets.

5. Varying instructional grouping. This includes the use of peer tutoring and cooperative groups.

6. Enhancing behavior. This includes praise, behavior contracts, and reward systems.

7. Altering curriculum. This includes lowering the content difficulty.

8. Facilitating progress monitoring. This includes reading tests orally, providing study guides, retaking tests, and modifying grading criteria.

Teachers in effective inclusive classrooms may use one or a combination of several of these adaptation types to meet the needs of diverse learners in the content areas.

Classroom teachers should choose adaptations that allow students to remain actively engaged and participating in the lesson and any corresponding activities whenever possible. Deschenes et al. (1994) provided a model of nine types of adaptations summarized below:

1. Size: Adapt the number of items that the student is expected to complete.

2. Time: Adapt the time allowed for learning, task completion, or assessment.

3. Level of Support: Increase the amount of individualized assistance for the student.

4. Input: Adapt the method of instructional delivery.

5. Difficulty: Adapt the problem or skill levels, or the rules on how the student can do the work.

6. Output: Adapt how the student can respond to the instruction.

7. Participation: Adapt the level of student involvement in the task.

8. Alternate goals: Adapt the goals or objectives, while using the same materials.

9. Substitute Curriculum: Provide different instruction and materials to meet the student's individual goals.

While general education teachers do implement a wide variety of adaptations to meet student needs, they do not always find that all types of adaptations are as readily implemented as others. Adaptations rated most feasible in a study by Johnson and Pugach (1990) centered around using positive

methods and multi-sensory techniques which were readily integrated into daily classroom routines. Adaptations less favorably rated involved dealing with students individually. Yesseldyke, Thurlow, Wotruba, and Nania (1990) found that teachers rated the following methods of desirable classroom adaptations: identifying alternate ways to manage student behavior, implementing alternative instructional methodologies, using a variety of instructional materials, and using alternative grouping practices.

Teachers use typical adaptations more frequently than substantial adaptations. Typical adaptations include altering the format of directions, assignments, or testing procedures. Substantial adaptations include changing the difficulty level for students, such as: implementing altered objectives, assigning less complex work, and providing texts with lower readability levels (Munson,1986). This research suggested that even though there are a wide variety of adaptation types, teachers will implement the types they are comfortable with and understand. Teachers in effective schools feel that they have the instructional freedom to alter instruction and assignments to meet the individual needs of their students (Jackson, Logsdon, & Taylor, 1983). When teachers understand typical and substantial adaptations and believe that they have the freedom to make such adaptations, students in inclusive settings benefit.

Creating an Inclusive Science Classroom

General educators can successfully adapt curriculum and instruction in all subject areas and science is no exception. Adapting science curriculum and instruction provides special needs students with rich experiences that they may not receive in traditional settings. However, due to the limited science background of many general educators, adapting curriculum in this content area can present special challenges. According to Scruggs and Mastropieri (1994), classroom teachers can successfully include students with disabilities in science when the following are present :

- Administrative support
- Support from special educators
- An accepting classroom atmosphere
- Effective teaching skills
- Student-to-student peer assistance, and
- Disability-specific teaching skills.

Science is conducive to inclusion, as it has a strong base of research supporting the value of hands-on multi-modality instruction as a superior form of instructional delivery.

Teaching science in an inclusive setting is one way for students with special needs to receive quality science instruction. Special education students often miss science instruction when they are pulled out to receive special education services. Often when these students do receive science instruction, it is from special educators who have little, if any, training in science instruction (Gurganus, Janas, & Schmitt, 1995).

When special needs students are included for science instruction, the most commonly used approach is the content approach (Scruggs & Mastropieri, 1993). In this approach, textbooks are the primary source of curriculum and instruction. A contrasting approach is the activity-oriented approach. The teacher may still employ direct instruction, however, students are being actively engaged in the exploration of science concepts (Scruggs & Mastropieri, 1993). In the activity-oriented approach, the use of the textbook and the need for acquisition of new vocabulary is significantly decreased. Students can apply the processes of science: observation, classification, measurement, comparison, predictions, and making inferences. Activity-oriented approaches to science that address fewer topics, but those are covered in-depth, can be especially beneficial for students with special needs (Patton, 1995). Both content and activity-oriented approaches can be adapted and modified to meet the diverse learning needs of students.

Teachers want all students to be successful in their science classroom. This success can also be achieved in an inclusive science classroom. When creating an inclusive science classroom, Patton (1995) suggested the following guiding principles:

- Science lessons should be hands-on;
- Teachers should be facilitators of knowledge, rather than dispensers of knowledge;
- Cooperative groups should be implemented;
- Teachers need to make curricular and instructional adaptations;
- Utilize theme-based instruction;
- Capitalize on "teachable" moments; and
- Encourage students to engage in problem-solving exercises.

When teachers apply these principles to create an atmosphere where all students belong and are engaged in quality teaching techniques, students will be successful in inclusive science settings. Like Patton, other researchers have strategies for creating a successful inclusive science setting. Mastropieri and Scruggs (1995) suggested the following four strategies for creating inclusive science classrooms:

1. Choose appropriate curriculum. Usually activity-oriented science materials are more conducive to inclusive science classrooms. They use far less vocabulary, less independent reading, less paper-pencil work, and allocate more time for manipulation of examples of the concepts being taught.

2. Use effective instructional strategies. Teachers can implement the effective teaching strategies known as "SCREAM." This is an acronym for structure, clarity, redundancy, enthusiasm, appropriate pace, and maximized engagement. Teachers can also use strategies such as cooperative groups, mnemonics (for vocabulary acquisition), and student self-monitoring to create an inclusive science environment.

3. Adapt specific science activities. When choosing activities and lessons, teachers must evaluate them in relationship to the students in their class. Providing adapted materials, lesson delivery, and activities is necessary when creating an atmosphere where all children can learn, participate, and feel a sense of belonging.

4. Use effective assessment strategies. Implementing performance assessment instead of paper-pencil tests often provides a more viable option for students with disabilities. Performance-based assessment can be directly linked to the scientific processes. This type of assessment allows students to demonstrate the skills and knowledge they have acquired during instruction.

Creating an inclusive science classroom is a balance of designing an accepting environment, implementing effective instruction techniques, and adapting curriculum, materials, and instruction. Inclusive science classrooms are important for students. Patton (1995) stated:

> As professionals interested in preparing students for the challenges of adulthood, we must ensure that all students - both with and without special needs- receive meaningful and relevant science education. If science is important in many aspects of our lives, then science education must cover the topics that have a significant impact on our personal, family, workplace and community needs. (p. 4)

Adaptations in the Science Classroom

When special needs students are included in general education settings, adaptations often need to be made to meet individual student needs. The inclusive science classroom is no exception. Patton (1995) and Mastropieri and Scruggs (1995) indicated that one of the steps in creating an inclusive science classroom is the need to make adaptations to curriculum, instruction, and materials. One major adaptation that can be implemented to achieve a successful inclusive science setting, according to Mastropieri and Scruggs (1992), is to shift to an activity-oriented science program from a content-centered curriculum. However, this is not always an alternative. Content-centered approaches can also be adapted to meet students' individual learning needs. Adaptations for both approaches are key to the success of inclusive science classrooms.

Designing and implementing curricular and instructional adaptations in the science classroom are similar to those in other content areas. However, science adaptations can sometimes pose special challenges due to the nature of experiments and the materials used. Teachers must plan lesson adaptations in advance and anticipate difficulties that students may encounter with the materials needed or the science activity. Scruggs and Mastropieri (1992) recommended the following adaptations for the inclusive science classroom:

1. Vocabulary: Simplify language, preteach vocabulary, use mnemonics, use picture clues, implement peer tutoring, and evaluate which vocabulary is essential.

2. Instructional Delivery: Modify rate and how material is presented, include visual organizers, present concrete examples, preteach prerequisite information, provide additional application activities, use a variety of instructional strategies, provide advanced organizers, use cooperative learning groups, integrate other content areas into science, shorten lessons, and provide structure.

3. Text: Provide graphic organizers and framed outlines, highlight important vocabulary and key concepts, implement partner reading, provide tape recorded readings of text selections, and use trade books at various reading levels.

4. Materials: Provide multi-textured materials, concrete models, materials that are easily manipulated and large enough for small hands, materials that can be taken apart and reassembled, manipulatives for linear measurement, and materials that can be felt or heard when solutions are stirred or shaken.

5. Assessment: Provide authentic and performance-based assessment that can be easily linked to scientific processes, allow for multiple opportunities to demonstrate acquired knowledge and skills, implement portfolio assessment, teach test-taking skills and study techniques.

Adapting science instruction to meet the needs of special education students is not always an easy task. It does, however, provide students with the opportunity to experience science in a content-rich environment. When teachers make adaptations in curriculum, instruction, and materials in the inclusive science classroom, students with special needs can interact with their peers and receive quality science instruction. Utilizing the adaptations outlined by Scruggs and Mastropieri (1992) may not only benefit students with special needs, but may also enhance instruction for all students in the science classroom.

Summary and Conclusion

Teachers need to make adaptations when students are not successfully meeting the demands of the general education setting. Teachers must make adaptations when the learning style or skills of a student do not match the instructional delivery or content objectives (Stainback et al., 1996). When pull-out programs are not meeting the needs of the students, teachers should make carefully designed adaptations in the general education setting. Teachers can ask themselves a series of questions to determine when

adaptations should be made (Udvari-Solner, 1996). Educators may choose to implement portions or all of a process similar to SMART to determine when adaptations should be made (Winter, 1997).

Teachers can implement numerous types of adaptations to help ensure the success of their students. Consulting a list of adaptation types, such as those from Deschenes et al. (1994) or Scott et al. (1998), can help when teachers determine what types of adaptations are appropriate. When teachers feel that the types of adaptations are feasible and desirable, they will use them (Johnson & Puchgach, 1990; Yesseldyke et al., 1990). Teachers in effective schools exhibit a willingness to make adaptations in assignments and instructional delivery to meet the individual learning needs of their students (Weber, 1971). Students with special needs can benefit when adaptations are made in the science classroom. Inclusive science classrooms provide rich learning environments for all students. Inclusive classrooms of all kinds provide teachers with the opportunity to design and implement both curricular and instructional adaptations. These adaptations can positively impact student learning. In inclusive settings, where adaptations are made, all children can learn, feel a sense of belonging, and achieve their educational and social goals.

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Chapter 8
The Cascade Model For Managing Students With Disabilities In Science Classrooms

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IDEA SEC 614 (Individuals with Disabilities Education Act) legislates that placement of students with disabilities in regular classrooms is mandatory unless it is specified that the general curriculum is not appropriate. Regular classroom teachers must be a part of a student's Individual Education Plan (IEP) and evaluation measures must take into account the goals and objectives of the regular curriculum.

Increasing numbers of students with disabilities have made the science teacher's responsibility of managing the classroom far more challenging than it used to be. Over 6 million students are identified with special needs in our nation's schools with more than 70% representing the least severe impairments for which pull-out programs are a disservice to their educational needs. A science teacher must work to build truly inclusive classrooms where children work and learn together. Students with disabilities must not just be tolerated, they should be valued and respected. That means the science teacher must create a caring, positive learning environment by modeling sensitivity to differences and using a variety of instructional approaches and interaction styles. The question is not whether to teach students with disabilities, but how to teach them.

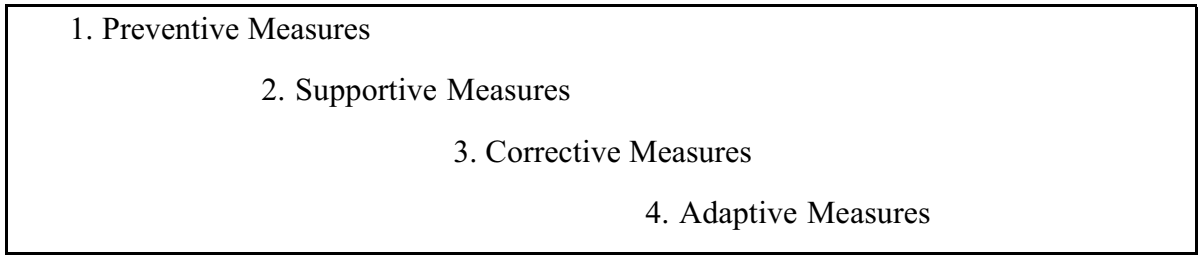
Criticisms of ability grouping and tracking have resulted in more academically heterogeneous classrooms. Efforts have been made to address the needs of children with disabilities in the regular education context. One such effort is The Cascade Model that stresses the need to create a positive learning environment in which all students are respected and have opportunities to learn.

The proactive and reactive teaching practices described in The Cascade Model are appropriate for all teachers, including science teachers who have students with disabilities in their classrooms. This chapter relates the four steps of The Cascade Model to science teaching and reviews the underlying principles of the discipline plan. Then it emphasizes procedures a teacher should follow to help students with disabilities successfully learn science with their non-disabled peers.

The Cascade Model = A Dynamic Approach

The Cascade Model can be likened to a journey in a raft moving down a cascading stream (the K-12 curriculum) to the sea (entrance to adulthood). The group about to take the classroom journey are the students and their science teacher. Just as there are four important aspects to consider in taking a raft trip, so there are four main steps to this model (see Figure 13.)

Figure 13 – STEPS IN THE CASCADE MODEL



Step One – Preventive Measures

Before a raft journey begins, it's important for the guide to plan ahead and prepare for it. Preparation includes becoming familiar with the territory and the route to be traveled as well as collecting and arranging for adequate equipment and supplies, planning a schedule, informing the raft participants of the plans and expectations, plus working out the "minor details." These preparations will prevent many unnecessary complications and make for a nicer trip.

Similarly, the first step of The Cascade Model is "Preventive Measures." During this phase, the science teacher must plan and prepare to prevent discipline problems from occurring. He/she arranges the learning environment, decides on materials and strategies appropriate to students' needs and abilities, and plans schedules and routines. Then the routines, expectations, and lesson information are clearly communicated to students. Advanced preparation and clear communication can prevent many problems from occurring.

Step Two – Supportive Measures

Once everyone is situated in the raft and the raft is moving in the water, the guide tries to help everyone choose to follow the specified behaviors. The guide acknowledges the productive efforts of the participants in order to maintain and increase the desired behaviors.

Likewise, the need to recognize and support students who demonstrate positive behaviors carries over to the science classroom. The second phase of The Cascade Model is "Supportive Measures." During this phase it is important that the science teacher becomes a vibrant figure in the classroom, one who is in close contact with the students throughout the school day and into the extended day when it is reasonable. A teacher can use questions and various types of rewards to recognize positive behaviors and express a genuine interest in the students' personal growth and development. When students feel that their needs and efforts are acknowledged, desired behaviors toward self-discipline will increase.

Step Three – Corrective Measures

Sometimes, regardless of the preparations and proactive measures taken, "Corrective Measures" must be taken to minimize or patch the damage and get the raft on course again. These reactive measures may include assessing the situation at hand, slowing down or backing up, speeding ahead, and in some cases, redefining the original planned route.

In the same manner, the third step of The Cascade Model, "Corrective Measures," emphasizes the need to sometimes react to correct inappropriate behaviors. Some students need defined limits of behaviors that include explicit rules and consequences. Each science teacher should have the skill and power to stop misbehaviors when they occur. Clarity is critical, and consequences should be consistently applied. The teacher's action to stop disruptive behavior should be at the lowest level of intervention possible, while at the same time making an effort to sustain classroom learning.

Step Four – Adaptive Measures

A final aspect to consider when planning a raft journey is to have definite procedures for emergency situations. What should be done when a participant leaves the raft (for whatever reason) and lands in the stream? If so, what kind of a lifeline or procedure should be followed to assure the safety of the overboard person as well as the other participants on board? The guide has to adapt to the situation and follow a procedure that will help ensure the safety and welfare of the participants.

The final level of The Cascade Model, "Adaptive Discipline," relates to situations in which a student does not (for whatever reasons) function within the defined limits of the science classroom. The rights of the students are considered and positive negotiations, such as conferences and contracts, may be implemented. But sometimes the teacher needs the power to remove a source of conflict which interferes with the delivery of positive learning experiences for those who are attending school to learn.

Just as the flow of a cascading stream changes with various conditions, The Cascade Model looks at an effective discipline plan along a continuum, with each science teacher and each classroom requiring adaptations which best fit the needs of the students and teacher at a specific place and point in time. The model ascribes to the view that a discipline plan must be dynamic, reflect the human condition, and continually adapt to the environment. The underlying principles of The Cascade Model are summarized in Figure 14.

Figure 14

UNDERLYING MANAGEMENT PRINCIPLES
(from The Cascade Model: A Dynamic Approach to Classroom Discipline, Stefanich, 1987)

I. PRINCIPLES OF STUDENTS
- A. Students don't have an innate awareness of what adults consider to be appropriate conduct.
- B. Students are hungry for human contact.
- C. Students should have a say in the management system.

II. PRINCIPLES OF TEACHERS & TEACHING
- A. Teachers are models for students
- B. Variety is appropriate and desirable.
- C. Equal is not always fair.
- D. Consistency is important to relationships. It's difficult getting people to do something they don't wish to do.
- E. Good teaching reduces discipline problems.

III. PRINCIPLES OF DISCIPLINE
- A. Schools should mirror cultural realities.
- B. Discipline is not a disease with a cure.
- C. A discipline plan is not always good because it works.
- D. Effective discipline requires high, but reasonable expectations for all.
- E. Effective discipline elicits student responsibility.
- F. Effective discipline isn't static.

Planning for Success

It is not unusual for regular classroom teachers to feel they lack the professional preparation necessary to help students with disabilities (Semmel, Abernathy, Butera, & Lesar, 1991), but often the teaching behaviors associated with outstanding achievement gains for students with disabilities are similar to the behaviors effective with all students (Slavin, 1989). The underlying principles of The Cascade Model are appropriate for teaching science to all students. Yet because the model is dynamic and reflects the human condition, there are some procedures a science teacher should follow when working with students with disabilities.

Fine Tune Your Language

Within past years there has been some debate over the most appropriate expressions to use when referring to students with disabilities. Education terminology has been greatly influenced by physicians and psychologists who use terms such as "physically handicapped," "mentally retarded," and "emotionally disturbed." These expressions represent a "medical" model and are used by professionals who tend to view problems as existing within the person (Borich & Tombari, 1997). The first major piece of

education law, PL 94-142, used such terms and was named the Education for All Handicapped Children Act of 1975 (EAHCA).

More recently, many advocates of learners with disabilities believe that classifications encourage stereotypic thinking and may stigmatize learners (Wang, Walberg, & Reynolds, 1992). In 1990, amendments to PL 94-142 renamed it the Individuals with Disabilities Education Act (IDEA). The phrase "handicapped children" was changed to "children with disabilities," and other phrases like "learners with developmental delays" and "children with attention-deficit disorder" were used. Using such phrases was to enhance the image of children with disabilities and affirm that they are "people first, who incidentally have certain physical, cognitive, or emotional characteristics" (Borich & Tambari, 1997, p. 475).

To enhance the image of children in the science classroom, the teacher must refine his/her language. Most students, including those with disabilities, think of themselves as "normal," so when referring to the fact that a student is not disabled, the term "non-disabled" (rather than "normal") should be used. The majority of students with disabilities experience no more sickness than other students, so they are not "patients" who need "sympathy." Students with disabilities need acceptance and respect for their abilities and talents, and the terms "brave," "inspirational," and "courageous" should be used only when appropriate (AAAS, 1991a). The science teacher should emphasize the students (rather than the disabilities) and carefully choose words with nonjudgmental connotations.

Mostakas (1967) stated that, at an early age, children are taught to perceive in a certain way; not in their way, but in the way adults perceive things. Compliant children learn through repetitive conditioning that the adult, who possesses authority, perceives correctly (Kamii as cited in Martin, 1997). Gradually, individuals begin to act in standard ways without being aware of conforming; they begin to base their reasoning on the standards and expectations of others.

