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ABSTRACT

This paper provides information on teaching science to students with special needs. The focus is placed on students with learning disabilities who may behave inappropriately due to frustration about their academic deficits. This perception is often brought about by a predominant mode of instruction in schools which is text-driven, teacher-centered, and conveyed through visual and auditory channels. A discussion of the role of an integrated curriculum in meeting the needs of students with disabilities is included, and thematic unit development is explained with a specific example provided. The example contains a butterfly and insect module developed in three ability levels that integrates skills in research sequence, prediction, comprehension, sequencing, vocabulary, summarizing, editing, spelling, dictionary skills, and punctuation. (DDR)

Teaching Science in Content Areas to Students with Special Needs

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Students with learning disabilities frequently manifest certain characteristics which compound their specific academic deficit. They may demonstrate hyperactive movements such as fidgeting and jerking, and sitting for an extended period of time listening to instruction becomes highly difficult and exhausting. Their distracted behavior and short attention span interferes with teaching and learning because they are unable to screen out extraneous stimuli. It is estimated that 20% of students classified as having a learning disability also have Attention Deficit Hyperactivity Disorder. Additional characteristics of these students include: language and reading difficulties, memory and metacognitive deficits, social-emotional problems, and motor and perceptual processing disorders (Norris, Haring, McCormick, & Haring, 1994).

The notion of perceptual processing disorders has recently lost its emphasis, although numerous authorities continue to stress its importance as correlates of learning disabilities (Learner 1993). The perceptual-modality concept is based on the premise that children learn through various channels. Some learn best by listening, others by seeing, and others by touching or performing an action. Perceptual-modality preference, often referred to as a person's learning style, was proposed as early as 1886 by Charcot (1886/1953). Charcot categorized people as "audile", "visile", and "tactile" learners. Many students with learning problems appear to have a much greater facility in receiving and learning information through their tactile/kinesthetic (haptic) modality. Haptic strategies and activities encourage to students to move around, interact with peers, and to actively discover information. Learning becomes more student centered and less teacher dominated. In addition to learning through their preferred modalities, students are strengthening deficit modalities; instructional tasks are performed through intersensory integration.

Memory and metacognitive abilities are crucial to the learning process. Children with learning disabilities often have difficulty with reception storage and retrieval. When short term storage is not coded successfully for long term storage, information is largely forgotten. We are more likely to retain information through cross-modality learning. It has been estimated that persons retain 10% of what they read, 20% of what they hear, 30% of what they see, 50% of what they see and hear, 70% of what they say as they talk, and 90% of what they say as they do (Touch Math, 1986). Students with disabilities have difficulty recalling information when instruction is solely presented through visual and auditory channels. The effect of memory on other mental abilities cannot be minimized. Learning is a cumulative process; memory of past experience must be integrated, evaluated and synthesized to form new learning. In addition, students must be able to generalize new learning to various environments and situations. Independent generalization is the outcome of highly developed metacognitive processes.

Metacognition is often defined as thinking about thinking. Efficient learners are aware of themselves and their surroundings, and are able to form strategies for acquiring and retaining information. Students with learning disabilities are frequently deficient in metacognition. As a result they are unable to self-evaluate, self-monitor, self-regulate, and self-reinforce (Ellis, Lenz, & Sabornie 1987). They are often impulsive, disorganized and lack social and emotional competence (Richardson, 1997).

Social and emotional problems can result in learned helplessness or aggressive behaviors. Frustrated by their academic deficits, students with disabilities frequently behave inappropriately and develop poor self-image (Norman & Caseau, 1995). This perception is often brought about by a predominant mode of instruction in schools which is text driven, teacher centered, and conveyed through visual and auditory channels. Intelligence is not a unitary factor. Gardner (1993) proposes multiple areas of intelligence: linguistic intelligence, logical-mathematical intelligence, spatial intelligence, bodily-kinesthetic intelligence, musical intelligence, interpersonal intelligence, and intrapersonal intelligence. The need for restructuring education is often heard, but schools generally favor and esteem students whose strengths lie mainly in logical-mathematical and linguistic intelligence. Most people can develop each intelligence to an adequate level of competency (Armstrong, 1994); however, when students are instructed to their strengths, motivation is increased and misbehavior is decreased. Additionally students are more likely to develop positive self-esteem and feelings of self-worth.

An Integrated Curriculum

A lack of adequate curriculum and instructional techniques for students with disabilities can present difficulties in integrating these students in the general mainstream of education. They need multi-modal activities to learn the content of specific courses. In numerous science courses, much of the content is taught by lecture, discussion and projects (Mercer & Mercer, 1993). Modifying the curricula can expedite the inclusion process and facilitate learning. Learning strategies sensitive to various learning styles and multiple intelligences can be integrated into thematic units for discovering meaningful scientific concepts. When information is presented in a manner that empowers students to be become self-directed, the goals of organizing, understanding, remembering, and applying information can be realized (Mercer & Mercer, 1993). Discovery learning strengthens metacognitive processes because students are involved in self-instruction, self-monitoring, and self-evaluation. In addition, they are given the opportunity to excel by using their most effective modality, while improving their weakest modality.

