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ADDRESSING THE EDUCATIONAL NEEDS OF STUDENTS WITH LEARNING DISABILITIES IN SCIENCE CLASSROOMS

Abstract:

The Individuals with Disabilities Education Act (IDEA) and the No Child Left Behind (NCLB) are the federal laws made in the United States (US), and claim that schools are accountable for the success of students with special needs and school responsibilities must be demonstrated through Individualized Education Program (IEP), which outline specific instructional accommodations, modifications, and effective evaluations. Historically, students with learning disabilities (SLD) receive services either in a resource room, a self-contained special education, or inclusive settings where they receive special education services within the general education classroom. Even though federal laws shifted the focus on how to effectively educate SLD, it appears that these students continue to fall behind their non-disabled peers in regular education classrooms in many subjects including science. Teaching science to SLD in inclusive classrooms is a challenging task for science teachers as the numbers of SLD has grown in such classrooms. This paper summarizes the effects of collaboration among teachers, setting high learning goals, effective teaching strategies, and providing some basic modifications with SLD in a 6th grade inclusive science classroom in an urban school district in a Western State. The paper also guides science teachers to incorporate some example lessons in their lesson plans for meaningful learning.

Keywords:

Science, special education, teaching strategies, learning goals, modifications

Introduction

Recent mandates such as the Individuals with Disabilities Education Act (IDEA) and the No Child Left Behind (NCLB) require schools to provide access to general education classrooms for students with learning disabilities (SLD) (Harris, Kaff, Anderson, & Knackendoffel, 2007). In general education settings, SLD take a variety of science courses including physical science, life science, and earth and space science in middle school (Steele, 2007). The first step in assisting SLD in the science classroom is to be aware of their disability, which might be associated with a disorder. "A disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, that may manifest itself in an imperfect ability to listen, think, speak, read, write, spell, or do mathematical calculations" (IDEIA, 2004).

Even though the intelligence of SLD varies from average to high, their behaviors can create a distraction to their engagement and performance in science. Depending on the type of disorder they have, SLD with visual disorders can have difficulty understanding visual displays, power point slides, data tables, or graphs (Lerner & Kline, 2006). SLD with auditory disorders can have difficulty with lectures, discussions, and group work. SLD with memory disorders can have difficulty with recalling pre-knowledge, solving problems, and engaging in higher-order tasks in science (McNamara, 2007).

SLD have at least one low basic academic skill, either in reading and writing or math. Having a low basic skill in one of these courses may interfere with their science learning (McNamara, 2007). A science unit that incorporates vocabulary terms about rocks, such as igneous, metamorphic, and sedimentary, may be challenging for students with reading problems. SLD that have problems associated with writing skills may have difficulty completing projects and assignments that require the use of science terminology. SLD who have trouble with math calculations may have difficulty solving problems involving science formulas such as Ohm's law and density. SLD who have difficulty with organization and attention may have challenges tracking in-class work and bringing home appropriate materials needed to study for assignments and assessments (Lerner & Kline, 2006; McNamara, 2007). The association of multiple disorders with SLD may create problems in retaining science knowledge and maintaining motivation and engagement during class time, and in inquiry-based learning tasks. These challenges can make science learning difficult for SLD. However, through teacher collaboration, high learning goals, effective pedagogical approaches, and modifications, SLD can become more effective learners in science classrooms.

1-Collaboration among teachers

Effective teaching to SLD requires collaboration among science teachers and special education teachers. Collaboration between science teachers and special education teachers would be a beneficial starting point. Science teachers can provide information on science content, and special education teachers can provide information on modifications, as outlined in the Individualized Education Program (IEP) for SLD. An IEP is a legal contract written for each child with a disability. It includes the student's disability classification, their present level of performance, annual goals, an explanation of services, projected dates for duration of services, the extent to which the student will participate in the general education classroom, accommodations, and modifications (IDEIA, 2004).

Collaboration among teachers is important as science teachers might have difficulty to have adequate skills in individualizing instruction for students with all types of disabilities and needs.

On the other hand, it might be quite challenging for special education teachers to be experts in science content. Therefore, collaboration between science teachers and special education teachers can help both groups to address the educational needs of SLD in middle school science classrooms (Norman, Caseau, & Stefanich 1998). Teaming up with another teacher can help science teachers to implement and generalize those strategies across subjects and classes for SLD (Bulgren, Deshler, & Schumaker 1997).

2- Setting goals

SLD can improve their motivation and achievements by setting goals for their science class (DeBacker & Nelson, 2000). These goals include effective study strategies to improve test grades or editing lab reports for understanding the science content. Focusing on these goals will help SLD to progress towards their goals and have a feeling of control in their learning (DeBacker & Nelson, 2000). Researchers suggest that setting up goals in science class may lead to other educational goals, which increase the student's achievement and motivation in all classes. These goals may help SLD increase their performance and continue to strive for strong learning and academic achievement. However, it is crucial for science educators to reconsider the ability of mixed groups when setting classroom goals. The abilities of the students may differ based on home influences, prior experiences, and differential treatments by teachers (Ames, Ames, & Felker, 1987; Brattesani, Weinstein, & Marshall, 1984). In addition, adopting classroom goals will depend on how much students construct the social reality of the classroom for themselves (Rosenholtz & Simpson, 1984).