Non-compliant children learn, through repetitive punishment, that they do not belong. They often become agents of disruption both individually and through interactions with peers who have similar signature feelings. The role of the school becomes clear – to stamp out the inappropriate behaviors and to bring the students into compliance. However, both the teachers and the students learn that teachers and administrators have neither the power nor the authority to carry out their threats.

Therefore, schools often become battlegrounds with the non-conforming students pitted against powerless authorities, each manipulating the ineffective weapons in their arsenal. One group challenges the system and the other group seeks ways to suppress the challenges to the institutional mores. The school becomes not an institution of learning, but an institution of conditioning to the mores and beliefs of the adults who make up the staff and administration of the school. Laotzu (cited in Bynner, 1944) characterized the degeneration of independent thinking in the following poem:

> Losing the way of life, men rely first on their fitness;
> Losing fitness, they turn to kindness;
> Losing kindness, they turn to justness;
> Losing justness, they turn to convention.
> Conventions are reality and honesty gone to waste,
> They are the entrances of disorder.
> False teachers of life use flowery words,
> And start nonsense.
> The man of stamina stays with the root
> Below the tapering,
> Stays with the fruit,
> Beyond the flowering;
> He has his no and he has his yes.

Students must learn to develop confidence in their ability to reason through logical relationships. Rowe (1973, P. 278-302), in her discussion of fate control, iterated the importance of instilling in children a belief in their ability to conceptualize based on their own skill and ingenuity. This, in turn,

implied that students need experiences in which they will have a reasonably good chance of developing a logical understanding.

Plan a Pre-Course Visit

Before the school year or semester begins, the science teacher should consult privately with a student who may need some accommodations. Privacy is important because the student may find it difficult to tell the teacher about his/her limitations and may feel embarrassed about requesting an adaptation. The student can learn what accommodations are available and find out more about the teacher and science activities that will be expected. In addition, a visit to the science classroom before classes begin can enable a student with a visual impairment to explore the lab and learn the locations of furniture, materials, and equipment. For a person in a wheelchair or with a physical impairment, concerns relating to trafficking, materials access, and materials handling can be addressed before they become problems during class or after school starts, when it becomes much more disruptive and difficult to make accommodations.

A teacher should not make preliminary assumptions about a student with a disability because not all students with disabilities need adaptations. Adaptations vary from person to person, and the best way to learn about an individual is to meet and consult with him/her about possible adaptations. A pre-course visit helps the student with a disability know that the teacher is concerned, and it benefits the teacher by learning about the disability and getting an early start on any lesson plan modifications that should be made (Weld, 1990).

In some instances, a student with a disability may not wish to identify him/herself as such. For various reasons, a person may try to hide the disability. It may be helpful for the science teacher to make an announcement at the beginning of the term inviting students with special needs to set up a private meeting. Although it is the student's responsibility to initiate a discussion, if a disability is apparent the teacher may consider bringing up the topic (AAAS, 1991c). But the teacher must remember that some students with disabilities may not wish or need any special accommodations.

Adapt the Environment and Materials

The design of the science laboratory is important to the success of students with disabilities. Aisles should be wide so that people using wheelchairs, crutches, or canes can easily move around tables. Lower mountings of chalkboards, water faucets, electrical outlets, and storage cabinets and higher lab tables can also benefit students in wheelchairs. Lighting is important, and there should be an unflickering light source that easily shows the teacher's facial expressions and lip movements. The science teacher must understand that building noises, mechanical equipment (fans, heaters, and buzzing lights), moving chairs, and group work that involves several people talking at one time can greatly interfere with the ability to understand speech (Birch, 1975).

Many science materials can be adapted or substituted with more appropriate materials. Students in wheelchairs can use special snap-on trays to transport equipment and microscopes with angled occulars to examine slides. Balances can be adjusted by putting tape at the midpoint where the pointer comes to rest, and Braille rulers and audible timers can be made available (Roberts & Bazler, 1993). In addition to Braille, large print, taped materials, talking calculators, clocks, and thermometers as well as light probes, raised line drawings, computers, and videotapes with Descriptive Video Service (DNS) can be used (AAAS, 1991b). Captioned films and videos, microphones, and assistive technology which includes computers and provides for "real-life" captioning of lectures (AAAS, 1991b) could be made available to students who are hearing impaired or deaf.

The effective science teacher must "play carpenter, interior designer, and adaptive technician" (Weld, 1990, p. 36). Students with disabilities must be encouraged to take part as much as possible in science activities. Even "minor" adaptations, such as wrapping tape around a handle or knob to enlarge it or providing a counter armrest to steady hand-held objects, can do much to help students with disabilities develop confidence and independence. Once students with disabilities know that the science classroom is free of obstacles to learning, "inhibitions disappear,

and they are free to focus on scientific, rather than logistic problem solving" (Weld, 1990, p. 36).

Prepare Positive Lessons

Learners with disabilities deserve more than just being placed in a science lab with their disabled peers and some modified equipment; they need to be included socially as well as physically. The science teacher must work to build a positive community of learners. Silence, ignorance, fear, separateness, and shunning/avoidance should be replaced with attention, importance, identification, dependence, and appreciation (Schlossberg, 1989). Students with disabilities should feel that others (teachers as well as students) are interested in and care about them, depend on them, and appreciate their contributions.

Students without identified disabilities should be given opportunities to understand the nature of disabling conditions. Instructional units and simulation activities (Wood & Reeves, 1989) can be used before students with disabilities begin working in regular science classrooms. If students with disabilities or their family members feel comfortable entertaining questions, perhaps a "getting to know you" question-and-answer lesson can be planned. It's important that special efforts are made to help students feel comfortable with each other before they are asked to work cooperatively on science activities.

Besides promoting positive relationships, science concepts can very effectively be taught and learned in cooperative "hands-on science – where all children have abundant opportunities to benefit from multisensory stimulation in cooperative settings" (Martin, Sexton, Wagner, & Gerlovich, 1997, p. 109). Pairing students as lab partners can be helpful to a student with disabilities provided one student doesn't end up doing all the work. A lab assistant familiar with terminology and equipment can greatly assist some students. When working in small groups, with partners or assistants, everyone should be involved in planning, monitoring, organizing, analyzing, and concluding (AAAS, 1991c). All should share in thinking and discovery.

As previously mentioned, the teaching practices appropriate for nondisabled learners are often effective for learners with disabilities. The National Science Education Standards of 1996 recommended that there be less emphasis on competition, whole group instruction, and recitation of acquired knowledge. Instead effective science education should emphasize cooperation and shared responsibility, active inquiry, discussion, and debate, and various forms of assessment (NSF, 1997). The learning of all students can be strengthened when students in science classrooms are given opportunities to work together, understand how different people approach different situations, and share responsibility for their learning.

Have High, Reasonable Expectations of Discipline

Nothing hurts the chances of success for a student with disabilities as much as the attitude, "Oh well, he (she) has a disability. I can't expect him (her) to do that." Children with disabilities are too often the victims of low expectations. Sometimes, in the science teacher's efforts to be sympathetic and understanding, the teacher waters down the curriculum and sets "ceilings" rather than floors (Good & Brophy, 1994). Far too frequently students in Special Education are students of Small Expectations, not great ones. Little is expected and little is demanded. Gradually, these children – no matter their IQ level – learn to be cozy in the category of being "special." They learn to be less than they are (Granger & Granger, 1986, pp. 26-27).

Some science teachers dealing with students with disabilities for the first time feel that the presence of these students will inevitably mean a "softening" of their approach to teaching as well as their disciplinary requirements. This idea equates "disabled" with "inferior" and "inept" and gives the message that students with disabilities are incapable of understanding and keeping pace. Students may be placed in safe environments where they are not asked to do things "we know they can't do," and inappropriate behaviors may be forgiven because "they can't help it." Then, when students with disabilities do not learn or act inappropriately, the beliefs about them seem justified (Gartner & Lipsky, 1987).

The advocates of PL 94-142 did not want students with disabilities to be treated with kid gloves – especially in regards to discipline. Dr. Edwin W. Martin, Jr., principal framer of the Education for All Handicapped Children Act, said that the intent of the act was not to give students with disabilities special rights, but it was to give them the same rights that had always been available to those without disabilities. "What disabled students have a right to expect is the same fairness, firmness, and compassion that would be given to any other student" (NAESP, 1983, p. 1).

Special education was never intended to focus on general education failings. It was an effort to focus on individual need. Special education is to serve the unique requirements of students with disabilities who are in danger of being handicapped by their disabilities unless they receive some form of accommodations or assistance.

The science teacher has the responsibility to clearly communicate classroom procedures to every child in the class. High standards must be set and enforced, and children must understand that there are consequences for misbehaviors. Disruptions should not be ignored. If a student with a disability acts inappropriately, he/she should be held accountable. As long as appropriate procedures are followed, even the most extreme aspects of school discipline, suspensions and expulsions, are allowed for students with disabilities. If a child is removed from the classroom, then appropriate special education services must still be provided (NAESP, 1983, p. 1).

For many people, discipline is associated solely with punishment. However, the word "discipline" has an origin close to the word "disciple," which is "one who learns from a leader" (Carpenter & Craig, 1991). A disciplinarian can be thought of as a leader (teacher), and discipline is a set of behaviors and attitudes that the leader (teacher) hopes the followers (students) will acquire. In the science classroom, effective discipline is an attempt to teach attitudes and behaviors that the teacher hopes the students will acquire and demonstrate even when the teacher isn't present. The focus of effective discipline is not just the enforcement of rules and consequences; it is a focus on developing a self-controlled and self-disciplined person. The science teacher must have high, reasonable expectations of discipline for all students, including those with disabilities.

Increasing diversity has made the science teacher's responsibility of managing the classroom far more challenging than it used to be. Yet many of the effective practices for homogeneous groups of students can be effective with heterogeneous groups. The proactive, preventive, and supportive measures and reactive, corrective, and adaptive measures of The Cascade Model can be implemented in science classrooms with students who have disabilities as well as in other classrooms. It's important that teachers should use appropriate language and have high, reasonable expectations of discipline for all students as they work with appropriate materials and learn science through cooperative, inquiry-based lessons. Diversity is an opportunity to make the science classroom a laboratory for living in a democratic society.

Preventive Management
"Creating a Positive Learning Environment"

The key to successful management is advanced planning and organizing an environment which meets the needs, interests, and abilities of individual students. An attractive classroom, good lesson preparation, fair rules, and an enthusiastic, caring teacher are major ingredients in preventing discipline problems.

An effectively managed classroom provides exciting, dynamic learning experiences for students and teachers. This involves managing space, time, materials, lessons, and people so that students are highly involved and use instructional time efficiently. On-task, involved students spend their energies learning and are rarely discipline problems.

Preventive approaches to discipline encourage learning as a lifelong process. Learning becomes more enjoyable for students when the teacher expends little time maintaining order. A fair, consistent method of management and discipline mixed with caring and understanding goes far in preventing most discipline problems.

A well-managed classroom is a task oriented, predictable environment where students know what is expected of them and how to succeed. Establishing such an environment requires the classroom to be effectively organized.

The classroom setting, which includes room arrangement and room preparation, has an impact on the students. Appropriate lighting, noise levels, bulletin boards, and seating arrangements can help to create attractive classrooms that are places where students come eagerly.

Careful consideration should be given to the selection of desks, tables, and furniture. The color, size, comfort, and type of physical surroundings can facilitate or handicap the materials flow and traffic patterns in the classroom, as well as influence how the students perceive the classroom. The principles of universal accommodation should apply to all decisions. Accessible classroom environments serve all children well, in addition to providing an independent learner environment for students with disabilities.

A classroom arrangement can be evaluated by answering the following questions:

1. Can the teacher see all of the students from any place in the room?
2. Does congestion occur in any particular area?
3. Do any students disturb others around them?
4. Can students easily access all or the appropriate resources; i.e., supplies, materials for experiments, computer sites, books, and nonprint resources?

If all students are able to access the materials without help from the teacher, there will be fewer disruptions and students will be able to spend more time learning. Materials should be counted out and ready for distribution before students enter the room so that work can begin promptly.

Classroom routines should be clearly established and spelled out. Accommodation procedures for special needs students who need accommodations should be clarified and practiced. These procedures should address the dignity and primary needs of the student. Relevant school policies and instructions for student behavior in emergencies should be clearly explained. Times when students are allowed to leave their seats and when they are expected to remain seated should be defined. There should be established routines for passing out and returning materials to students. Taking a little time during the first week to practice and refine classroom routines in order to improve efficiency can be a big time saver throughout the year.

Expectations and Routines

Permissive teaching is not humanistic teaching. It is difficult for students to adjust to a classroom in which there is not a certain level of predictability and stability that includes routines and procedures to direct behavior. It is necessary in managing a classroom to spend sufficient time developing and implementing a workable set of performance standards. Effective classroom managers have clear expectations. Students know the limits of acceptable behavior and exactly what is expected of them.

Although there is no one "correct" belief regarding what is acceptable behavior, teachers need to delineate limits that are consistent with their educational philosophy and instructional style. Students must realize that standards of conduct may change between classes because teachers are individuals with different philosophies and styles. Just as there are different traffic regulations with different speed limits, students should understand that different teachers have different regulations and limits.

Better managers clearly denote procedures to students during the first few weeks of school and give feedback to the students when inappropriate behavior occurs. They begin the year by explaining that order is needed for a classroom to function efficiently. Then they give specific instructions about the expectations, routines, and procedures that are to be followed in their classroom. Effective teachers are explicit about what is desirable behavior and use these standards when giving feedback to their students.

Most students prefer firm teachers to overly permissive ones. Effective teachers maintain discipline in their classrooms without punishing students because their students understand expectations and live within the limits of appropriate behaviors. Yet this does not mean that a firm teacher cannot be warm and supportive.

The following items list areas where expectations should be explicitly defined for students:

1. Beginning the period
2. Grading policies
3. Communication regarding assignments
    a) procedures for turning in written assignments
    b) procedures for returning assignments to students
    c) procedures for make-up work
    d) procedures for group work
    e) consequences of assignments which are not completed
    f) procedures of work which is not done in a satisfactory manner
4. Proper behavior for teacher-led instruction
5. Proper behavior for group work
6. Proper behavior for seat work
7. Course requirements
8. Planning of class activities
9. Ending the period.

Instruction

Students have ideas about how teachers should teach and direct effective instruction. A ninth grader generalizes that:

> Some teachers lecture for an entire period and will not let up. Others never lecture. There should be a compromise somewhere, allowing the student to understand the lesson by presenting the material in an interesting way. The students would enjoy it more and so would the teacher, probably. (Stefanich & Bell, 1987)

Thirteen-year-old Teresa is more specific about her "neat" teacher's instruction:

> We have a really neat teacher! He's neat because he challenges you. He's really exciting and everything. He's not a boring guy using the same voice all the time. He has all sorts of things up his sleeve. He challenges you because you have to dig for information. (Stefanich & Bell, 1987)

Both of these students cite the necessity for a teacher to use a variety of teaching techniques to prevent boredom and lead to more on-task behavior. These techniques include emphasis on multi-modality instruction, and using semi-concrete mediums such as computer simulations, pictures, videos, and films when direct interaction is not possible.

The needs and abilities of each student should be considered when choosing various materials. Special consideration should be taken to provide high interest material at the students' instructional level. Selecting appropriate texts and other reading materials can be especially challenging. In the typical seventh grade classroom, the range of reading abilities spans eight years.

It should be remembered that what is preferable and reinforcing for one student may not be for another. Instruction which includes a variety of teaching methods and materials based on student needs, abilities, and interest can help a lesson be effective. A well-taught and effective lesson is a strong deterrent to disruptive classroom behavior.

The teacher should work to vary instruction. There's a time for whole class instruction, group instruction, and individual instruction. Regardless of class size, every instruction period would include discussion and questioning by the students. Discussions give students a legitimate reason for talking and a chance to clarify their ideas. When the teacher asks questions, he/she should wait at least 3 seconds before rephrasing the question or moving on. A longer wait-time encourages students to think before responding.

The four quarter paradigm is a good framework for reflective thought. After a week of teaching consider the following as a general goal: _ of the time is teacher talk, _ of the time is spent in cooperative work groups, _ of the time is discussions and sharing class, and _ of the time is spent in independent work suited to the student's individual needs.

When an eighth grade student was asked how she felt about school her reply was:

> Some teachers make fun of you during class if you don't understand the material and ask questions. Also a couple of the teachers stereotype students, and some can't understand what it's like for a person to have a bad day. I'm not a very good student. I try hard, but often the words are difficult to read. I wish that my teachers would be concerned about me and understand me. (Stefanich & Bell, 1987)

Managing the classroom well includes creating a positive learning environment by paying attention to individual differences among students. Some students misbehave because the teacher has not considered what the individual students are able to do, and instruction is not at their performance level. Frustrating students by giving them very difficult assignments causes disruptive behavior which can surface in a variety of forms. Sometimes students try to gain attention by acting like class clowns to cover up their feelings of being "dumb." It is essential that academic work be in tune with students' ability levels so that all get positive reinforcement for what they are able to do.

All students must be challenged. It is just as important to provide material at an appropriate level for gifted students as it is for students of limited abilities. Providing challenging, successful experiences offers students a positive means of gaining recognition and helps them build positive self-concepts. Just as teachers can reinforce students with limited abilities by providing short assignments and recognizing the completion of each task, he/she should provide learning tasks and activities that challenge and "stretch" the thinking processes of the most able students.

Physical factors often affect student performance. A hungry or tired student is often unwilling to do school work because food or a rest is necessary. Sometimes an overactive learner cannot sit still for long. It may be that the overactive student may be a kinesthetic learner who needs frequent movement.

These comments made a junior high school student are worth considering:

> I think that it is important for teachers to try to understand how their students feel. They shouldn't favor one student over another. I also think that teachers should know that most of us kids enjoy school. The thing most of us don't like is busy work. I think that if we are going to spend time working, it ought to be on worthwhile things. Another thing I have noticed some teachers doing is humiliating or embarrassing us to get us to learn. A better approach is to try to tell us all how to do things correctly. Adults don't like to be embarrassed in front of their friends, and neither do students. It is important for us to get to know all of our teachers as people and not just as teachers. One way to do this is to tell us about yourself and also about the way you feel about certain things. Also try seeing your students as you would see the people you work with and not just as children.

As this student points out, good teachers are concerned about each student and express this concern by being available to talk to students about their problems and build trust relationships. A caring teacher can help students reach their fullest potential as total human beings by encouraging them to be the best possible people they can be and by modeling behavior the students should exhibit. By treating students with respect and showing them feelings of love and self-worth, the teacher demonstrates his/her care and concern for their well-being. The students, in turn, will treat the teacher with respect, admiration, and trust.

The teacher's expectations for students also play an important role in determining student behavior. A teacher who makes students feel capable can have a significant impact on the students' academic performance. The teacher should let the students know the suitable, the challenging expectations. Students who are expected to do their best work and act in a proper manner will learn to evaluate their own work and to take the responsibility for their own learning. As students develop a sense of pride in themselves, their feelings of self-worth will improve as well.

Enthusiasm

Enthusiasm is as important as expectations. It is contagious, and a positive, enthusiastic teacher will go far in instilling the desire to learn in students. Students tend to imitate behaviors they observe. Just as sarcasm breeds sarcasm, so enthusiasm breeds enthusiasm. The saying, "he who kindles others must first glow," is true especially in education.

The caring, enthusiastic teacher with high expectations knows himself/herself and builds a positive learning climate. The classroom environment should reflect the teacher's educational philosophy, teaching style, and personality. As a facilitator and catalyst in the learning process, the teacher must be flexible, willing to change to improve his/her teaching techniques, and give students a sense of belonging and personal responsibility of the school. Students can be given opportunities to perform tasks like watering the plants, arranging books, decorating the room, pinning up bulletin boards, or even planting trees and shrubs in the schoolyard. The school needs to be a safe, secure place to which students eagerly come, where they are excited by what they learn. As students develop pride in their classroom and school, acts of vandalism will diminish because students are reluctant to destroy their own work.

Conclusion

The following suggestions written by students to teachers sum up the essence of creating a positive learning environment.