Thematic and modular curricula can integrate several content areas to teach a specific theme in science or in other academic subject. Students can be taught to observe, record, analyze, conclude and predict within several academic content areas. Units revolving around a central theme can integrate reading, vocabulary, math, history, art, music, drama, science and other subjects. Such configuration addresses the multiple intelligences concept by providing a growth paradigm in all intelligences. An integrated approach to learning helps students to observe holistically and to understand the interaction of various variables. These concepts are not

isolated in their daily lives. Music, art, current events, math, linguistics, and scientific principles are part of our lives, and influence our decisions and behaviors. An inquiry-based curriculum teaches students to express their knowledge in various ways and for different purposes. Students with learning disabilities simultaneously use all multiple intelligences and are perceived as whole individuals with strengths in many intelligence areas rather than in terms of deficits, disorders, or disabilities (Armstrong, 1994). Successful individuals with disabilities such as Albert Eistein, Charles Darwin, and Thomas Edison are excellent models to emulate. Students learn than a learning disability is not a handicap (Illingworth & Illingworth, 1966).

Thematic Unit Development

Students with learning disabilities in general classroom settings may require curricular modifications. Frequently this disability manifests itself in the area of reading; consequently, gaining information from science books becomes increasingly difficult. However, science as a content area, lends itself to opportunities for exploration and discovery. Reading becomes more meaningful with a constructivist approach emphasizing theme building and incorporation of relationships between various concepts. Learning becomes holistic rather than isolated concepts and skills.

The following is an example of skill-based theme integrating science across the curriculum. It was developed by a group of participants in a state funded project. Project Inclusion offered courses in special education methods to general educators seeking knowledge in curricular adaptations. An outcome of the project was the development of a series of adapted modules for students with learning disabilities. The content of each module is designed to be of high interest and at a success level for the learner. Each module includes teaching scripts, lesson plans, goals and objectives, student assessment schedules, assessment rubrics, grading criteria, and feedback.

Strategies were chosen to involve students in engagement and exploration activities. They include, Socratic questioning, discussion and explanation, cooperative learning, journaling, artistic productions, research assignments, brainstorming, editing, publishing, discovery experiences, and generalization and transfer strategies. In addition, various academic and non-academic focus activities were integrated in each lesson to adapt to various learning styles and multiple intelligences. The Jay Buros (1995) schematic was implemented to integrate drama, math, social studies, literature, creative writing, science, and art with the main theme and the skills in content.

The Butterfly/Insect Module consisted of a thematic unit developed in three ability levels. A snapshot on the first page of each unit describes the thematic cluster of subject matter on butterflies. Drama, literature, writing, science, math, social studies, music, and art are integrated to develop information on butterflies. In addition, the skills in context include; research sequence, prediction, comprehension, sequencing, vocabulary, summarizing editing, spelling dictionary skills, and punctuation.

Special considerations and modifications were provided for students with special needs. Language mechanics were emphasized as well as creative writing. The students were taught to edit their stories for final publication in a class or school newspaper when appropriate. Short stories were included in each unit and students were encouraged to research additional stories on the theme's topic from the library or web sites.

A teaching script was included to provide background information and serve as a point of departure prior exploration. In their discovery activities, students studied the symmetry of butterflies, constructed insect cages, went on field trips, observed live and dead butterflies, painted butterflies pictures, learned to read and spell related words, read, wrote and published butterfly stories.

Conclusion

Learning becomes meaningful when students are directly involved in their instruction. They acquire a positive attitude when they are provided with a purpose for learning. A constructivist approach creates new meaning from experience and discovery. Learning becomes holistic and students construct and develop relationships. Motivation affects learning, and the reverse is also true. Students with disabilities frequently assume feelings of learned helplessness because they lack successful experiences. Schools can contribute to the development of motivation when the curriculum considers the strengths of students rather than their deficits. Labeling students often contributes to a self-fulling prophesy of failure. Teaching to the students special abilities and learning styles enables them to experience success An important goal is to establish classroom conditions in which students can develop intrinsic motivation Integrated learning makes sense, it appeals to all students because they are able to satisfy their needs and drives.

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First Grade

BUTTERFLIES Theme

Skills in Context
- Research sequence
- Predict
- comprehension
- Sequencing
- Vocabulary
- Summarizing

Skills in Context
- Editing
- Spelling
- Dictionary skills
- Punctuation
- Vocabulary

Drama
Dramatizing life cycle, make up
What would be said in each cycle
Flannel board for Very Hungry
Caterpillar
Roly Poly Caterpillar hand movements

Literature
- A Time of Their Own
- Lamb and Butterfly by Arnold Sungoard
- Very Hungry Caterpillar Eric Carle
- Butterfly and Caterpillar Barnie Watts

Writing
- Journal on metamorphasis
- Fictional story
- Write about your butterfly
- Which would you rather be: caterpillar or butterfly
- Research type of butterfly

Science
- Study type of insect mouths
- metamorphis - life cycle
- observe metamorphis
- difference between moth & butterfly
- parts of a butterfly and caterpillar
- raising butterflies
- make insect cage
- butterfly habitat

Math
- Symmetry
- Write counting book (model V.H.C)
- A time of their own math act.
- Butterfly bites (cooking)
- Measurement (time & area)

Social Studies
- Map the route of the monarch butterfly
- Environmental effects of a butterfly
- Building insect house
- visit butterfly exhibit at zoo

Music
- Students will write a butterfly song & dramatization to Flight of the Bumblebee
- "Inch by Inch"
- " Butterflies are free"

Art
- Filmstrip of life cycle
- Butterfly/tissue paper middle
- Symmetry
- Clothespin butterflies

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From *Why Whole Language*, by Jay Buros.

Jay Buros

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