1. Be considerate of other's feelings.
2. Listen actively to what students have to say.
3. Find out their interests.

4. Be courteous.
5. Radiate genuine enthusiasm.
6. Be positive at all times—even among peers.
7. Make the classroom an exciting place to be.
8. Treat students in ways you would like to be treated.

Among the most noteworthy of the preventive techniques employed by successful teachers are demonstrated abilities to:

1. Effectively pace instruction without distraction, inactivity, or interruptions.
2. Establish routines which enable students to engage in a smooth transition from one learning task to the next without interrupting others or waiting for others to finish.
3. Assign different learning alternatives within a class in the normal course of classroom instruction.
4. Use a variety of techniques to keep students attentive and active. Prompt action is taken to control disruptions unobtrusively when they first occur, rather than waiting to correct misbehavior.
5. Use interactive techniques which provide the teacher with frequent feedback and active monitoring of student performance.
6. Use techniques and statements which have a ripple-effect of stimulating motivation and on-task behavior by others in the classroom. The group becomes a collective support system.

An appropriate, well-planned, interesting lesson with fast, smooth transitions and challenging assignments sets students up for a high rate of success and little or no time for negative behavior and time off-task.

The teacher should come to class each day ready to use every minute of every period. If worksheets are used, they should reinforce what is being learned rather than provide busy work. Students like to know what will happen next, so the schedule should be posted somewhere in the classroom. Routines help students know how the period will begin and end, where finished work is to be place, and procedures for asking questions, sharpening pencils, and visiting the restroom. Structure helps reduce anxiety and provides for a smoother running classroom.

The amount of time allocated for instruction may be quite different from academically-engaged time. Allocated time refers to the amount of time provided in the school calendar or time limited to instruction by the teacher, while academically-engaged time is an expression that denotes time in which the students are actually engaged in learning activities or instruction. Time spent in getting students ready for learning, materials traffic, clean-up, and waiting all reduce available learning time and consume allocated time. Classes that begin and end on time help students to spend more effort on academic tasks. Starting and ending late, discussing irrelevant material, and taking considerable time to pass out materials all erode time students could be on task.

A study conducted through Northwest Laboratories in Denver, Colorado, found that in comparing 50 math classrooms with 250 minutes of allocated time per week, engaged time ranged from 244 minutes to 100 minutes. Consider this, if just five minutes are lost each 50 minute period, an entire school day would be lost in just two weeks!

Supportive Discipline
"Reinforcing Desirable Behavior"

It is important that teachers become vibrant figures in the lives of their students. Teachers should frequently employ both direct and indirect methods of expression to communicate to all students that they are caring adults. They must express a genuine interest in the personal growth and development of each individual student.

A positive classroom atmosphere must be created for supportive techniques to be most effective. Students should develop respect for the worth and dignity of individuals. They should feel free to communicate ideas and feelings without fear or hesitation. If students feel a supportive atmosphere, they might have more positive feelings than expressed by this eighth grade student:

> I have a feeling that most teachers don't think of their students as people but that they should be taught as a person might teach a dog a new trick. We rarely get rewarded when we do well and if we do badly, we are punished by being embarrassed in front of the whole class. I understand that teaching is a stressful job, but so is being a student. I feel that if the students and the teachers understood each other's needs they would be able to function as a class better. (Stefanich & Bell, 1987)

Developing Self-Discipline

A positive atmosphere lets students develop self-discipline as rapidly as possible so that they can make their own decisions rather than rely on teachers. The principle of accepting minority views while supporting majority decisions is an essential element of a democratic society.

Two techniques used to help students achieve desirable behaviors are "shaping" and "modeling." "Shaping" involves reinforcing behavior that is close to the desired behavior. As each level of behavior is attained, the criterion for reinforcement is raised until the ultimate behavior is achieved. "Modeling" is the teacher demonstrating appropriate behavior in all interactions including: teacher-administrator, teacher-teacher, teacher-staffer, and teacher-student so that students will see the expected behavior and follow it.

Praise

A study conducted by Evertson and Emmer (1981) compared two groups of 13 teachers identified as being effective or non-effective in classroom management. They reported the following summary: "Teacher attention has a powerful effect on behavior. A statement such as, 'I appreciate the way Bob is listening' often encourages the non-listeners to develop this behavior."

Careful consideration should be given to the way in which a teacher praises the students. The praise should share information that can be used to direct student learning. When delivering praise, speak to specific behaviors rather than forwarding a general comment. Specific praise as, "Your use of descriptive adjectives is excellent," or "I can visualize the scene well," relate to the behavior and not the student. General praise such as "You're a great student," does not share information which can be used for the student to direct further learning.

Rewards

For some students, concrete rewards are often effective in reinforcing desirable behavior. Younger students often appreciate tokens, happy faces, and/or treats. Many students of all ages like to receive positive written notes and comments. Rewards may take the form of certificates awarded and communicated through assemblies, school newspapers, or the local news media. To older students, the manner in which the reward is given as well as the perceived source of the reward may be more significant in determining the student response than the reward itself. Some students like types of

concrete rewards. Reinforcers that are usually effective with middle level students include praise, recognition, opportunities to participate in unusual events, and engaging in conversation with peers. At the high school level the most prevalent positive consequences are intrinsic student satisfaction resulting from success, accomplishment, good grades, social approval, and recognition (Emmer & Evertson, 1984). Concrete rewards often work well as additional motivators particularly when coupled with recognition (i.e. pins or school letters).

Other Strategies

A strategy to support desirable classroom behavior for both younger and older students is to have regularly scheduled meetings during class time to discuss positive events and problems. (The meetings or discussion should be well-planned and conducted using a prepared parliamentary procedure or discussion format. An important part of effective supportive discipline is respect for academic learning time. Therefore, the effective use of time in sharing sessions is equally as important as when engaging in academic instruction.) Encourage students to provide their input into how the problems can be solved. The students can role play problem situations to clarify and solve their problems.

A variety of non-verbal signals can be used to communicate approval and appreciation for an appropriate behavior. These include a smile, a pat on the shoulder, a handshake, or just a twinkle of the eyes. The teacher's closeness or proximity to the student must show interest and concern and can serve as an additional reinforcer. Proximity can frequently be used to focus student attention or bring students back on task.

In using praise, rewards, or positive non-verbal communication, it is important to remember that what works as a reinforcer for one student won't necessarily work for another. One student may feel receiving tokens is highly reinforcing, and another student may feel receiving those same tokens is very degrading. The teacher should allow students to suggest meaningful methods of reinforcing. Then he/she should vary praise by using a variety of remarks and differing delivery styles that take into account individual feelings.

The students are important, the reinforcers are important, and the teacher is equally important during this supportive discipline phase. If the teacher is skillful in motivating students to a level that ensures real interest, student performance and good grades will help to promote good behavior.

In the Everton and Emmer (1981) study of teacher's classroom management, more effective managers were rated higher than less effective managers on several variables. These included clarity in giving directions and information, stating desired attitudes and behavior more frequently, providing activities and assignments with higher levels of student success, presenting clear expectations for work standards, and consistency of response to appropriate and inappropriate behavior. Effective teacher managers were rated higher on use of listening skills and maintaining eye contact with students (Emmer, et.al., 1980).

Support Reports

Teachers should continually communicate with guardians to enlist their support. There should be a two-way flow of information between the home and school because parents need to understand what their child's teacher is trying to accomplish. Parents need to know how they can assist and support the teacher at home, and teachers need to understand what's going on in the homes.

Parental support can be gained through support reports as described below, phone calls which show an accomplishment or proctor behavior, and written newsletters. Phone calls can be very effective in obtaining support. The teacher should find something positive and true to say about each student.

Figure 15

Support Report

Reasons for This Report

ABILITY

_____ Good aptitude in subject
_____ Conscientious preparation in subject
_____ Effective motivation

ATTITUDE

_____ Good attendance
_____ Ample preparation for class
_____ Serious approach to studies
_____ Homework turned in regularly

PERFORMANCE

_____ Satisfactory test scores
_____ Excellent written homework
_____ Exemplary participation in class discussions

Comments _____

_____

_____

Sincerely,

_____
Your child's teacher

Activity Ideas

The following list includes a few supportive measures which have been successful with students:

1. Vandalism Fund-Provide students with information on the cost of school maintenance attributed to acts of vandalism in and around the school. Designate an equivalent fund for the upcoming academic year and, if the monies are not expended, allow students to provide input into how the surplus is spent. It may be in the form of a party or adding something which makes the school a better place in which to learn.

2. No Tardy-No Absence-Provide some form of recognition on a 9-week, semester, and yearly basis for students who display perfect attendance. A form of recognition may be a special luncheon with a community civic leader or humorist presenting a short address to the group.

3. Ironman Award-A special recognition for individuals who have maintained perfect school attendance along with perfect attendance and response to assignments and responsibilities in an extracurricular school activity.

4. Beach Party-Allow students to have a special party on a certain day if they meet a goal concerning performance or behavior. An activity which has been found to work well is a beach party in the middle of the winter season, particularly in a northern latitude in a setting where there is an indoor pool. Other possibilities include: Cowboy Party, 50's Day, or a Holiday Celebration.

5. Communicate with Parents-Ideas include: Happy Grams, Thank you notes, and Support Reports.

6. Provide Challenge Opportunities-Provide a challenge for students and recognize those who are the most successful. Ideas include: a) a ping pong ball hunt, b) how many seeds in the great pumpkin, c) match each teacher with his/her baby picture, d) intramural contests, e) Mind Olympics, and f) faculty-student athletic events.

7. Recognize Individuals Throughout the School Year-Ideas include: a) birthday recognition, b) student of the week, c) writing a school song, and d) painting murals in the halls or lunchrooms.

Supportive discipline encompasses the second level in The Cascade Model. Using positive regard, students are rewarded for desirable behavior. Verbal, non-verbal praise, and specific rewards are all part of the process. Support reports are sent home to parents, encouraging their involvement in classroom activities. Students are encouraged to take pride in their school endeavors. Self-control and love of learning are the desired outcomes. A supportive teacher combined with a positive classroom environment will ensure that maximum learning will take place under the most desirable circumstances.

In implementing elements of supportive discipline into your school discipline plan, consider the following:

1. Utilize student comments and parental input. An effective supportive model cannot be left totally to school personnel.

2. Parents must consistently support the premise that students have responsibilities as well as rights, and schools have an obligation to insist on both.

3. The primary responsibility of the school, which is to direct academic learning, cannot be achieved efficiently if a disproportionate amount of time and resources must be expended to maintain order or facilities.

4. No one is ever taught anything. The school environment is intended to facilitate the learning process. Active cognitive participation on the part of the learner is essential for learning to take place.

5. If you do things for students that they can do for themselves, you are robbing them of self-respect and responsibility.

6. Be both kind and firm. Kindness refers to your manner, and firmness refers to your follow-through behavior.

7. Talk less; act more.

8. Be patient.

9. A good place is one where people are courteous, especially the adults. Yelling, sarcasm, and denigration are the exception instead of the rule.

10. A good place is one where laughter is frequently heard, not because of frivolous activity but because of genuine joy brought about by involvement with caring people engaged in relevant work.

11. A good place is one where communication is practiced and not preached.

12. A good place is one that has reasonable rules, rules which everyone agrees on because they are beneficial to the individual and the group, and rules which everyone has a democratic stake in because everyone has a say in making and changing the rules as needs arise.

13. A good place is one where the administrators actively support and participate in an approach to discipline that teaches self-responsibility.

Corrective Strategies

Despite measures taken to prevent discipline problems, inevitably some students will choose to misbehave or fail to respond to the academic opportunities provided in the school environment. Disruptive students may be verbally and physically aggressive or non-compliant. These behaviors consist of interrupting the class frequently, leaving seats without permission, provoking other students, or refusing to become involved in school work. An eighth grade student stated:

> I feel that discipline is a very important thing in school. If students are acting up, they should be reprimanded, but it shouldn't be held against them for the rest of the year. On the other hand, if students are acting up and they don't get reprimanded, they will continue to disrupt the class. This is unfair to other students.

Withdrawn, shy students who retreat into their own world of daydreaming are too often over-looked but need to be brought into the mainstream of the class. Many teachers indicate that the most troublesome of all behaviors they face is not misbehavior, but rather student apathy and lack of motivation. Teachers must approach passive students with a vigor equivalent to that of the disruptive students. They must clearly communicate to each student that the consequences of passive, resistant, or disruptive behavior are sufficient to make on-task behavior a more desirable choice.

At the corrective level of The Cascade Model, student support is enlisted for the development of rules. These rules are designed to establish norms and limits of students' behavior. In addition, consequences are established to clearly communicate to students that misbehavior will not be tolerated and to provide the classroom teacher with a consistent format for dealing with non-compliant behavior.

Rules

The importance of defining routines and expectations was mentioned at the preventive level. Some may argue that the differences between these terms and rules are simply a matter of semantics. However, the differences are significant in how the classroom teacher deals with them and in the way they are communicated to the students.

At the preventive level, the classroom teacher communicates behavior patterns he/she expects the students to assume. Although many items which may be defined as rules are expressed, these rules are mentioned in a more casual manner as reminders to the students, treating students as if they understand the rules of conduct and common courtesy and have the maturity to live within these norms. Routines and expectations are defined in order to provide mechanisms for smooth traffic flow within the classroom whether it concerns papers, supplies, equipment, or working in groups.

On the other hand, rules defined at the corrective level of classroom discipline reflect clearly defined expectations with the imposition of consequences if they are not adhered to and respected. Student responses to the rules are monitored and supervised by the instructional and administrative staff in the school.

Formulating rules.

The process of rule formulation requires reflection on the part of the classroom teacher prior to talking with students. The teacher needs to decide what the tolerable limits of the classroom will be and the extent of student involvement in selecting rules.

A good starting point in preplanning is to reflect on the following questions:

1. What behaviors do I wish to increase?
2. What behaviors do I wish to decrease?
3. What are some likely consequences for inappropriate behavior?
4. What are some effective rewards for reinforcing appropriate behavior?

It is much easier to start with a management plan that is overly firm than it is to revise a discipline policy that isn't working effectively. Proactive decision-making is critical with a careful review of the limits of students' choices. It is easy to loosen up classroom limits, but to impose more severe limits often erodes the potential for gaining cooperative student support for the new policies.

The teacher should choose two or three rules considered essential and state them in positive terms. An example might be "Students are to be in their seats and ready to learn when the bell rings." The rule should be stated in terms of observable student behavior using a vocabulary which students clearly understand.

Then the teacher should engage in a cooperative dialogue with the students to establish other classroom rules of behavior. The total number of rules may vary but should be limited to less than 10. Younger students and students of limited abilities should have a number of rules appropriate to their capabilities and development. Extreme care must be taken to ensure that everyone will be able to abide with the student generated rules.

If necessary, instructional time should be allocated to insure that all students are familiar with the rules and capable of interpreting them based on their own behaviors. Some time should be allowed for the rules to be tested to ensure that they produce the desired student behaviors and are consistent with school policy.

After the rules are clearly understood and students have established a pattern of expected behaviors, it is appropriate to establish the consequences for those who choose to break the rules.

General Consequences

Students need to see the relationship between their actions and the consequences of their actions. Natural consequences are more effective than punishment because they teach the student what should be done. This helps them understand that consequences are a natural outgrowth of breaking the rules and that positive behavior is more conducive to successful learning than negative behavior. Each consequence should be fair but firm. In violating a rule, the student must accept the responsibility for the inappropriate behavior and the consequences of this act.

Allowing students to have input into developing consequences gives them the opportunity to express their feelings and have some input into the functioning of the classroom. This is essential if the classroom is to become their classroom. However, the teacher must reserve the right to veto any consequences which he/she determines to be inappropriate or ineffective with a student or group of students.

Most inappropriate classroom behavior is not seriously disruptive and can be managed by addressing the individual and avoiding escalation. The classroom teacher must immediately address minor misbehaviors such as prolonged inattention, failure to follow instructions, incessant whispering or talking, and/or movement about the classroom. Whenever possible, the behavior should be unobtrusively addressed without disrupting the instructional activity. Some suggestions are:

1. Use proximity control and move towards the offending student.
2. Use eye contact, a nod of the head, or some other non-verbal signal.
3. Pass the student a written reminder.
4. Provide a short verbal cue.
5. Redirect the student by stating what the student should be doing and, if applicable, cite the proper procedure or rule.

If several students are involved in misbehavior, the best strategy may be to refocus the class attention to the assigned learning task. The teacher might say, "I would like everyone to address their attention to the transparency and focus on the illustration. What are some physical features that influenced the decision to build a canal through the Isthmus of Panama?" The purpose of the redirection is to create a behavior that is incompatible with the disruptive behavior.

In implementing consequences, it is essential that the teacher be consistent. An eighth grader explained:

> One major problem that teachers seem to have is discipline. They always complain about certain problems that we are causing. Maybe if teachers were more consistent in their reactions, we could tell when to quit. I really hate it when a teacher sees a whole class talking and then picks on one individual and comes down hard enough on that one to stop the whole class. Teachers shouldn't make examples. (Stefanich & Bell, 1987)

Better classroom managers do not ignore deviations of classroom rules. Students expect discipline procedures to be fair with consequences that are enforced consistently, not according to how the teacher feels at the moment. When resolution of a problem occurs, whenever possible the student should be addressed in private. For many students with disabilities, confrontational teacher actions in public will escalate rather than moderate appropriate behaviors. The teacher should explain to the student that he/she has a choice; abide by the rules or accept the consequences.

As little time as possible should be spent on disruptive behavior. The teacher should let the student know the rule that has been broken and then move on with the lesson. The teacher should mean what he/she says and follow through with it. At a later time, the teacher can discuss with the student what occurred. In effective schools, teachers handle most discipline problems themselves and rarely send students to the principal's office.

If discipline problems occur, students need to know what to expect. Students need to be aware of what is acceptable and unacceptable behavior and that consequences will be imposed if they engage in a pattern of inappropriate behavior. Discipline should be prompt, appropriate, and private. An eighth grader offered the following statement:

> I think the thing I dislike the most about discipline is that a teacher says, "I'll give you two more warnings." If you are going to teach us anything, then you have to enforce the punishment and really go through with it. If a teacher keeps giving the person who's acting out a "warning," then you are not only embarrassing the student but yourself as a teacher. (Stefanich & Bell, 1987)

The Teacher's Role

To correct discipline problems, the teacher must begin by being a good listener. The good disciplinarian is emotionally mature and professionally competent. She/he must express empathy and develop rapport with students, but also must establish limits and carry out consequences if students go beyond these limits. Providing for the disruptive student takes patience and understanding.

Discipline should be developed through a human relations perspective with emphasis upon communicating in a democratic way. The teacher should communicate beliefs and feelings by letting students know his/her expectations. The teacher should encourage student dialogue in addressing the problem or concern by listening to what students are saying and communicating that she/he cares.

Yet sometimes angry conditions occur that can possibly lead to power struggles. Angry feelings are natural, but under angry conditions, judgment is impaired and perceptions are inaccurate. Arguments follow that become emotional encounters which create ill will for all concerned. If a teacher gets drawn into a power struggle with a student, a no-win situation ensues.

When angry feelings are present, there should be a "cooling off" period before tackling the problem. The student should be told that the problem will be discussed later during a private conference. The teacher should make a conscious effort to put some space between himself/herself and the student.

Listed below are 12 suggestions for the teacher to consider when dealing with discipline problems:

1. Do not allow students to remain passive in a classroom setting.

2. Do not allow excuses. Instead, focus on appropriate future behaviors.

3. Determine a course of action to deal with small problems. Try proximity control; move closer to the child who is misbehaving or move the child closer to you. If you must take action to stop a behavior, try to establish an unobtrusive signal to alert the student without disrupting instruction. A glance, a frown, or a shake of your head is often sufficient.

4. Avoid challenges. If you dare a child to misbehave, he/she will more than likely take you up on it.

5. Avoid extracting confessions. The accused may lie just to have the situation over with. It is better to tell the student you know what he/she did and that you don't want it to happen again. Then drop the matter.

6. Avoid confrontations in front of others. Whenever possible, handle a confrontation by postponing it until later when it may be handled in private.

7. If you feel you must threaten, be certain you can carry out your threat.

8. When you reprimand, do it privately whenever possible.

9. Avoid humiliating a student. Ridicule and sarcasm make students resentful and may turn the entire class against the teacher. Treat students with respect.

10. Know your students. A trip to the office may be just what a student wants at that moment so he can get out of a difficult situation.

11. Beware of mass punishment. If a child misbehaves, he should bear the responsibility, not the whole class. In most cases, if you don't know who did it, it is better to drop the matter rather than accuse the whole class.

12. If behavior problems cannot be solved in the classroom, seek the help of counselors and administrators.

Using Consequences

There are two ways to use consequences. One is to have consequences that are the same for each rule. These are carried out in sequential order regardless of the past history of the individual involved. A list of consequences carried out in this manner might be as follows:

1. Warning
2. Time out in the classroom (for 5 minutes)
3. Detention (for 30 minutes)
4. Contact parents and detention (1 hour)
5. In-school suspension (for one-three days)

When disruptive behavior occurs, the rule is stated and the consequence implemented. ("Robert, you called out without raising your hand. Go to the time out area for five minutes.") An alternative method to verbally stating the rule and consequence is to post a class roster and communicate to the student by placing a check after his/her name when an infraction occurs.

If a discipline problem occurs that threatens the teacher's or students' safety, the disruptive student must be removed from the classroom immediately. Plans should be made ahead of time for procedures to be used in the event of violent student behavior. If an intercom button is available, it can be pressed to call for assistance. If not, the teacher should identify another person who can help. There should be a predetermined means of notifying that person, such as giving a pen to a student to take to that special helper.

An alternative approach to implementing consequences is to provide a range of alternatives for each rule and to select the consequences that best meet the needs and past history of the individual student. For the rule "Use appropriate language," the consequences of using foul language might consist of the following:

1. Detention (30 minutes)
2. Write a 300-word paper on the proper use of oral expression
3. Ask the student to leave and come back when he/she is ready
4. Meeting with parents, teacher, and student
5. In-school suspension

The means of implementing consequences should be decided by the teacher and explained to the students. One teacher may feel that consequences should be implemented in sequential order regardless of the particular student involved. Another may feel that a consequence should be selected that fits a particular student's needs. In this manner, the uniqueness of each student is addressed and individual needs are met.

Having a range of alternative consequences allows the teacher greater flexibility in dealing with misbehavior and greater opportunity to provide a consequence, if necessary, which is most likely to arrest the negative behavior for the individual student. To help students accept differential treatment, let them know why a particular consequence is selected. Explain that not everything in life is equal because no two people are alike. If necessary, engage in a discussion related to the statement, "There is nothing so unequal as the equal treatment of unequals."

On the other hand, with individual treatment there is a greater risk of generating student perceptions that the teacher plays favorites or is punitive towards certain individuals. It is common for

students to establish attitudes concerning the fairness of a teacher. Consider the following statement from a 7th grader:

> I feel that teachers should pay more attention to a student's feelings before action is taken. But most teachers do not do so. The teacher should not pick on certain kids in order to make them feel stupid. It just isn't fair. Maybe the teachers don't realize they are playing favorites. (Stefanich & Bell, 1987)

It's important to reexamine rules and consequences at regular intervals to ensure that they are having the desired effect. The following suggestion came from an eighth grade student:

> I think you should take certain steps in handling trouble makers such as, first give them a warning in class and if they fail to pay attention to this, talk to them privately. If they continue to make trouble, then have a teacher-parent-principal talk. I hate the way some teachers hand out detentions to anyone who disobeys some meaningless rule in the slightest way. What good does it do to make someone sit in the library for an hour? This just gives them another chance to goof off. Basically what I'm trying to say is that detention study halls don't teach people to stop goofing off. (Stefanich & Bell, 1987)

By periodically examining rules and consequences, the teacher can be assured that consequences are having the desired effect.

Specific Consequences: Details and Limitations

Time-out.

Time-out is useful in helping students correct disruptive behavior. Placement in a time-out area in the classroom isolates the student by setting him/her apart from peers in a non-reinforcing situation. This provides the individual with a chance to gain control and organize himself/herself. It is based on the premise that being a part of the class is more desirable than sitting in the time-out area.

Since time-out calls for the student to be removed from a reinforcing environment within the regular part of the classroom, care must be taken to insure that the regular classroom is more reinforcing than the time-out area. The time-out area should be non-reinforcing and free of decorations. The location should allow the teacher to observe the student as well as his/her impact on the rest of the class. If this time-out area is more reinforcing than the regular classroom, the misbehavior may be strengthened rather than weakened. It should also be noted that time-out is not effective for all disruptive behaviors. Behaviors such as daydreaming or rocking can be performed in the time-out area, and the frequency of these behaviors may increase rather than decrease.

To determine if time-out is effective in decreasing a particular behavior, a baseline count of the disruptive behavior may be taken prior to and after using time-out. The baseline data should be taken over a one to two-week period. This allows the teacher to determine if a change is the disruptive behavior has taken place after time-out has been implemented.

Prior to using this procedure, consider possible problems and determine how they could be handled. What will you do if...

1. The student refuses to go to the time-out area?
2. The student has to go to the bathroom during time-out?
3. The student engages in behavior that could injure himself/herself while in time-out?

If the student refuses to go to the time-out area, have a back-up plan such as after school detention or in-school suspension. If using time-out does not solve the problem for a particular student, other strategies may be needed.

Time-out is useful in managing disruptive behavior. If properly applied, it allows the student to stop receiving reinforcement for inappropriate behavior.

Notification sheets.

An approach found to be effective in classrooms is to hand a disruptive or off-task student a notification sheet. Figure 16 gives an example of a first notification sheet to be given to a disruptive student, and Figure 17 gives an example of a first notification sheet to be given to a student engaged in an off-task behavior. Figure 18 shows an example of a second notification sheet.

Punishment versus logical consequences.

Punishment usually stops disruptive behavior only temporarily. It is designed to get even with the student and alleviates the teacher's need to seek release from anger and stress. It does not teach the student what he/she should be doing and is the least effective means of dealing with disruptive behavior. Punishment tends to create further discipline problems rather than correct them. It often encompasses a strong dislike for the punished and can have a negative effect on learning. When teachers punish a learner, they are encouraging hate, fear, or withdrawal. The student wants to avoid contact with the teacher and whatever is being taught. Punishment induces violence rather than acceptable behavior.

Instead of punishment, logical consequences that are related to the misbehavior can be used. If a student is late for class, asking him/her to remain after school to make up the work that has been missed is a logical consequence. Requiring the student to write "I must not be late" 100 times is a punishment. A consequence is logical if it helps the violator learn acceptable behavior. Here are several differences between punishment and logical consequences:

- Punishment expresses the power of personal authority. Logical consequences express the impersonal reality of social order.
- Punishment is rarely related to misbehavior. Logical consequences are logically related to misbehavior.
- Punishment tells the child he or she is bad. Logical consequences imply no element of moral judgment.
- Punishment focuses on what is past. Logical consequences are concerned with present and future behavior.
- Punishment is associated with a threat, either open or concealed. Logical consequences are based on good will, not on regulation.
- Punishment demands obedience. Logical consequences permit choice.

Detention, depending upon the manner in which it is handled, can be perceived either as a logical consequence or as a punishment. Whenever possible it should be communicated as a logical consequence for inappropriate use of time during the instructional day. Students should be expected and provided opportunities to engage in productive learning efforts during detention periods and resources should be available whenever possible.

If there are no logical consequences, the teacher may withdraw privileges. If a student breaks a rule, he/she may lose the privilege that may consist of free time to pursue a desired activity, play an educational game, or go to recess on time. The essence of discipline is finding effective alternatives to punishment. To punish a child is to enrage him and make him uneducable (Ginott, 1972).

Figure 16 - Notification Sheet-Warning

I perhaps do not realize it, but I am interrupting the classroom lesson by my behavior. It is rude and unfair to the rest of my classmates. I will cease my rude and untimely habit immediately or realize I may have to engage in an alternative learning task to demonstrate that I have mastered the concepts included in this lesson and provide evidence of self-responsibility and self-control.

Figure 17 - Notification Sheet-Warning

I perhaps do not realize it, but I am engaging in a behavior that is not in my best interest. The teacher has the responsibility to provide opportunities for me to learn and to expect achievement from me. I will pay attention to the assigned task immediately or realize that I may have to engage in an additional activity that may take longer than what is required of my classmates who are paying attention at this time.

Figure 18 - Notification Sheet-Action

I have chosen to ignore the written warning of the first notification sheet. Disregard for the first warning shows immaturity and rudeness that will not be tolerated. Therefore, I will bring this paper to my teacher at the end of the class period, or earlier if appropriate, so that he/she can circle a consequence for my action.

1. An additional assignment of _____
2. Meeting with teacher before or after school.
3. Written plan of how I plan to improve my behavior and why improvement is necessary.
4. Conference with my teacher and parents on _____(date) and _____ (time).

_____
Signature

P.S. Proper manners and conduct will make me a more pleasant person and will benefit me in gaining friends and future employment.

Parental involvement.

One consequence for a broken rule may be to have a student call his/her parents and explain what has happened and why he/she must remain after school. When the student makes the phone call, the teacher should be there to be certain he/she is telling what actually happened. This may be sufficient to stop the disruptive behavior.

If behavior problems continue, enlist parental help. Call the parents to let them know what is happening and ask for suggestions regarding possible management strategies. Continue communicating with the parents regarding student class progress. Call home, send notes, and have periodic conferences. Parents may be able to offer the support needed to motivate the student to change his/her behavior.

If parents say that it is difficult for them to manage behavior at home, suggest getting help from a professional guidance counselor or psychologist. Meet as a team on a regular basis to try out strategies at home and at school and determine those that seem to work best for the particular student.

In-school suspension.

The most restrictive consequence to be suggested at the corrective level is in-school suspension. Students are assigned to a special room set up for this purpose. While there, students must keep up with

their regular classroom assignments. This offers a means through which the misbehaving student may be dismissed temporarily from the regular classroom. The plan is designed to keep students in school. Assignments are given by the student's teacher(s) commensurate with that of their classmates. The in-school suspension teacher assists the student if there are questions about the assigned work.

The student is assigned to in-school suspension for one to three days. Parents are notified immediately. While under this plan, students are restricted to the in-school suspension room for the entire day with only brief trips to the bathroom. Lunch is eaten individually, and contact with other students is strictly limited. In using this procedure, care should be taken that suspensions are being administered consistently and fairly.

The teacher, as the instructional leader, is the authority in the classroom and must conduct himself/herself accordingly. If misbehavior is not addressed, one can expect the incidences to increase.

Among the most important elements in the discipline process are: a) a feeling of trust that your decisions are for the good of the group and not capricious or arbitrary, b) a feeling of confidence of the group so that they know what to expect, c) acceptance of you as the person responsible for the learning in the classroom and confidence that each day will provide meaningful learning.

The general plan is to establish rules by which the school and classroom must operate. These rules are directed toward observable student behavior and are clearly communicated to the students. Consequences are developed which are imposed on students who break the rules, with the severity of the consequence increasing if rule violations are repeated. This aspect of the management plan is designed to control undesirable behavior and to clearly communicate to students specific unacceptable behaviors.

The effective disciplinarian is a good listener and expresses empathy with students but also establishes limits and carries out consequences. He/she avoids power struggles and punishment and, if necessary, is consistent in using time-out, notification sheets, logical consequences, and in-school suspension.

Adaptive Measures

Adaptive measures take on two forms. One is the accommodation of the educational environment for those students who have special physical, emotional, or learning needs. Suggestions in this category are the essence of this publication. We cannot overemphasize the importance of the teachers' role in presenting every student with a learning environment in which he/she can have a successful learning experience if the student gives forth a full scale effort to equilibrate. Although absolute attainment cannot always be accomplished, it is important that students feel a sense of growth when engaging in the learning process. We must always keep in mind that persistence in adults results through high levels of perceived success in childhood.

However, some students may elect to engage in behaviors that are not conducive to their learning. As with all strategies, no one approach is successful with all students, particularly the highly aggressive ones. Despite using the techniques suggested within the previous levels in The Cascade Model, chances are that a few students will continue to be consistently disruptive and frequently break classroom rules. Students with intensive behavioral problems require an individualized discipline plan with intensive monitoring.

Adaptive discipline emphasizes individualizing the corrective process for students when all other techniques have failed. It includes a process of incremental steps using behavior management techniques, contracts, and tangible rewards to reinforce desirable behavior. This procedure is used with students who choose to engage in deviant behavior or those students who need special support to help them acquire an acceptable behavior pattern at school. It utilizes a reinforcement system drawing heavily from behavioral psychology and is highly structured with a carefully designed, systematic plan for dealing with disruptive classroom behavior or refusal to participate in learning activities.

In any plan the importance of becoming familiar with a process, thinking it through, and then enlisting the support of the learner is critical in the adaptive management process. The following steps can be used as a guide:

1. Identify the behavior pattern(s) you want to encourage and any behaviors which you perceive as dehabilitating to the learning process for the student and/or others in the classroom.

2. Talk with the student to develop a value judgement about the behaviors and a plan to eliminate the negative behaviors and increase the positive behaviors.

3. Obtain the student's commitment and offer a reinforcement if a certain success level is met. Establish easily attainable levels at first and increase expectations after the student has had several successful outcomes.

4. Do not tolerate excuses. Simply replan and readjust if necessary; do not punish or impose consequences.

The role of the teacher is to provide a context of learning in which there is a high likelihood that the student can achieve success, to work with the student to generate a commitment, and to encourage and support the student when good choices are made.

In effective schools, students are afforded due process like that offered by the judicial system in a democratic society. The process carries out a sequential series of successively more restrictive alternatives until behavior is under control. Sometimes in a democratic society it is necessary to incarcerate or restrict individuals who behave in ways which interfere with opportunities for others to live their daily lives in safety and security. Likewise, in classrooms, teachers need mechanisms for establishing order. At times they will need the power to remove a source of conflict which serves to interfere with the delivery of positive learning experiences for students who are attending school to learn. So, in extreme cases, it is suggested that students who have exhibited defiant, non-compliant, or disruptive behavior be removed from the regular classroom and sent to an alternative classroom or residential school.

The Baseline Period

Determining targeted behaviors.

This process begins with the teacher determining the target behavior. Questions like "What do you want the student to change?" and "Why is this change necessary?" should be examined. It is important that the target behavior focuses on the need to remediate a behavior, not on an inadequacy within an individual. Only one or two behaviors should be concentrated on at a time to prevent frustration and rebellion.

When choosing a behavior to focus on, the teacher should choose one with a high likelihood of success for modification. Success is necessary because at the earliest stage gaining student compliance is most important. The primary goal is to obtain a sense of self-responsibility on the student's part. To build this attitude, success is essential. Success builds confidence, generates trust, and improves self-concept.

Some specific disruptive behaviors that can be modified are:

1. Not being seated (when he/she is supposed to be)

2. Whispering (when everyone is to be quiet)

3. Laughing or snickering at people

4. Talking out of turn or using unacceptable language

5. Excessively loud coughing, hiccuping, burping, mumbling, or knuckle cracking.

It's also important for a teacher to consider some of the passive and/or resistive behaviors that can be modified. Students should learn self-responsibility for their own growth as well as considering the needs of others. Among some passive and resistive behaviors that can be modified are:

1. Not completing assignments
2. Forgetting supplies and/or homework
3. Excessive daydreaming
4. Not following directions

Collecting and examining the data.

After the teacher determines the targeted behavior(s), the teacher should take a baseline count to determine the frequency of that behavior to measure the number of times the behavior occurs. This baseline data can be collected in several ways depending on a teacher's preference. It should be collected for at least a week to determine the actual frequency of the behavior.

The Conference

The plan continues as the teacher holds a conference with the disruptive student. Holding a private conference allows the student to save face.

Talking with the student.

The teacher's role during the conference is to talk with the student and indicate a concern and a desire to be a helpful, supportive adult. The teacher attempts to develop a trust relationship by emphasizing the good qualities and worth of the individual while demonstrating a firm intolerance of specific undesired behaviors. The focus is on the present and how unacceptable behavior can be altered.

Positive confrontations are provided as the teacher and student discuss the problem. The student is allowed to express himself without being blamed for the inappropriate behavior. However, the student is encouraged to realize that s/he must take the responsibility for his/her own behavior in class and in the learning process. It's important for the teacher to let the student know what is acceptable behavior. The teacher should discuss behaviors, not feelings, and force a value judgment of appropriate and inappropriate behaviors.

The following items should be discussed during the conference:

1. What behavior should be changed?
2. Why is this change necessary?
3. What does the baseline data show about the frequency of the behavior?
4. What are the expected, appropriate behaviors?
5. What will happen if the student behaves in the expected, appropriate way (the reward)?

Developing a contract.

Once the appropriate behavior has been delineated, the teacher should plan a written contract with the student using specific rewards. The student is asked to offer information about what he/she would like to do. Perhaps he/she would like free time to pursue an area of interest or receive tangible items such as a poster. Care must be taken to assure that the event or item selected is reinforcing to the

student. These free time activities or tangible items are used to reward the student for using the appropriate behavior instead of the targeted disruptive behavior.

Figure 19 is an example of a student contract.

Figure 19 - Student Contract

I, Mike Brown, do hereby agree on this 9th day of February to the following terms: I will received 1 point for each 15 minute period in which I don't interrupt. For every 20 points I earn, I will receive 5 minutes of free time to build a model car. Points are earned for not interrupting.

Signed: _____ Signed: _____
Teacher Student

Using a contract puts the responsibility of the behavior on the student while promoting self-confidence. Students are responsible for their own behavior as they make choices to behave appropriately or inappropriately and must accept the consequences of their choices. In using rewards, it is hoped that tangible items and reinforcing events will give way to the satisfaction derived from succeeding and that learning will become self-rewarding.

The sample contract offered here is a performance agreement between the student and the teacher and is directed toward improving the targeted behavior. The student is involved in how it will work and what the reward will be. The contract is made for a week, and the accompanying data sheet is evaluated daily. The data sheet should begin with small increments that help students achieve success quickly. Gradually these small increments can be increased.

When the teacher and the student have agreed to the stipulations in the contract, both parties sign it. In signing this "official" contract, the student is alerted to responsibility for his behavior.

Monitoring the Behavior

Data should continue to be collected while the reinforcement plan is being used and after it is discontinued to determine the degree of progress (or regression). Unlike the data collected during the baseline period to determine the frequency of the undesirable behavior, the data collected after signing the contract should determine the frequency of the desirable behavior. The desired behavior should be built through a series of small incremental steps rather than large leaps.

If the contracted task is not accomplished, the time frame may need to be adjusted. For some students, it is easier to accomplish a difficult task in the morning. For others, the afternoon may prove more effective. Although classroom contracts may be adjusted, excuses are not accepted. Punishment should not be imposed. The student and teacher should continue to work together to find the best means of increasing the desired behavior.

If, despite the implementation of the contract and reward system, the student's disruptive behavior is not diminishing, it may be that he/she is reinforced by receiving attention from peers. To encourage help from the class, set up a class reward such as a popcorn party or a special time to interact with peers.

When the student does succeed, the teacher should be sure to reinforce the accomplishment. Success stimulates commitment.

Sample Narrative

In discussing a student's problem, the teacher is an active listener. The decision-making process should involve the student and lead to self-management. The teacher helps the student achieve the goal by helping him realize that actions involve consequences and that he can change actions to become a more productive human being.

The dialogue with a problem student may run as follows:*

Day 1
"Ed, do you know why you're here?"
"No."
"I've been watching you for the last week. How many times do you think you have interrupted this class?"
"I don't know."
"Well, I've been keeping track of how many times you interrupted this class during the past week. This data shows that you interrupted 76 times. Did you realize that?"
"No. Seventy-six times?"
"What we're going to have to do, Ed, is to come up with something that will reduce the number of times you interrupt the class! When you constantly interrupt, you are making it hard for other people to attend to their task. Let's develop a plan. I believe that you're trying to get your driver's license, right?"
"That's right."
"Let's see if we can make a plan to help you decrease your interrupting in class. We'll write a contract. For every class period that you don't interrupt the class, you receive a point. When you have 10 points altogether, I've made arrangements with a driver's education instructor to give you a half hour behind the wheel. How does that sound?"
"Sounds great!"
"I'll write that on this contract...Now you sign here...And I'll sign here."

Day Two
"Ed, you didn't make it. I'll tell you what. Let's try just the first 15 minutes of each class period for not interrupting the class. Do you think that would be better for you?"
"Yes, I'll try."

Day Three
"You made it. You have a total of 3 points from yesterday. All you need is 7 more points and you'll have your driving time. Can you do it?"
"I'll try."

Day Four
"You made it."
"When do I start driving?"
"I've arranged for a driving lesson at 4:00 p.m. Saturday. Will you stick with the contract?"
"Sure will." (Stefanich & Bell, 1987).

Although it is more risky, a social alternative may bring out positive outcomes. This can be carried out through cooperative learning groups, role playing situations, or the use of literature. Again it is important that the teacher engage in preplanning and reflective thought before involving students. The teacher may serve as a facilitator and guide, however the primary goal is to use group processes in developing solutions that alleviate the problem behaviors while maintaining the dignity of the individual. The strategy is to:

1. Bring the problem to the group or cooperative learning groups through a case study, role playing, or selected piece of literature that accentuates the issue at hand.

2. Engage in discussions and brainstorm ideas for addressing the problem.

3. Provide support and encouragement for all students to follow through on the suggestions generated in the plan.

4. If necessary, confront the problem student if the undesirable behavior continues and work to garnish his/her cooperation.

Conference with the student in private and enlist support of other professionals when appropriate. The primary goal is always to gain the cooperation of the student, to maximize supportive actions when acceptable behaviors emerge, and to minimize punitive actions against the student.

A series of more restrictive steps may be needed. Time-out within the classroom and time outside of the classroom under direct supervision can be tried. It may be necessary to consider a class for behavior disordered, an alternative school, or a residential school. A student who remains insubordinate or whose conduct endangers the welfare of others may be suspended or expelled after due process. Evaluate the situation. If the student's disruptive behavior is not improving or is preventing other students from learning, document the behavior, and state your case through the referral process.

Recapping the Main Ideas

Adaptive techniques are used for students who cannot function productively within the previous three levels in The Cascade Model. During this phase the teacher pinpoints a disruptive behavior exhibited by the student, collects and examines data about that behavior, and has a conference with the student. During the conference, the teacher shows the student the data representing the frequency of the undesired behavior, discusses and decides on a more desirable behavior, and writes and signs a contract specifying a reward system for achieving the more desired behavior.

The goal of adaptive techniques is to have the student gradually assume responsibility for his/her own behavior. As the student finds benefits and pleasures derived from learning, he/she can be weaned from extrinsic reinforces. The student who improves in his reading ability will begin to enjoy reading and will no longer need to be rewarded for completing a reading assignment. The student who begins to feel good about participation in a discussion will no longer need check marks to encourage that participation. The student who receives reinforcement from both the teacher and peers for conforming behavior will withdraw his attention-getting comments.

In using these adaptive techniques, persistence is important. The teacher shouldn't give up too easily. Remember that the student probably has had these problems for a long time, and it may take a few months to see any positive changes. If the student doesn't succeed at first, the teacher should keep trying. Since all else has failed in the past, there's nothing to lose.

Management Profile

The primary tool for the implementation of the principles included in the Cascade Model is the Management Profile contained in Appendix A and point total summary contained in Appendix B. The tool can be used by a classroom teacher for planning and/or self-reflection, by a collaborative team in assessing an overall management strategy, by an administrator as an assessment tool, or by a supportive teacher peer willing to conduct an external assessment.

The tool works best when two or more assessments are graphed on the same profile and compared. In a self-assessment the entries could be, "What I perceive as my current management practices" to "What I would consider to be the ideal management profile for me." Multiple perspectives can be obtained by including the input of an external observer and comparing his/her perceptions with yours. Areas where there are discrepancies can be discussed and sometimes targeted as goals for self-improvement. Awareness is often a critical first step in improving instructional practice and the management profile can be a valuable tool in the process.

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Chapter 9
Assistive Technologies, Safety & Accessibility

Greg Stefanich, William Callahan, & Charles Johnson

The information in this chapter will improve awareness about assistive technologies and their importance, provide information on physical accommodations to allow classroom participation of individuals with significant physical impairments, give suggestions for assistive technology screening that involves the student and other participants in the Individual Educational Plan, and share information about safety and accessibility including a science safety checklist and general accessibility checklist. It will also address ways that recent and ongoing advances in technology have made science learning through direct engagement possible for persons with physical disabilities in many instances.

Universal Design Principles

It is important that science teachers become active participants in the planning and organization of space and materials to allow for maximum access and participation of all students. The principles of universal design challenge all responsible persons to design products, environments, services, and resources to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design. Most persons with architectural or administrative backgrounds are not familiar with the daily operation of a science laboratory or science classroom. Typically their designs are made for the average able-bodied user. The implications of inattentiveness at the outset, frequently require major accommodations when a student with a significant disability or health impairment is placed in science classes, particularly those with a major laboratory component. On the other hand, when universal design principles are considered during new construction or remodeling, the necessary facility modifications can usually minimal, even for persons with severe disabilities.

In examining the learning environment attention should be given to equitable use – identical when possible-equivalent when not. Consider persons with physical challenges, sensory impairments, and cognitive limitations. Whenever possible the student should be able to gain independent access to the materials and work space.

The following seven principles should be applied to evaluate existing designs, guide the design process and educate both designers and educators about the characteristics of more usable products and environments (Connell, B., et. al., 2000).

1. Principle One: Equitable Use
   The design is useful and marketable to people with diverse abilities.
   - Provide the same means of use for all users: identical whenever possible; equivalent when not.
   - Avoid segregating or stigmatizing any users.
   - Provisions for privacy, security, and safety should be equally available to all users.
   - Make the design appealing to all users.
2. Principle Two: Flexibility in Use
   The design accommodates a wide range of individual preferences and abilities.
   - Provide choice in methods of use.
   - Accommodate right- or left-handed access and use.
   - Facilitate the user's accuracy and precision.
   - Provide adaptability to the user's pace.
3. Principle Three: Simple and Intuitive
   Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.
   - Eliminate unnecessary complexity.
   - Be consistent with user expectations and intuition.
   - Accommodate a wide range of literacy and language skills.

- Arrange information consistent with its importance.
- Provide effective prompting and feedback during and after task completion.

4. Principle Four: Perceptible Information
   The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.
   - Use different modes (pictorial, verbal, tactile for redundant presentation of essential information.
   - Provide adequate contrast between essential information and its surroundings.
   - Maximize "legibility" of essential information.
   - Differentiate elements in ways that can be described (i.e., make it easy to give instructions or directions).
   - Provide compatibility with a variety of techniques or devices used by people with sensory limitations.
5. Principle Five: Tolerance for Error
   The design minimizes hazards and the adverse consequences of accidental or unintended actions.
   - Arrange elements to minimize hazards and errors; the most used elements are most accessible; hazardous elements are eliminated, isolated, or shielded.
   - Provide warnings of hazards and errors.
   - Provide fail safe features.
   - Discourage unconscious action in tasks that require vigilance.
6. Principle Six: Low Physical Effort
   The design can be used efficiently and comfortably and with a minimum of fatigue.
   - Allow user to maintain a neutral body position.
   - Use reasonable operating forces.
   - Minimize repetitive actions.
   - Minimize sustained physical effort.
7. Principle Seven: Size and Space for Approach and Use
   Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility.
   - Provide a clear line of sight to important elements for any seated or standing user.
   - Make reach to all components comfortable for any seated or standing user.
   - Accommodate variations in hand and grip size.
   - Provide adequate space for the use of assistive devices or personal assistance.

Architectural accessibility is an important consideration in accommodating students with disabilities in your classroom. Most school buildings have already been made accessible. However, science labs have seldom been made fully accessible. Also consider things like whether visually impaired students can read exit or warning signs, and whether steps and floors have non-slip surfaces. These are not only important in making your classroom or lab convenient and accessible for persons with disabilities, but are often important safety factors, too

General Considerations

The 1997 Individuals with Disabilities Education Act (IDEA) mandates the inclusion of students with disabilities in school programming. All science classrooms should be built to accommodate every student. It is illegal to restrict any student with a disability to a different facility. There is ample evidence to indicate that laboratory experiences greatly enhance science learning, therefore laboratory participation is essential in providing students with disabilities an equal opportunity to learn.

Still, students with disabilities constantly face barriers to participating in science. Stereotypical attitudes have historically prevented students with severe disabilities from active laboratory participation and have limited almost all but the most vigorous students with disabilities from the full scope of science experiences appropriate for their abilities and interests. Yet, this hands-on participation is what can help all students attain a normal part of developmental readiness—the transition through

concrete operational thought. Appropriate concrete experiences are critical aspects of schema construction, as are opportunities to apply new learning to unfamiliar challenges.

Scientists and engineers with physical disabilities invariably talk about advisement, counseling, and administrative efforts to steer them away from the laboratory sciences and towards vocational choices involving human services or trade professions. Although there is no evidence to support an increased rate of injury in students with disabilities, advisors and science teachers have concerns about safety and reservations about of students with disabilities participating in the laboratory sciences. The skepticism becomes more pronounced as students progress through the grades into secondary schools. Staff in disability services from higher education can often provide guidance concerning available assistive technologies for general classes but, usually have no familiarity with laboratory accommodations, particularly in specialized science laboratories.

How can students with disabilities have science classes and laboratory experiences that meet their needs? The Department of Justice enforces guidelines for applying the ADA in the Americans for Disabilities Act Accessibility Guidelines for Building and Facilities (ADAAG). However, some interpretation is needed because the guidelines are not specific to science. The ADA requires that existing deficiencies be corrected as each area of the building is renovated. Every area of the school used by any student must have access for physically disabled persons. ADA requires that one sink in each laboratory be in compliance with its guidelines.

In addition, computer-based technology has done much to improve information access for persons with disabilities. Experiment simulation programs and laboratory systems, where measurements are made through a computer, are becoming more commonplace. Other devices and instruments are emerging to help students communicate and use a computer such as dictation programs, alternative keyboards, voice output, infrared sensitive receptors, etc. However, regardless of how realistic the experience is to the informed learner, it is insufficient in meeting the needs of most learners. While these are tremendous aids, they are not sufficient alone to meet the needs of students with disabilities.

Assistance for adapting science classes and lab space can also be found in the 1988 Technology-Related Assistance Act and its 1993 amendments. These provide federal funding to help states establish programs to promote the provision of technology-related assistance. For more information visit web sites for RESNA, DO-IT (Disabilities Opportunities, Interworking and Technology), EASI (Equal Access to Software and Information), and Closing the Gap.

A standing committee of the American Chemical Society, active since the mid-1970s, has also endeavored to provide assistance to make laboratories and workspaces for scientists with disabilities more accessible. The following information has been extracted with minor modifications from a modern graph titled Teaching Chemistry to Students With Disabilities (Kucera, 1993):

> Laboratory experience is essential for students of an experimental science, and the student with a disability is no exception. Some disabilities may restrict the student's laboratory activities more than others, and the level of involvement desirable and necessary must be determined through discussion with the student on an individual basis. However, students whose efforts in the laboratory are sharply restricted by a disability are not necessarily barred from careers involving laboratory work. Many successful scientists with disabilities direct experimental programs without the need to perform laboratory manipulations themselves. Many persons in science and engineering with disabilities work in the lab in the same manner as scientists who do not have a disability, with few or no special accommodations. With technology advances there are devices such as probes or robotics that can manipulate materials to allow active participation even for individuals with limited motor capabilities.

Certain general considerations apply to all students with disabilities entering a laboratory course. It is important, for example, to involve the laboratory instructor from the beginning. The teacher can do this by scheduling a conference with the instructor and the student before lab work begins and by seeing to it that the two remain in regular contact. It is customary in some lab courses to pair students as

partners or to work collaboratively in groups. In this case, it is important to help the student locate a congenial lab partner or group and to check occasionally to be sure everything is working well. In certain situations, hiring a full-time laboratory assistant enables the student with a disability to gain the most educational experience. The student and the instructor would jointly select the lab assistant.

If a student needs extra time to complete a lab assignment, the teacher should try to be flexible. A student might attend an additional lab section during the week or start early or stay late in the regular section. It is best that the student and teacher agree on a reasonable amount of extra time so that time does not become an issue when the student's work is evaluated.

Some physical modifications in the lab might be necessary. They are discussed below in regarding specific types of disabilities. Whatever modifications are desired may require ingenuity on the part of the small school or department with limited resources.

Students with Mobility Impairments

The student with impaired mobility needs easy access to equipment including computers, materials, safety devices, and other services such as restrooms, ramps, elevators and telephones, and accessible doors and exits. The student also needs enough aisle space to permit lateral movement and maneuverability. Positioning a wheelchair parallel to the lab bench and fume hood is generally restrictive, although some students prefer it. Ideally, a workbench should have an opening underneath which allows a student using a wheelchair to be closer to the work surface.

Every teaching laboratory should have at least one adapted workstation. The basic requirements for a laboratory work station for a student in a wheelchair have been described. Briefly, they are:

- Work surface 30 inches from floor
- 29-inch clearance beneath the top to a depth of at least 20 inches and a minimum width of 36 inches to allow leg space for the seated individual
- Utility and equipment controls within easy reach
- Clear aisle width sufficient to maneuver a wheelchair; recommended aisle width is 42 to 48 inches

If the aisles in the lab/classroom are too narrow, portable workstations are available with lowered decks and modified control access (i.e. push button or electronic) to accommodate students with limited mobility. These stations may be equipped with water, gas, electrical power, and sockets for apparatus rods.

Laboratory Sinks ADAAG Guidelines specify a sink depth of no more than 6 inches with a rim height maximum of 34 inches, vertical knee space of 27 inches, and knee width of 30 inches. There must be lever controlled faucets or a similar alternative. Controls should not require tight grasping, pinching, twisting of the wrist, or exerting more than five pounds of force to operate.

Fume Hoods Maximum height and knee space requirements for fume hoods are the same as for sinks. In most cases, this will require the purchase of portable fume hoods that meet ADA Guidelines. These are available with ducts or ductless. (i.e. www.aircleansystems.com)

Safety Showers and Eyewashes Standard eyewash systems are generally mounted too high for access by students in wheelchairs. The stations must be modified, generally to 32-34 inches to accommodate a student in a wheelchair. If there is a second eyewash in the room, it may be at standard height.

Other adaptations Wall cabinets, table tops, and shelving should be examined for sharp corners. Supplies students use should be accessible to the student with disabilities at a suitable height and easy access without stretching. Federal guidelines have been forwarded for students aged 12 and under, but these are not yet enforceable. The key factor to remember is that accessibility for students with disabilities is mandatory.

Another alternative for setting up a lab station, if the student can transfer from the wheelchair, is to design a more maneuverable chair for use in the lab only. A modified chair can often permit good mobility around the lab, increased mobility at the bench, and increased accessibility to the bench top. Supplies and equipment can be moved around the lab on the chair-and-platform device, which provides a flat, steady surface. The adjustable-height wheelchair may include a tray that can be snapped onto the chair's arms to carry equipment such as flasks and crucibles, leaving both hands free to operate the chair. Mobility and accessibility at the bench can also be enhanced by constructing a platform to raise the student to a height more compatible with the height of the bench top and by modifications to the bench itself, such as pull-out shelves.

One chemist who uses a wheelchair performs most experiments on a standard vacuum rack. This 22-inch high, 12-inch deep workspace provides the vertical access required by a seated individual for doing titrations, distillations, and column chromatography (41). Another piece of readily available adjustable table top can be obtained using the adjustable serving tables used in hospitals. They can easily be rolled out of the way when not needed for instructional use, and the table can be prepared in advance to reduce set up time for the student with a disability.

The laboratory as a whole can be made more accessible to students with impaired mobility by making various modifications:

- Adjustable-height storage units and special-equipment work space
- Pull-out or drop-leaf shelves or counter tops for auxiliary use; for example, shelves at lap-board height for holding instruments to be used by students in wheelchairs
- Single-action lever controls or blade-type handles rather than knobs for students with impaired manual dexterity
- Flexible connections to electrical, water, and gas lines for students with limited reach (i.e., in a wheelchair)
- Alternative means of storage, such as a portable Lazy Susan or a storage cabinet on casters
- Use of low-tech occupational therapy equipment and devices fashioned for ADL (Activities for Daily Living) and independent activity in the home.

Students whose disabilities affect the use of both upper and lower limbs may need an assistant to perform experiments under the student's direction. The student should be able to observe the data acquisition as well as direct the experiment. This approach for the quadriplegic student is much the same as that described for the student who is visually impaired.

The above provisions for making a laboratory more accessible to students with impaired mobility have been used successfully by various disabled scientists. Again, however, students' needs tend to be individualized, so accommodations are best considered on a student-by-student basis.

Information Sources

Title II of the ADA requires public schools to comply with either the ADAAG (Americans With Disability Act Accessibility Guidelines) or the Uniform Federal Accessibility Guidelines (UFAS). Independent schools must follow ADAAG requirements.

For help in applying ADAAG regulations to specific design issues, contact the Justice Department's technical assistance hot line at 1-800-514-0301. The web site is http://www.usdoj.gov/crt/ada/adahom1.htm. Also consult the state ADA accessibility office to determine state requirements.

Information is also available from the Office of Technical and Information Services, Architectural and Transportation Barriers Compliance Board (also known as the Access Board), 1331 F Street, NW, Suite 1000, Washington, DC 20004-1111, Telephone: 1-800-872-2253 or 202-272-5434. Documents can be accessed at www.access-board.gov/.

Publications are available, including

- A publications checklist (Document G-08)
- The *Uniform Federal Accessibility Standards* (UFAS) (Document S-04)
- Title III of the ADA, with the latest requirements from the Justice Department on the ADAAG (28 CFR 36, Appendix A; Document S-14)

An updated reprint of the *Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities* (ADAAG) (36 CFR 1191, Appendix A; Document S-08; Document S-30 for children's guidelines only).

Students with Impaired Vision

Many students with severe visual disabilities have mastered laboratory work. Blind students who have been accommodated in the laboratory testify that the work is not only educational, but enjoyable; for them, the hands-on experience was vital. Some students with impaired vision have completed laboratory sessions, possibly using only a magnifying glass or relying informally on a partner or nearby classmate to read numbers or confirm observations. Other students with impaired vision require more help. The degree of disability determines the policy to be adopted. Computer-interfaced devices are one way to provide an intermediate level of accommodation that allows blind students to work in the laboratory more independently.

Some students who are visually impaired may require a full-time laboratory assistant. In schools that allow or use the lab partner system, the instructor should assist the student in finding a suitable partner. The assistant should not be taking the course simultaneously, but it is useful to have someone who has taken the course previously and knows the equipment and terminology. The student does the thinking and directs the assistant to give a response. It is helpful for the student to have the opportunity before or during the lab session to feel and visualize how the equipment is set up. The student should be encouraged to be as independent as possible. In some cases, it may be necessary for the assistant to manipulate the equipment. The instructor should confirm that the assistant functions properly. When questions arise the student should take them up directly with the instructor, not through the assistant, and vice versa.

Blind students negotiate best in familiar surroundings. Even though they may never need to visit remote parts of the laboratory, they should familiarize themselves with the entire setting. A short time with the lab instructor locating sinks, reagent shelves, hoods, safety showers, and the like will orient the student and help to determine the best place to work. The student will find the exits, learn the bench configurations, memorize the positions of the utilities, and so forth. The laboratory becomes familiar and comfortable. This orientation session can also be used to explain the safety rules and outline fire drill and other procedures. It is also the time to explain what locations in the laboratory pose the greatest potential hazards.

Blind students who have guide dogs may decide not to take them into the laboratory. A small office nearby or an out-of-the way spot at the far end of the balance room might be an ideal place to leave a dog. Guide dogs are obedient and accustomed to waiting.

Students with partially impaired vision may require no special laboratory assistance at all. One lab station may be better than another because the lighting is better, for example. Some students with partial sight may need larger letters on reagent bottles, a magnifying glass to read burettes, or a larger notebook than prescribed for the course. Such requirements are easily met; usually the student takes care of them.

The development of special equipment to facilitate laboratory work for students with impaired vision is a relatively new area of research, but progress is being made rapidly. References to such equipment can be located easily on the Internet or through science organizations such as AAAS or NSTA. Examples of equipment now available include:

- Voltmeters and multimeters with audible readout
- Talking thermometer
- Light probes (used as part of readout devices; it emits a tone that increases in pitch proportionally to changes in light intensity)
- Liquid-level indicators
- pH meter
- Talking balance
- Spectroscope
- Electronic calculators with Braille printout
- Braille labelers
- Braille rulers and meter sticks
- Braille thermometer
- Laboratory glassware with raised numbers
- Sandpaper labeling for hazardous chemicals
- Spoons with sliding covers
- Electronic calculators with both voice and Braille output
- Microcomputers equipped with interfacing cards to control a variety of instruments

Students with Impaired Hearing

Unlike visual and orthopedic disabilities, impaired hearing is not a visible disability unless one sees the student wearing a hearing aid or using sign language. Some deaf students do not speak at all. In general, impaired hearing has little effect on the ability to work in a laboratory setting. Except for the installation of visual warnings in addition to normal audible warnings, and emphasis on good communications, students who are deaf or hard of hearing have few special needs in a science laboratory.

Students who are deaf sometimes face a social barrier in that deafness impedes communication with other students. The teacher can assist in finding a sensitive lab partner or assistant when a partner is needed. Accommodations may be required regarding this positioning of an interpreter to allow concurrent communication. These can usually be worked out through individual consultation.

Duties of Laboratory Assistants

Mathews (2000) listed the following recommendations for responsibilities of laboratory assistants. The amount of assistance may vary from experiment to experiment. The instructor and the student should assess each experiment to determine appropriate assistance.

When assisting a student who cannot physically do the experiment:

1. The assistant will follow the directions given by the laboratory instructor and student they are assisting.
2. The assistant will physically manipulate the lab experiment as needed.
3. The assistant will discuss the procedure with the student before proceeding whenever possible.
4. The assistant will not solve problems for the student.

5. The assistant will permit the student to participate as much as possible in the process.

6. The assistant will not discuss the student's experiment or progress with the instructor or anyone else without the student's presence and permission.

7. The assistant will follow all of the lab safety rules and adhere to all lab policies as outlines in the syllabus, lab manuals and other pertinent written materials.

When assisting a student who cannot write lab notes:

1. The assistant will follow the directions given by the laboratory instructor and student they are assisting.

2. The assistant will write only when the student directs.

3. The assistant will not solve problems for the student.

4. If the assistant does not know how to write a symbol, draw a picture, or write a formula, the student should be prepared to assist.

5. The assistant will not discuss the student's experiment or progress with the instructor or anyone else without the student's presence and permission.

6. The assistant will follow all of the lab safety rules and adhere to all lab policies as outlines in the syllabus, lab manuals and other pertinent written materials.

When assisting a student who cannot see:

1. The assistant will describe the components of the experiment.

2. The assistant will read all printed materials such as directions, labels, charts, etc.

3. The assistant will follow the directions given by the lab instructor and student they are assisting.

4. The assistant will physically manipulate the lab experiment as needed.

5. The assistant will wait for the student's instructions before proceeding whenever possible.

6. The assistant will not solve problems for the student.

7. The assistant will permit the student to participate as much as possible in the process.

8. The assistant will not discuss the student's experiment or progress with the instructor or anyone else without the student's presence and permission.

9. The assistant will follow all of the lab safety rules and adhere to all lab policies as outlines in the syllabus, lab manuals and other pertinent written materials.

Assistive Technology Screening

Plan for maximum flexibility. In considering physical challenges among the things which must be considered are wheelchair access, walking/standing, pushing/pulling, lifting/carrying, balance, gross motor control, fine motor control (grasp/pinch/manipulation), mobility (bending, stooping, movement

and stamina/endurance. Sensory challenges include vision, hearing, touch, smell, taste, and expression. Cognitive impairments include writing, reading, number recognition and computation, learning disabilities, behavioral disabilities, attention deficit disorders, and unique circumstances relating to medication or traumatic brain injury. Just giving attention to the range of individuals that might be students over the life of the instructional space can make the environment more accessible and enjoyable for everyone. In general, accommodations made with a specific group in mind (i.e. curb cuts, closed captioning) are found to be good for the general population as well.

The inclination so often is to think about costly and major accommodations rather than simple accommodations that can provide equitable and flexible access. Communication with the individual, drawing upon the intuition and ideas of all parties, can often address an inconvenience or accessibility issue with minimal cost. Think about the range of abilities, experiences, and language skills through the eyes of the learners when planning instruction.

Providing information access in a variety of formats can improve accessibility and accommodate for differences in learning styles and learning preferences. Whenever possible, think about making the same information accessible in a variety of formats (i.e. pictorial, textual, computing, tactile); redundancy is an admirable attribute of effective classroom instruction.

Review the following list of challenges, interventions and modifications as a beginning point in assistive instructional screening. Use the information in Table 4 in conjunction with the Assistive Technology Screening Guide found in Appendix C (modified from Assistive Technology Screening (2000). Always remember the best alternative is often to go through and review with the student or, if necessary, an appropriate mentor to determine which modifications might best fit the learning needs of the individual.

Table 4
Challenges, Interventions, and Modifications Relating to Assistive Technology Screening

Physical Challenges	Sensory Challenges	Access to Materials & Equipment
lifting/carrying stamina/endurance push/pulling kneel/squat reaching repetitive tasks fine motor: pinch/grasp fine motor: manipulate/maneuver gross motor: sit in chair walking/standing balance bend/twist stoop/crouch other	vision hearing touch smell taste oral communication temperature fumes external stimuli other	place keepers, tracker, pointers manipulatives (blocks, counters, magnetic letter, etc.) pencil grips highlighters for underlining templates and/or graph paper rubber or latex gloves (be aware of allergies) non-slip floor surfaces, non-slip mats computer/word processor (in classroom or lab) plastic labware safety goggles hearing aide Braille writer auditory trainer augmentative communication device electronic switch access tape recorder personal alarm alarm system which responds to those with sensory deficits sensors and accessories
Cognitive Challenges	**Instructional Interventions**	**Environmental Adjustments**
short term memory long term memory task complexity reading writing spelling string of #'s (math) attention span student learning style self-esteem advocacy issues behavior issues/acting out other	untimed assignments oral administration of tests use of large print use of a word bank short answers accepted for lengthy essay project accepted for major written assignments teacher or assistant records answers when given orally supply copies of notes instructions given in Braille direct instruction generalization instruction maintenance instruction	proximity seating small group instruction study carrel available interpreter instructional assistant
Curricular Modification	**Scheduling Modifications**	
textbooks on tape textbooks in Braille adjustment in performance criteria use of a competency checklist modified text	academics scheduled at appropriate times for student scheduled breaks testing done at the time of day beneficial to the student accessibility to laboratories after school hours	

Assistive Technology Resources

Closing the Gap provides a comprehensive list of assistive technology devices accessible from the Internet (Closing the Gap, 2000). A check on the web done on 3/6/01 yielded the following options.

TABLE 5

Device Type	
Alternative keyboard – 92 options	Braille output – 54 options
Braille input – 15 options	Dedicated communicator – 61 options
Game port input – 1 option	Environmental control – 67 options
Keyboard emulator – 18 options	Large print display – 32 options
Keyguard – 38 options	Printer – 49 options
Optical character recognition – 22 options	Speech output – 390 options
Switch – 554 options	Modem – 25 options
Voice recognition – 45 options	Speech trainer – 21 options
Mouse emulator – 63 options	Switch interface – 47 options

Disability	Computer
Hearing – 189 options	Apple II series – 154 options
Learning – 789 options	PC – 1012 options
Cognitive – 676 options	Macintosh – 690 options
Physical – 685 options	
Speech – 678 options	

Each option is followed with a short description of the device and its use. The description includes technical information, address of vendor, and approximate costs. There are additional lists that provide information about the manufacturers and their products.

Most individuals with disabilities can engage in 2-way communication if sufficient effort is made to obtain an appropriate assistive technology. A few categories and short descriptions are listed, taken from the website of the University of Washington Adaptive Technology Laboratory (University Adaptive Technology Lab, 2000) to provide you with an awareness of some common assistive devices.

ALTERNATIVE INPUT

HeadMaster (Prentke Romich Company) and HeadMouse (Origin Instruments) allow hands-free operation of a Macintosh or PC (HeadMouse only). A light-weight headset (HeadMaster) or a reflective dot worn on the forehead (HeadMouse) translates head movement to the mouse pointer.

The DARCI TOO (WestTest Engineering) and Adap2U (AdapTek Interface) for PC and Kenx (Don Johnston) for Macintosh are alternative input devices that allow switch input control of a computer (via sip and puff, paddle, or jellybean switches). The user can use regular, step, inverse scanning, or Morse code input methods with a variety of switches.

WORD PREDICTION

Co:Writer 2 (Don Johnston), Screen Doors II (Madenta Communications), and Telepathic (Madenta Communications) are word prediction software packages that operate on a Macintosh. They simplify the text entry process, especially when used in conjunction with an alternative input device.

ALTERNATIVE KEYBOARDS

Intellikeys (IntelliTools) is a large programmable keyboard with a variety of overlays designed for individuals with limited fine motor control. Only light pressure is required to activate the keys. Both Macintosh and PC versions are available.

KEYBOARD AIDS

Accessibility Options Control panels (Microsoft), and Easy Access (Apple) are features that assist individuals who, due to mobility impairments, can press only one key at a time. They allow two and three key functions to be accessed by pressing single keys sequentially on the keyboard of a PC. They make it possible to perform mouse functions by pressing single keys on the keyboard.

MOUSE ALTERNATIVES

A Track Ball (Kensington) and GlidePoint Trackpad (Cirque) are pointer alternatives that replace the mouse on a Macintosh or PC.

COMFORT AIDS

A CarpalRest hand rest (Fox Bay Industries), marvel Wrist Support (Office Emporium), and WristAir 2000 (Wristair) provide support in front of the keyboard for those who require extra wrist support while typing. A document holder (Fellowes) helps people with disabilities position documentation so that it is easy to read.

OPTICAL CHARACTER RECOGNITION SCANNING PACKAGE

The Open Book Unbound (Arkenstone) package, installed on a PC, offers powerful document scanning and voice output. Components include a Scanjet IIc Scanner (Hewlett Packard) and a DECTalk (Digital Equipment Corporation) voice synthesizer card. The system uses optical character recognitIon (OCR) technology to convert scanned documents to text that may be saved in a variety of formats.

SCREEN READERS

OutSPOKEN Screen Reader (ALVA Access Group) for Macintosh, and JAWS for Windows 3.0 (Henter-Joyce) allow a visually impaired user to navigate a graphical interface using ovice output and sound cues.

BRAILLE OUTPUT

Index Braille Embosser (Access Systems International) prints PC output in Braille. Duxbury (Duxbury Systems) allows the computer to translate text into Braille format and send it to the Braille embosser.

Navigator Refreshable Braille Display (Telesensory Systems) provides a tactile Braille display of a PC screen, allowing the user to read what is on the screen 40 characters at a time.

BRAILLE NOTETAKER

The Braille'n Speak 640 (Blazie Engineering) is a portable Braille notetaking device with speech output. This small unit contains 640K of active memory and has a built-in spell-checking utility. It can connect to a PC via a serial port for file transfer.

WORD PREDICTION

Inspiration (Inspiration Software) is a brainstorming and writing tool that allows ideas to be represented graphically and converted to outline format. Intellitalk (Intellitools) is a simple talking word processor that can speak letters, words, or sentences through a variety of sound cards. It is available for PC and Macintosh platforms. Mathcad (MathSoft) is a program that uses standard math notation to represent problems and graphs, allowing a person who can't use pen and paper to show his or her work.

HEARING PROTECTORS

Hearing Protectors (American Optical Corporation) can be helpful to individuals who are distracted by noise in the facility.

VISUAL CUES FOR COMPUTER SOUNDS

When the sound level is set to zero on a Macintosh, a visual cue is provided as an alternative to sound for the individual with a hearing impairment. Accessibility Options Control Panels for Windows 95 and 98 (Microsoft) include a "Show Sounds" option that blinks the screen or puts a small musical note in the upper left-hand corner of the display whenever the computer makes a sound.

Safety

Science teachers indicate perceptions of widespread concern for safety when working with students with disabilities. In an April 2000 survey of 7-12 science teachers, 59% of the respondents believed that students with disabilities presented an increased safety risk in a laboratory setting (Stefanich, 2000). However, no research evidence has indicated that students with disabilities are at greater risk than other students. Yet, classroom safety is always a concern and it is true that the accident rate of students in school chemistry laboratories is considerably higher than that of the chemical industry. Research into the factors that accompany school accidents indicate accidents happened because of:

- Inadequate or poorly designed working space, overcrowding, and too few workstations
- Teachers with poor course work preparation
- Teachers who are teaching more than two preparations at the same time
- Poor school discipline
- Inadequate safety training

Some teachers fear that students with disabilities may be uncontrollable in the lab, creating a safety hazard for themselves and others. Again, no evidence has indicated that students with disabilities

in the regular classroom are more disruptive on the average than other students. In fact, one advantage of working with students with disabilities is the extra assistance available. If a behavior problem arises, the special education teacher or aide can help find a solution. Of course, continuous disruptive behavior by any student cannot be allowed in the laboratory. For a special education student, a re-evaluation of placement can be requested if necessary. In some cases, it may not be in the student's best interest to be in the regular classroom. However, this should be a rare exception, not a common practice.

Fortunately, the most important strategy for ensuring the safety of students is simply a good safety program! For example, all students should pass each safety test required. Adaptive strategies may be necessary for some student disabilities. This simply means modifying instructions, like giving the safety test orally. This can be done during the lull when others are being tested. The special education teacher can provide other ideas and can often help with adaptations, for example, helping a student in the resource room. For liability purposes, keep all safety tests or checklists on file.

A good safety program requires constant teacher awareness. All students need reminders, especially if they have not recently used a particular piece of equipment. Also, it is imperative to require the use of safety devices, like safety glasses. Discuss emergency communication procedures with the students, outlining the steps in case of an accident. This chapter later includes a list of suggested elements for a good safety program.

With a comprehensive safety program, additional safety adaptations for students with disabilities will be minimal. When a special student is placed in a regular classroom, one needed alteration may be more emphasis on safety. When a group of special students has a maturity level significantly below their age, a separate or organizational laboratory experience outside of regular laboratory times may be needed. In this case, an adjusted safety program can be developed based on student needs. As a beginning point, a Science Safety Inspection Checklist is in Appendix D.

Legal Considerations

The primary function of the school safety program is to prevent accidents. If an accident does occur, it is normally either:

1. Pure accident: An unavoidable accident that could not be foreseen by the student or instructor.

2. Intentional act: An accident intentionally caused.

3. Negligence: An accident resulting from the instructor, students, or a combination acting in a careless manner.

Negligence is a major concern for instructors. To be held liable for negligence, it must be shown that an instructor failed to exercise the care expected of a reasonable and prudent person. Determination of a reasonable and prudent person includes: (1) acting in a manner consistent with that which a person of ordinary intelligence and foresight would act under similar circumstances; and (2) providing care consistent with the danger involved and age and maturity level of the student.

School boards (Maxwell v. Santa Fe Public Schools, 1975) and school districts (Reagh v. San Francisco Unified School district, 1953) have been liable for allowing a lack of proper facilities and mandating curricula where facilities are inadequate. The best protection for the science teacher is to inform his/her superiors about facilities that do not provide a safe working environment. Any of the following factors might result in litigation:

- Inadequate space
- Poor ventilation
- Conditions that lead to poor supervision of students
- Lack of safety eyewashes, safety showers, or alarm systems

- Lack of adequate lighting
- Lack of equipment or chemical storage
- Unsafe electrical outlets (Biehle, Motz, & West, 1999)

The best defense against a charge of negligence is having a good safety program and adhering to it. The courts expect a reasonable and prudent person to account for four areas if an accident occurs: having a plan; following the plan; providing for health and safety; and giving proper instruction. For example, if you are lax about safety glasses and an accident occurs, there would be negligence in following the safety plan. More teachers are found negligent for failing to follow a plan to prevent injuries than for failing to plan and foresee dangers.

Another important consideration in negligence is foreseeability. A reasonable and prudent instructor is expected to foresee potential dangers and take necessary precautions to avoid accidents. For example, if a student is injured while using improperly working equipment, the instructor may be held liable. Another example is making objects in class that can be potentially dangerous outside class. An instructor may be held liable if a student is not warned of this potential danger and given safety instruction. An example might be an electrical tester. If electrical safety is taught and documented, then the instructor has fulfilled his or her obligation.

Many states have a "save-harmless" law that protects employees from financial loss that results from assigned duties. If an instructor is found negligent in a school accident, the school district will usually pay the damages. However, this does not protect the instructor and administrator from being charged with the accident and defending his or her instructional plan in court. This law also does not protect the instructor from damage to personal reputation.

Suggested Safety Program Components

The following components are suggested for a comprehensive safety program:

1. Policy and Objectives
    a. school system policy
    b. lab use policy
    c. program safety objectives
2. Safety Inspections
    a. annual lab safety inspection and recommendations
    b. annual architectural accessibility inspection and recommendations
3. Instruction
    a. general lab safety rules
    b. specific equipment safety rules
4. Evaluation and Documentation
    a. cognitive tests
    b. performance tests
    c. record keeping form for documentation
5. Emergency Action
    a. emergency action procedures (primary and secondary)
    b. parent/guardian communication
    c. accident report form
    d. hazardous conditions report form
    e. tags for non-working equipment
6. Maintenance
    a. maintenance cards for equipment

Suggested Teaching Techniques

1. Be sure that eye protection is worn. Have the students remind each other that safety glasses must be worn.

2. Check out each student on the laboratory apparatuses that he or she is about to use. Review the safety rules from time to time with each student, especially after a vacation or prolonged absence of the student. Be sure to document this instruction review.

3. Check medical records to determine if any special students are subject to seizures, fainting spells, etc. If the teacher finds someone with one of these conditions, that person should be given extra attention while using all equipment.

4. Make students aware of the potential dangers of chemical supplies, glassware, etc.

5. Remind students periodically of the importance of keeping work areas clean and free of hazardous objects.

6. Supervise all students and keep them busy to limit the horseplay. The amount of horseplay from special students will depend on the professional personnel and the rules established for the laboratory

7. Isolate a special student when laboratory rules are violated. However, keep the student separated from the rest of the group no longer than one class period.

8. Assign special students to a lab area and be sure they understand they must stay there.

9. Test a special student's abilities using continual teacher observation and student demonstration. Evaluation should not be limited to tests requiring reading, writing, and comprehension.

10. Make modifications in operations and supplies to promote a higher level of student success while doing laboratory experiments.

11. Communication between teacher and student may be enhanced by using devices that improve reception and expression of information. Amplifying and magnifying stimuli, whether coming in or going out, are important considerations.

12. Individualize the program of instruction as much as possible to modify the instructional method to meet the needs of the student.

13. Plan to reserve a portion of your facility that can be made free from noise, physical stimuli, and visual stimuli. This may help students who are easily distracted by them.

14. Maximize access barriers to sinks, doorways, laboratory solutions, tools, etc.

15. Accept the child as he or she comes to you. Keep in mind that the student's success depends not only on his or her own characteristics and abilities, but also on the teacher's attitude and the quality of the learning environment.

16. Employ the aid of special education resource people on your school staff. These specialists can provide you with valuable information in dealing with the problems of the special needs students in your program.

17. Keep in mind that many special needs students respond very favorably to frequent acknowledgement and positive reinforcement.

18. Encourage heterogeneous grouping in the classroom. Placing the special student in a small group of students with various abilities will provide a model for behavior in a laboratory.

Emergency Action

Emergency situations can arise anywhere in a school. The procedures for dealing with these events should be developed and approved by each district or building before the school year starts. Review and revise these procedures periodically to determine their effectiveness and review appropriate accommodations for moving special needs students.

When an injury occurs.

Two areas of concern arise in emergency situations: 1) activities that must be done immediately following the injury; and 2) the actions to be taken after the confusion has subsided and the injured party is treated.

Primary concerns.

Your first concern relates directly to the injured party and reducing the hazard to that person. The degree of emergency care depends on the injury and the qualifications of the person administering the care. If you are not qualified in first aid, only do the things that will ensure no further damage to the injured student, and immediately seek trained help. Your role might be limited to stopping the bleeding or covering a person in shock with a blanket. Although every teacher should be trained in basic emergency first aid, many are not. Serious damage to the injured can sometimes result when they are treated by a nervous, untrained, panic-stricken teacher. Here are some basic first steps to follow when an injury occurs:

1. Determine the extent and type of injury. If this is not possible, immediately obtain professional help.
2. Restore breathing, restore heartbeat, and stop bleeding if trained in these areas; if not, send for help.
3. Apply only the first aid that is necessary to preserve life. Do no more until trained help arrives.
4. Disperse crowd and keep the injured and the surrounding area as quiet as possible.
5. Ask students to notify school nurse, principal, and immediate supervisor. Do not leave the injured alone.
6. If the injury is minor (splinter, slight cut), send the student to the school nurse accompanied by another student. Do not send the injured student alone.
7. If a foreign particle has entered the eye, seek professional help. A teacher should never try to remove something from a student's eye. If a liquid has entered the eye (acid, etc.), immediately wash the eye in an eye wash and contact the nurse.
8. Notify parents and school officials.

It is your responsibility to know what to do in case of an accident and also to know what not to do. This kind of information is best obtained through a variety of first aid courses offered by the Red Cross and other agencies. The first few seconds or minutes of a pupil's injury are sometimes the most critical. The action or inaction of the science teacher could be crucial to the student's life.

Secondary concerns.

When the injured student has been treated by professional help (nurse, ambulance crew or doctor), the teacher's concerns focus on the remaining students and the follow-up procedures regarding the injury.

1. Calm the other members of the class. Restore the situation to a safe environment. If the accident was serious, discontinue instruction for the period. The students will be too upset to perform effectively and may in fact be "accident prone" due to the accident.

2. Complete an accident report in triplicate; one for the school nurse, one for the principal and immediate supervisor, and one for your permanent file (to be retained until the injured pupil reaches age 21; if the pupil is a special education student, retain permanently).

3. Analyze cause and effect of the accident and make written recommendations to the principal for corrective measures to be taken. Retain a copy of this communication and subsequent action.

4. Review and record safety practices, procedures, instruction, and student evaluation concerning the cognitive, psychomotor, and affective instruction that was delivered and was intended to prevent this type of accident.

5. Check on the treatment results of the injured pupil.

6. Follow-up in your classes with a discussion and instruction regarding the safe practices that were violated and contributed to the accident.

These procedures should also be followed for "almost accidents" to ensure that the conditions that almost caused an accident are treated and eliminated from the class or lab.

Emergency communications.

Procedures established for emergency situations and accidents must contain the approved method of "who tells what to whom and when." To facilitate this communication, have a plan for contacting the nurse, building administrator, ambulance, fire and police emergencies. In addition:

1. All students should be familiar with the emergency procedures and numbers.

2. If there is an accessible outside line, post the emergency procedures and police, ambulance and fire department numbers and the procedure for dialing an "outside" line.

Communicating Safety to Parents

For years, science teachers have sent home "permission slips" to be signed by the parent permitting their child to participate in the field trips. Many teachers believed that this "permission slip" relieved them of some or all of their responsibility and liability should an accident occur. It does neither of these. The purpose of this type of communication is to:

1. Inform the parent of his or her child's participation in out of school activities.

2. Outline the safety instruction and procedures that are followed by the teacher and the district.

3. Obtain from the parent relevant information about health problems that may have a bearing on their child's performance.

4. List the parents' names and telephone number(s) where they can be reached during school hours and list the name of their family doctor.

An example of this type of communication to the parents is included in Figure 20.

Hazardous conditions report.

The form in this chapter is a suggestion for reporting the hazard and directing action to see that the hazard is corrected or removed. If a hazard exists, the operation should be "red tagged" and shut down until corrected. (Note: This form can be used to report a student who is a hazard as well as a hazardous condition in the laboratory.)

Accident reporting.

Any accident that occurs during a science class and in the science laboratory must be reported. This applies to after-school accidents and those during the school day. Any accident, even a slight cut, must be reported since this indicates corrective action that must be taken by the teacher, administrator, or both.

A form for reporting these accidents can be adapted from the one in this chapter. This report should be completed in triplicate: one for the principal, one for the school nurse, and one for your permanent file.

Accident reporting and analysis.

1. Require students to report all accidents to the teacher, regardless of nature or severity.

2. Keep a record of all accidents resulting in injury to students, regardless of nature or severity.

3. Analyze all accident reports to help prevent other accidents.

4. Use your school district's printed or duplicated form to record the details of accidents and forward to the appropriate personnel.

Figure 20
Parent Communication on Laboratory Safety

The Student and Safety in the Science Laboratory

School District
Science Department
School:
Teacher:
To: Parent or Guardian

(Name of Student) is enrolled in our science (specific science) program and will have the opportunity to use various equipment and laboratory apparatus and chemical supplies. Appropriate instruction in the safe operation of the laboratory is given and close supervision is maintained at all times. Although every precaution is taken to prevent accidents, a certain risk is involved due to the nature of the experience, the age of the student, and the learning environment.

We are asking your cooperation in impressing your child with the importance of being careful. We believe this will back up the instruction given in school.

We welcome your visit to our school and the science department to see our program. These visits can be arranged by calling _____.

Thank you very much for your help and assistance in providing your child with the "real world" experience of science in a safe working environment.

I have read the attached communication and I understand the type of program that (student name) is enrolled in. I will stress the safety aspects of this program to my child. I encourage my child to participate fully in this laboratory program.

(Signature of Parent or Guardian)_____ Date_____

Phone_____(Home) _____(Work)

Please identify any health problems which may have a bearing on your child's participation in this class.

I agree to observe all safety rules and procedures for safe operation and conduct in the school science laboratory and will wear approved eye protection at all times in the laboratory in accordance with state law.

(Signature of Student)_____ Date_____

Figure 21

Student Accident Report

To be Completed by Instructor

Student Name_____ Grade_____

Location of Accident_____ Time _____A.M./P.M.

Data of Accident

Description of Injury

_____

_____

_____

Location of Instructor when Accident Occurred _____

Description of How Accident Happened

_____

_____

_____

Indicate Experiment, Apparatus, Chemicals Involved_____

Describe unsafe practices, if any, contributing to accident_____

Suggestions for prevention of similar accident_____

Witness to Accident 1._____
2._____

Instructor's Signature_____ Date_____

Student's Signature_____ Date_____

Note: One copy to be filed with department chairman

Figure 22

Hazardous Conditions Report

Date_____

To_____
(Building Administrator, Position, School)

Description and Location of Health or Safety Hazard:

Suggested Solution:

Teacher Signature_____

Distribution: Original – Building Administrator
1st Copy – Department Chairperson
2nd Copy – Teacher Reporting Hazard
3rd Copy – District Safety Officer

Action Taken:

By Whom:_____
(Signature)

Figure 23

Student Safety Guide Example

Reference: Modified from Industrial and Vocational Education Safety Guide and Safety in the Science Laboratory (Matthews, 2000)

This section of the guide should be readily accessible to all students as active participants in the school safety program. Teachers should encourage suggestions and contributions to this guide as an on-going activity to keep abreast of changing trends in the school.

A Message to Students

You should learn about the procedures, equipment and chemicals to use them with confidence instead of being scared. Don't fake it…learn it! Horseplay in the laboratory is for people who never grow up.

We talk a lot about common sense and why the other person doesn't use it, but in the school laboratory the whole safety program depends on it and that means everyone in the course…no exceptions. It does require involvement by you…the individual student. Do your thing for safety because other students are depending on you.

Student Responsibility

As a student in science you have a responsibility not only to yourself but to the group for safety in the classroom and the laboratory. Teamwork is required for the safety of all members who participate. Don't wait for the next person to correct an unsafe condition…just do it or call it to the attention of your teacher. The following list is your responsibility to your team:

General Safety Rules for all Students

1. Review your experimental procedures and all apparatus you plan to use.
2. Wear appropriate clothing. Always wear an apron when appropriate.
3. Long hair should be confined.
4. Wear shoes at all times to prevent foot injuries.
5. Always wear approved eye protection.
6. Caution any student you see violating any safety rule.
7. Report to the teacher any equipment that does not seem to work properly.
8. Keep equipment and materials from projecting over the edge of benches whenever possible.
9. Keep counter tops clean and cabinet drawers closed.
10. Cooperate with your classmates in the management of your laboratory.
11. Keep floor clean.
12. Wipe up immediately any liquids spilled on floor.
13. Report all injuries to your teacher immediately.
14. Know and practice procedure to follow in case of fire or other disasters.
15. Keep hands and floor area area completely dry.
16. Keep talking to a minimum and keep your mind on your work.

Safety Practices for All Areas

Safety rules vary from one school to another. However, most school laboratories have definite rules and regulations to follow and the teacher has the responsibility to enforce them. A successful safety program results from an understanding by the students of the reasons and the advantages for each rule.

"Basic Eight" Safety Rules

Rule 1. Have the teacher approve all work that you plan to do and all equipment that you plan to use.
a. Protect all class members from accidents caused by careless or incompetent use of equipment and chemicals.
b. Ensure that laboratory equipment and supplies are not abused or misused.

Rule 2. Have the teacher's permission before using any laboratory apparatus.
Reasons:
a. Ensure that each student understands the proper laboratory procedures and can perform them safely.
b. Allow the teacher the opportunity to check the condition of the apparatus.

Rule 3. Always wear approved eye protection whenever anyone is working in the laboratory or wherever eye hazards exist.

Rule 4. Wear clothing suitable for laboratory and always wear your laboratory apron when appropriate.

Rule 5. Make sure that no other student is in your laboratory area.
a. Prevent crowding and bumping.
b. Give the student conducting the experiment complete responsibility in the use of apparatus.

Rule 6. Cooperate with your classmates in the student management of the laboratory.
a. Make sharing in the responsibilities of laboratory management a satisfying experience.
b. Equal distribution of tasks is necessary in maintaining a desirable place to work.

Rule 7. No student is allowed to work in the laboratory unless a qualified science teacher is present.
a. The science teacher is responsible for the personal safety of each student in his or her classroom or laboratory.
b. The safety of the students working would be jeopardized without proper supervision.
c. The professional status and reputation of the teacher would be jeopardized if an accident occurred.

Rule 8. Report all injuries, even though slight, to the teacher immediately.
a. Teacher will determine if treatment is required for the injury. Immediate attention may be given by the teacher.
b. First aid treatment helps prevent minor cuts, abrasions, bruises or burns from becoming infected.
c. Assist teacher in correcting situations to prevent further injuries.

Reference: Students with Disabilities (Matthews, 2000)

There is no reason to assume that students with disabilities will be less careful or will pose a greater hazard than other students in the laboratory. This argument was borne out by a study of 1,4000 employees with disabilities at DuPont. The author commented, "DuPont's experience has proven that disable workers are safe workers."

There is certainly a need to enforce good laboratory practices and sensible safety measures for students. There are many safety suggestions that need to be followed in the laboratory setting; those that follow are just a few that are particularly oriented towards students with disabilities. This is not an attempt to provide a comprehensive discussion on lab safety.

- Give the student with impaired vision an opportunity to become familiar with the lab before the first session. The student can then participate in the safety-orientation program with little trouble and will already know the location of exits, showers, and extinguishers.
- Discuss and resolve individual limitations with the student with impaired vision. Can the student read labels? Are the labels big enough? Consult with the student as to whether there are any operations too risky for the student to handle alone.
- Ensure that reagent containers are labeled clearly and returned to their shelves after each use. These shelves or the materials used for each lab assignment should be readily accessible to the student with a disability.
- Assign the student with impaired mobility to a lab station on an outside aisle and close to an accessible exit, if possible.
- Students, including those with impaired vision or poor manual coordination, are strongly urged to wear rubber gloves when working with harsh chemicals or those readily absorbed by the skin. Disposable, lightweight gloves are available which will allow the student to manipulate equipment.
- All students should wear plastic or rubber aprons when working with chemicals in order to protect their clothing. Students in wheelchairs or those who have no sensory perception in the lower half of the body should be advised of protecting their laps with a heavy rubber apron while working with chemicals.
- Accessible and usable eye washes should be located near the disabled student's work station.
- When a deaf student is working in a lab, it is helpful to have available equipment with lights or other visual means of indicating on/off status, although most equipment can be monitored easily by touch. Alarm systems also should be visual, with flashing lights. Expensive changes to equipment are seldom needed for deaf students. For example, they can feel when a timer sounds if they are holding it or touching it.
- Ideally, combustible gas supplies from gas jets on the benches should contain odorants. Students with hearing impairments may not hear the sound of an open gas jet.
- Lightweight fire extinguishers should be provided for mobility impaired students, but all students should be instructed in the use and limitations of fire extinguishers and in fire drill procedures. Lightweight dry chemical fire extinguishers are often the only kind a mobility impaired student can handle.

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Appendix A
The Cascade Model
Management Profile

Assess your classroom management procedures using characteristics of The Cascade Model. Check the column that best describes your classroom. Add the points for each section. Graph the results on the final page.

SCALE: 1 = rarely 2 = occasionally 3 = usually 4 = always

	Rarely	Occasionally	Usually	Always
	1	2	3	4
I. ORGANIZING THE CLASSROOM				
1. Classroom furniture and materials are rearranged periodically to accommodate different teaching techniques.	___	___	___	___
2. Supplies and resources are easily accessible without interrupting others.	___	___	___	___
3. It is easy to monitor student activities.	___	___	___	___
4. Bulletin boards are neat and frequently changed.	___	___	___	___
5. Storage areas are orderly and well maintained.	___	___	___	___
6. There is private area where a student can work without interruption.	___	___	___	___
				Total points = ___
II. ROUTINES AND PROCEDURES				
1. Students have a clear understanding of acceptable and unacceptable movement in the classroom.	___	___	___	___
2. The teacher models the same behavior desired of the students.	___	___	___	___
3. Students have been pretrained for fire drills, hallway behaviors, lunchroom procedures, and restroom procedures.	___	___	___	___

4. Students are aware of routines relating to completing assignments, handing in assignments, returning assignments, and the consequences of late assignments. ___ ___ ___ ___

5. Students follow appropriate routines in asking questions, responding to questions, small group work, individual work, and self-monitoring. ___ ___ ___ ___

6. Students effectively use the classroom library, obtain passes for work outside the classroom (if necessary), and leave and enter the classroom unobtrusively during the school day. ___ ___ ___ ___

Total points = ___

III. INSTRUCTION

1. Pretesting is used frequently to ascertain previous student learning. ___ ___ ___ ___

2. Students are provided with advanced organizers and lesson objectives before beginning the lesson. ___ ___ ___ ___

3. Large group lectures are limited to 20 minutes. ___ ___ ___ ___

4. Concrete and semi-concrete resources are used frequently. ___ ___ ___ ___

5. Considerable opportunities are provided for independent and small group learning activities during the class period. ___ ___ ___ ___

6. Homework assignments are appropriate and meaningful. ___ ___ ___ ___

Total points = ___

IV. PERSONALIZED INSTRUCTION

1. Instruction is adapted for individual learners. ___ ___ ___ ___

2. The interests of students are considered when planning activities. ___ ___ ___ ___

3. The most able students are challenged with meaningful learning experiences. ___ ___ ___ ___

4. All students have opportunities to experience success in the classroom. ___ ___ ___ ___

5. Students and the teacher demonstrate enthusiasm for the lessons and learning.	___	___	___	___
6. Student comment and parental input is positively received and responded to tactfully.	___	___	___	___

Total points = ___

V. TIME ON TASK

1. Materials and assignments are prepared and ready before the students enter the classroom.	___	___	___	___
2. Punctuality is demonstrated in starting and ending classes, meeting appointments, and returning assignments.	___	___	___	___
3. Handing out and implementing the use of materials in the classroom is done quickly and efficiently.	___	___	___	___
4. The teacher moves around the classroom and is involved with assisting students.	___	___	___	___
5. Students are frequently given short assignments and begin working on them at once.	___	___	___	___
6. Class time is used to maximum efficiency.	___	___	___	___

Total points = ___

VI. RECOGNIZING POSITIVE BEHAVIORS

1. Students respect the dignity and worth of others in the classroom.	___	___	___	___
2. Students feel free to communicate ideas without fear or hesitation.	___	___	___	___
3. Students demonstrate self-discipline when not closely monitored.	___	___	___	___
4. Democratic principles are applied in establishing classroom routines and procedures.	___	___	___	___
5. Praise is directed to specific behaviors.	___	___	___	___
6. Reinforcement behaviors by the teacher stimulates improved on-task behavior.	___	___	___	___

Total points = ___

VII. REWARDS

1. Rewards are varied to meet individual differences.	___	___	___	___
2. Concrete and tangible rewards are awarded to students.	___	___	___	___
3. Students are responsive and appreciative of the tangible rewards.	___	___	___	___
4. Reinforcers are given as soon as possible after the desired behavior occurs.	___	___	___	___
5. Activities selected as rewards are arrived at democratically.	___	___	___	___
6. Criteria for receiving rewards is adjusted for individual student abilities.	___	___	___	___

Total points = ___

VIII. QUESTIONS

1. Questions are structured in a manner which allows students to respond.	___	___	___	___
2. There is a wait time of a minimum of 3 seconds before calling on a student.	___	___	___	___
3. The majority of teacher questions provide supportive action and are open-ended.	___	___	___	___
4. Student assignments reflect questions at the application, analysis, synthesis and evaluation levels rather than knowledge and comprehension.	___	___	___	___
5. Students are encouraged to ask questions.	___	___	___	___
6. Students can ask questions and answer questions without fear or hesitation.	___	___	___	___

Total points = ___

IX. SELF DISCIPLINE

1. The teacher models self discipline by using appropriate manners, tone of voice, choice of words, and disposition.	___	___	___	___
2. The teacher shows self discipline in punctuality, consistency, fairness, and patience.	___	___	___	___

3. The teacher shows self discipline in advance planning and organization.		___	___	___	___
4. Specific efforts are made to establish positive relationships with the other teachers and principal.		___	___	___	___
5. Specific efforts are made to stimulate personal enthusiasm and generate enthusiasm in students.	___	___	___	___	
6. Specific efforts are made to make life outside of school pleasant and rewarding.	___	___	___	___	

Total points = ___

X. COMMUNICATION

1. Introductory letters and thank you cards are sent to parents.	___	___	___	___	
2. Phone calls are used to communicate with parents in appropriate circumstances.	___	___	___	___	
3. Support reports indicating desirable student behaviors are sent home.	___	___	___	___	
4. Efforts are made to encourage parent involvement and participation in school activities that reflect participation of their children.	___	___	___	___	
5. Support group opportunities for improving parent-student interactions and communication are supported and encouraged by the school.	___	___	___	___	
6. Parent suggestions for improving class and teacher relationships with the children are encouraged and positively received.	___	___	___	___	

Total points = ___

XI. CONFERENCES

1. Time is taken to talk with students to indicate a desire to be a helpful and supportive adult.	___	___	___	___	
2. During conferences there is a clear indication of one or two behaviors which need to be remediated rather than references to inadequacies within the individual.	___	___	___	___	
3. During conferences, good qualities are mentioned along with a firm intolerance of specific undesired behaviors.	___	___	___	___	

4. While conferencing, modifications which might help the student become more successful are discussed. ___ ___ ___ ___

5. While conferencing, procedures for helping a student chart his/her own progress are provided and discussed. ___ ___ ___ ___

6. When appropriate, parental input and involvement are utilized in preparing an adaptive discipline plan for a student. ___ ___ ___ ___

Total points = ___

XII. FORMULATING RULES

1. There is a clear articulation of classroom behaviors which should be practiced. ___ ___ ___ ___

2. A clear justification can be given for classroom behaviors to be practiced which is acceptable to students, administrators, and parents. ___ ___ ___ ___

3. There is a clear articulation of unacceptable classroom behaviors. ___ ___ ___ ___

4. A clear justification can be given for unacceptable classroom behaviors which is acceptable to students, administrators, and parents. ___ ___ ___ ___

5. There is a clear articulation of likely consequences for inappropriate behavior. ___ ___ ___ ___

6. A clear justification can be given for selecting consequences which is acceptable to students, administrators, and parents. ___ ___ ___ ___

Total points = ___

XIII. IMPLEMENTING RULES

1. Students have a clear understanding of classroom rules. ___ ___ ___ ___

2. The rules are stated in positive terms. ___ ___ ___ ___

3. The total number of rules is less than 10. ___ ___ ___ ___

4. The rules have been evaluated to insure that they produce the desired results. ___ ___ ___ ___

5. All students are familiar with the rules and capable of interpreting them in terms of their own behaviors. ___ ___ ___ ___

6. The rules are reexamined at regular intervals to insure that they are still needed and continue to produce the desired results. ___ ___ ___ ___

Total points = ___

XIV. FORMULATING CONSEQUENCES

1. Logical consequences rather than punishment are used whenever possible. ___ ___ ___ ___

2. Assurance has been made to insure that the consequence is appropriate for the student receiving the restriction. ___ ___ ___ ___

3. A plan for "cooling off" rather than producing confrontation has been formulated. ___ ___ ___ ___

4. A procedure is planned for the student who refuses to comply with an imposed consequence. ___ ___ ___ ___

5. The desired consequence is consistent with school policy and will be supported by the administration of the school. ___ ___ ___ ___

6. Parent involvement and input for correcting misbehaviors has been encouraged. ___ ___ ___ ___

Total points = ___

XV. IMPLEMENTING CONSEQUENCES

1. Consequences are enforced immediately after the undesired behavior. ___ ___ ___ ___

2. Consequences are implemented in private whenever possible. ___ ___ ___ ___

3. Proximity control, eye contact, and other forms of nonverbal communication are used to alert students to misbehavior. ___ ___ ___ ___

4. There is consistent enforcement of rules and imposition of consequences. ___ ___ ___ ___

5. There is a plan for refocusing class attention to the directed learning task if several students are involved in misbehavior. ___ ___ ___ ___

6. Consequences for misbehavior respect the dignity and self-worth of the affected students. ___ ___ ___ ___

Total points = ___

XVI. ENVIRONMENTAL MODIFICATIONS

1. Efforts are made to determine if students have any special needs which could be accommodated by classroom arrangement or seating.	___	___	___	___
2. Accommodations are made to allow all students to participate in hands-on activities and laboratory investigations.	___	___	___	___
3. There is close collaboration and cooperation between specialists and the regular teacher in addressing the needs of students in the classroom.	___	___	___	___
4. Walkways, placement of supplies, and elements of privacy are modified to allow easy access by all students.	___	___	___	___
5. Physical accommodations are made to facilitate and encourage socialization of all students with specific attention to those with special needs.	___	___	___	___
6. Efforts have been made to become aware of technology and software which can be used to extend learning opportunities for students.	___	___	___	___

Total points = ___

XVII. CURRICULUM MODIFICATIONS

1. Alternatives to written work are provided for students who would experience enhanced learning with this adaptation.	___	___	___	___
2. Extra time is provided for assignments and tests when the adaptation would improve student learning and enhance performance.	___	___	___	___
3. Framed outlines or other study help devices are used to assist students in learning.	___	___	___	___
4. Graphic organizers and assistance in study skills are provided to students who needs help in organization.	___	___	___	___
5. Mnemonic tools are used to help students who have difficulty assimilating specific facts and concepts.	___	___	___	___
6. Participation guides are provided to help students acquire better interactive skills.	___	___	___	___

Total points = ___

XVIII. INSTRUCTIONAL MODIFICATIONS

1. Efforts are made to expose students to new information through multi-modality and hands-on learning opportunities.	___	___	___	___
2. Efforts are made to examine the learning styles of students and differentiate instruction for different students.	___	___	___	___
3. Additional wait-time is provided for all students to allow more time to think of answers and more opportunity to elaborate on first responses.	___	___	___	___
4. Students receive prompt and supportive feedback on their performance.	___	___	___	___
5. Efforts are made to reduce concept density of the materials to allow extra time for some students with special needs and opportunities for elaboration by the most able learners.	___	___	___	___
6. Students are able to utilize technology including calculators, word processors, and special software to help them in expressing what they know and what they can do.	___	___	___	___

Total points = ___

XIX. TESTING AND TEXTBOOK MODIFICATIONS

1. Assignments and directions for work are frequently presented to students in written forms.	___	___	___	___
2. Students are given opportunities to work and study together in a collaborative rather than competitive learning atmosphere.	___	___	___	___
3. Students are sometimes provided with a partial outline to help organize thoughts on essay questions.	___	___	___	___
4. Students are sometimes allowed to practice on alternative forms of a test to assist them in learning how to take tests.	___	___	___	___
5. Study guides and study aids such as identifying key words or concepts are used to help students learn the desired information.	___	___	___	___
6. Alternative testing formats are used to allow students to communicate what they have learned.	___	___	___	___

Total points = ___

XX. STUDENT CONTRACTS

1. Student misbehavior is sufficiently targeted to collect data on its frequency of occurrence.	___	___	___	___
2. A reasonable plan for collecting data on student misbehavior has been formulated.	___	___	___	___
3. A thorough study of the data on student misbehavior is conducted to determine if there are patterns to the disruptive behavior.	___	___	___	___
4. A written contract indicating a method of receiving points for appropriate behavior, a reward for achieving desired behavior, and a time line for meeting noted goals is used to encourage students who have not been successful under general school policies.	___	___	___	___
5. Students using contracts have clear understandings of the reward when the terms of the contract have been obtained.	___	___	___	___
6. In cases of defiant of non-conforming behavior, clear delineation of successive stages for further restriction is communicated to the students.	___	___	___	___

Total points = ___

Appendix B
Management Profile Summary

																						XX	Student Contracts		ADAPTIVE
																						XIX	Testing & Textbook Modifications		
																						XVIII	Instructional Modifications		
																						XVII	Curriculum Modifications		
																						XVI	Environmental Modifications		
																						XV	Implementing Consequences		CORRECTIVE
																						XIV	Formulating Consequences		
																						XIII	Implementing Rules		
																						XII	Formulating Rules		
																						XI	Conferences		
																						X	Communication		SUPPORTIVE
																						IX	Self Discipline		
																						VIII	Questions		
																						VII	Rewards		
																						VI	Recognizing Positive Behaviors		
																						V	Time on Task		PREVENTIVE
																						IV	Personalized Instruction		
																						III	Instruction		
																						II	Routines and Procedures		
																						I	Organizing the Classroom		
24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3			Category Point Totals	

Appendix C

Assistive Technology Screening Guide

ASSISTIVE TECHNOLOGY SCREENING…….GENERAL INFORMATION

Date_____ Page_____ of_____

STUDENT INFORMATION:

Name:_____ DOB_____ Age_____ Gender_____

Parents_____ School_____
_____ Teacher_____
Address_____ Grade_____ Placement_____
_____ School Phone_____
Home Phone_____ SBSEC_____
Work Phone_____ SBSEC Phone_____

Disability Area:

___Learning Disability ___Mild Mental Disability ___Functional Mental Disability

___Physical Disability ___Emotional/Behavior Disability ___Hearing Impairment

___Visual Impairment ___Other Health Impairment ___Developmentally Delayed

___Other: Specify_____

Related Services:

___Occupational Therapy ___Physical Therapy ___Speech Language

___Orientation & Mobility ___Assistive Technology ___Other_____

SCREENING INFORMATION

Date of Screening:_____

Persons Participating in Screening:

Name	Position	Phone #	Best Time to Call

ASSISTIVE TECHNOLOGY SCREENING…….CONSULTATION

Student Name_____Date_____ Page____ of____

TYPE OF EVALUATION:

✓	**Type of Evaluation**	**Purpose of Evaluation**	Persons to Conduct Evaluation
	Existence	To determine aids needed in the areas of feeding, eliminating, washing and other activities of daily living	
	Communication	To evaluate and recommend augmentative communication systems (both high and low tech). Systems may include access, selection method, and language components.	
	Body Support Alignment & Positioning	To evaluate ways to improve positioning to increase support and provide improved access to the environment.	
	Travel	To evaluate current method of ambulation (if any) and recommend changes.	
	Environmental Adaptation	To determine appropriate ways to access the environment in the classroom and laboratory	
	Learning & Education	To evaluate and recommend software, instructional tools, and related hardware that enhance learning.	
	Sports, Leisure & Recreation	To evaluate current access to leisure & recreation activities before and after school activities, field trips, camps., etc., and recommend ways for the student to participate in such activities.	

ASSISTIVE TECHNOLOGY SCREENING…….FUNCTIONAL ANALYSIS

Student Name:_____ Date_____ Page____ of____

Environment, Context and Demands:

1. Describe the environment (e.g., home, school, community, etc., and the context (e.g., classroom laboratory) where the student is experiencing difficulty. Add pages as appropriate for multiple environments.

2. Check the functional area(s) where accommodation would enhance student learning:

___existence ___communication ___body support ___travel

___environmental adaptation ___learning & education ___sports & recreation

3. Briefly describe the event(s) in each functional area where accommodations would enhance student learning (e.g., communication: social interaction, movement, classroom, laboratory, learning & education: test taking, generating reports)

4. Describe the demands placed on the student by the instructional/environmental event, the responses made by the student in attempting to meet these demands, and the student's personal perceptions concerning these demands. (e.g., what are we asking the student to do and how does the student feel about it?) Add pages as appropriate for multiple demands.

Demands of the Instructional Activity	Student's Responses	Student's Personal Perceptions

ASSISTIVE TECHNOLOGY SCREENING
ADAPTATIONS TO INSTRUCTIONAL EVENTS

Student Name_____ Date_____ Page ___ of ____

Adaptations to Instructional Events can include: instructional interventions, environmental adjustments, scheduling modifications, curricular modifications, and access to materials and equipment.

1. Describe 1) an adaptation previously made to the student in meeting the demands of the instructional event, 2) the outcomes of the adaptations, and 3) the student's personal perceptions concerning the adaptations. Add pages as needed for additional adaptations.

Adaptations	**Outcomes**	**Student's Personal Perceptions**

ASSISTIVE TECHNOLOGY SCREENING
CONSULTATION SUMMARY

Student Name_____ Date_____Page___ of ___

Assistive Technology Consultant
Name_____

DOCUMENTATION OF FINDINGS:

	Yes	No
1. Prior instructional strategies are documented.		
2. Additional experts have been consulted.		
3. Have strategies been tried over sufficient time?		
4. Technologies readily available to current classroom have been tried?		

RECOMMENDATIONS:

___1. Additional consultation needed:

____Assistive technology specialist_____

____Curriculum specialist_____

____Instructional specialist_____

____Therapist_____

____Other_____

___2. Monitor student progress using recommended strategies.

___3. Progress toward IEP objectives is currently being demonstrated. Teacher will initiate additional consultation as needed.

___4. Refer for an Assistive Technology Evaluation.

NOTES:

Appendix D

Science Safety
Inspection Checklist

Modified from the Inspection Checklist prepared by the Joint Safety Committee of the American Vocational Association-National Safety Council

Introduction

A safe environment is an essential part of a safe science education program. This safe environment will exist only if hazards are discovered and corrected through regular and frequent inspections by school personnel – administrators, teachers and students. Safety inspections are to determine if everything is satisfactory.

Inspections may be made at the request of the board of education, the school administration or upon the initiative of the teacher. Some communities have drawn upon the cooperative service of professional safety engineers, inspectors of state labor departments, insurance companies, and local safety councils to supplement and confirm inspections by school personnel.

Directions

Who inspects?

This will depend upon local policies. It is recommended, however, that science teachers and students – the student safety engineer and/or student safety committee – participate in making regular inspections. This not only tends to share responsibility but stimulates a broader interest in the maintenance of a safe science laboratory.

When to Inspect?

As a minimum, a safety inspection should be made at the beginning of every school term or semester. More frequent inspections may be advisable.

How to Inspect?

Inspections should be well-planned in advance.

Inspections should be systematic and thorough. No location that may contain a hazard should be overlooked.

Inspection reports should be clear and concise, but with sufficient explanation to make each recommendation for improvement understandable.

Follow-up

The current report should be compared with previous records to determine progress. The report should be studied in terms of the accident situation so that special attention can be given to those conditions and locations which are accident producers.

Each unsafe condition should be corrected as soon as possible in accordance with accepted local procedures.

A definite policy should be established in regard to taking materials and equipment out of service because of unsafe conditions.

The inspection report can be used to advantage as the subject for staff and class discussion.

Checking Procedure

Draw a circle around the appropriate letter, using the following letter scheme:

S – Satisfactory (needs no attention)

A – Acceptable (needs some attention)

U – Unsatisfactory (needs immediate attention)

Recommendations should be made in all cases where a "U" is circled.

Space is provided at the end of the form for such comments. Designate the items covered by the recommendations, using the code number applicable (as B-2).

In most categories, space is provided for listing of standards, requirements or regulations which have local application only.

A. General Physical Condition

1.	Shelves, equipment & supplies arranged so as to conform to good safety practices	S	A	U
2.	Condition of stairways	S	A	U
3.	Condition of aisles	S	A	U
4.	Condition of floors	S	A	U
5.	Condition of walls, windows and ceiling	S	A	U
6.	Illumination is safe, sufficient and well placed	S	A	U
7.	Ventilation is adequate and proper for conditions	S	A	U
8.	Temperature control	S	A	U
9.	Fire extinguishers are of proper type, adequately supplied, properly located and maintained	S	A	U
10.	Teacher and pupils know location of and how to use proper type of extinguisher for various fires	S	A	U
11.	Number and location of exits is adequate and properly identified	S	A	U
12.	Proper procedures have been formulated for emptying the room of pupils and taking adequate precautions in case of emergencies	S	A	U
13.	Walls are clear of objects that might fall	S	A	U
14.	Utility lines are properly identified	S	A	U
15.	Teachers know the procedure in the event of fire including notification of the fire department and the evacuation of the building	S	A	U
16.	Air in laboratory is free from excessive dust, smoke, etc.	S	A	U
17.	Evaluation for the total rating of A, General Physical Condition	S	A	U

B. Housekeeping

1.	General appearance as to orderliness	S	A	U
2.	Adequate and proper storage space	S	A	U
3.	Lab tables are kept orderly	S	A	U
4.	Corners are clean and clear	S	A	U
5.	Special equipment racks, in orderly condition, and provided at laboratory sites	S	A	U
6.	Supply and/or material locations are steady	S	A	U
7.	Sufficient disposal instructions are provided	S	A	U
8.	Waste material is put in disposal promptly	S	A	U
9.	Materials are stored in an orderly and safe condition	S	A	U
10.	A spring lid metal container is provided for waste.	S	A	U
11.	All waste materials are promptly placed in the containers	S	A	U
12.	Containers for oily rags and waste materials are frequently and regularly emptied	S	A	U
13.	Dangerous materials are stored in metal cabinets	S	A	U
14.	Safety cans are provided for flammable liquids	S	A	U
15.	Materials are stored in an orderly and safe condition	S	A	U
16.	Flammable liquids are not used for cleaning purposes	S	A	U
17.	Floors are free of oil, water and foreign material	S	A	U
18.	Floors, walls, windows and ceilings are cleaned periodically	S	A	U
19.	Evaluation for the total rating of B, Housekeeping	S	A	U

C. Equipment

1.	Equipment is arranged so workers are protected from hazards of other apparatus, passing students, etc.	S	A	U
2.	Danger zones are properly indicated and guarded	S	A	U
3.	All laboratory equipment is in a safe working condition	S	A	U
4.	Adequate supervision is maintained when students are using equipment and chemists tools	S	A	U
5.	Equipment is clean and in safe working order	S	A	U
6.	Adequate storage facilities are provided for equipment and materials not in immediate use	S	A	U
7.	Evaluation for the total rating of C, Equipment	S	A	U

D. Electrical Installation

1.	All switches are enclosed	S	A	U
2.	There is a master control switch for all of the electrical installations	S	A	U
3.	Electrical outlets and circuits are properly identified	S	A	U

4.	All electrical extension cords are in safe condition and are not carrying excessive loads	S	A	U
5.	Electrical motors and equipment are wired to comply with the National Electric Code	S	A	U
6.	No temporary wiring in evidence	S	A	U
7.	Evaluation for the total rating of D, Electrical Installation	S	A	U

E. Gas

1.	Gas flow to appliances is regulated, so that when appliance valve is turned on full, the flames are not too high	S	A	U
2.	No gas hose is used where pipe connections could be made	S	A	U
3.	Gas appliances have been adjusted so that they may be lighted without undue hazard	S	A	U
4.	Students have been instructed when lighting gas burners to light the match first before turning on the gas	S	A	U
5.	There are no gas leaks, nor is any odor of gas detectable in any part of the laboratory	S	A	U
6.	Evaluation for the total rating of E, Gas	S	A	U

F. Personal Protection

1.	Goggles or protective shields are provided and required for all work where eye hazards exist	S	A	U
2.	If individual goggles are not provided, hoods and goggles are properly disinfected before use	S	A	U
3.	Proper kind of wearing apparel is worn and worn properly for the job being done	S	A	U
4.	Hoods and/or respirators are provided to avoid toxic atmospheric conditions	S	A	U
5.	Questions are made for cleaning and sterilizing respirators	S	A	U
6.	Students are examined for safety knowledge ability	S	A	U
7.	Clothing of students is free from loose sleeves, flopping ties, loose coats, etc.	S	A	U
8.	Evaluation for the total rating of F, Personal Protection	S	A	U

G. Instruction

1.	Laboratory safety is taught as an integral part of each teaching unit	S	A	U
2.	Safety rules are posted particularly at each danger station	S	A	U
3.	Printed safety rules are given each student	S	A	U
4.	Pupils take a safety pledge	S	A	U
5.	Use of a safety inspector	S	A	U
6.	Use of safety tests	S	A	U
7.	Talks on safety are given to the classes	S	A	U
8.	Periodic safety inspections of the laboratories made by a student committee	S	A	U
9.	All accidents are investigated	S	A	U

10.	A proper record is kept of safety instructions which are given preferably showing the signature of student on tests given in this area	S	A	U
11.	Evaluation for the total rating of G, Instruction	S	A	U

H. Accident Records

1.	There is a written statement outlining the proper procedure when and if a student is seriously hurt	S	A	U
2.	Adequate accident statistics are kept	S	A	U
3.	Accidents are reported to the proper administrative authority by the instructor	S	A	U
4.	A copy of each accident report is filed with the State Department of Education	S	A	U
5.	Accident reports are analyzed for instructional purposes and to furnish the basis for elimination of hazards	S	A	U
6.	Evaluation for the total rating of H, Accident Records	S	A	U

I. First Aid

1.	An adequately stocked first aid cabinet is provided	S	A	U
2.	The first aid is administered by a qualified individual	S	A	U
3.	The school has individuals qualified to administer first aid	S	A	U
4.	Evaluation for the total rating of I, First Aid	S	A	U

Recommendations