3-Different teaching styles

SLD benefit from different learning and teaching styles in science classrooms as these styles help science instructors to differentiate and individualize their instruction (Goodnough, 2001). Individualized attention to SLD allows science instructors to provide more choices that are based on SLD's learning styles in order to make instruction and evaluation more meaningful (Goodnough, 2001). The richness of the teaching methods is likely to make the new teaching items more attainable and interesting for students. Such variety in learning styles can enable educators to help SLD succeed in writing a variety of reports, observing, discussing, participating in group activities (e.g. sharing data and ideas), creating websites, doing hands-on activities, and reflecting. The use of different teaching styles can be implemented by science teachers not only to teach the science content, but also to teach students how to study and learn science (Bulgren et al., 1997). This method is not only crucial for SLD, but also for all students without disabilities who need assistance in reading, learning, memorizing, and organizing difficult science content.

Some of the effective teaching methods for SLD include inquiry-based learning and cooperative learning. Inquiry-based learning involves problem solving and critical thinking skills to arrive to conclusions. This teaching strategy is student-centered. By using this method, SLD can improve their skills of observing, measuring, classifying, inferring, hypothesizing, engaging in controlled investigation, predicting, explaining, and communicating (Wild & Trundle, 2010). In addition, research shows that inquiry-based learning promotes cooperative learning among students from different ability groups in science classroom (Jimenez, Browder, Spooner, & Dibiase, 2012).

Cooperative learning involves putting students in small groups and allowing them to work together. Their grouping of students is not based on their ability; instead they come from all levels. Students are expected to complete assigned tasks together. This model enables students to maximize their own and each others' learning (Smith, Johnson, & Johnson, 1981; Johnson,

Johnson, & Smith, 1991). Table 1 includes examples of strategies for teaching in science. It is important for science teachers to ensure that all members in the groups cooperate and have positive effects on one another (Bruffee, 1999). Research supports cooperative learning due to promoting cognitive elaboration, enhancing critical thinking, providing feedback, promoting social and emotional development, appreciating diversity, and reducing student attrition (Macgregor, Cooper, Smith, & Robinson, 2000).

Table 1

Strategies for teaching science in middle schools

Inquiry-based Learning
<ul style="list-style-type: none"> • Observing • Measuring • Classifying • Inferring • Hypothesizing • Engaging • Predicting • Explaining • Communicating
Cooperative Learning
<ul style="list-style-type: none"> • Mixed ability • Small groups • Cognitive elaboration • Enhanced critical thinking • Social and emotional development • Celebrating diversity • Reduced student attrition

4-Modifications

Before making any modifications in science classrooms, it is important that science teachers and special education teachers collaborate with one another. Some effective modifications for SLD include, but are not limited to, the use of class time, textbook reading, mnemonics, homework assignments, and assessments. The effective use of class time is crucial in terms of providing learning within outlined time frames. Therefore, this issue requires collaboration and lesson planning among teachers several weeks before school starts. This will allow educators to go over each student's IEP goals and clarify key ideas for effective science teaching and learning (Morocco, Clay, Parker, & Zigmond, 2006). Teachers can also have the opportunity to discuss the option of co-teaching, which can allow SLD to benefit from two instructors in the science classroom coordinating science teaching (Brigham, Parker, Morocco, & Zigmond, 2006).

Modifications for textbook reading are important, especially for SLD with low-reading skills, given the complexity of middle school science textbooks. Pointing out key textbook elements such as questions, specific objectives, and summaries, will help SLD with organization (Polloway, Patton, & Serna, 2005; Salend, 2005). With organization, SLD will have a chance to review prerequisite knowledge, clarify the purpose of reading, and review challenging and abstract science vocabulary before assigned reading components (Friend & Bursuck, 2006). After the reading task is over, science teachers can summarize specific ideas, including graphs, charts, and figures (Polloway et al., 2005). In addition, science teachers can provide chapter notes for challenging reading parts so that SLD can focus on science learning (Brigham et al. 2006). Involvement of special education teachers in note taking activities is important as it takes time to prepare.

Recalling science knowledge may be problematic for some students. Science teachers can use mnemonics to help all students recall their pre-knowledge. Mnemonics include picture cues, keywords, association clues, and acronyms (Bulgren et al., 1997). Table 2 includes examples of mnemonics in science. For example, to memorize physical states of matter, types of rocks, the cell cycle, or metric prefixes, science teachers and students can generate sentences using the first letter of each word representing the science term in sequence. This skill not only helps students learn and develop new mnemonics but they can apply this strategy to other disciplines.

Table 2

Mnemonics for teaching science in middle schools

Mnemonics	Explanation	Example
Sally Loves Gum	Three phases of matter	solid, liquid, gas
Science is magnificent	Three types of rocks	sedimentary, igneous, metamorphic
I picked my apples today	The cell cycle	interphase, prophase, metaphase, anaphase, telophase
Kittens hate dogs but do chase mice	Metric prefixes and base unit	kilo, hecto, deca, base-unit, deci, centi, milli

Homework assignments can be very challenging for most SLD in science classrooms (Polloway et al., 2005). It is helpful when educators provide clear directions and specific oral and written explanations for homework assignments. Science teachers can assist with such assignments during class time, and special education teachers can monitor the progress and ensure that the completed parts of homework are correct (Brigham et al. 2006). In addition, breaking down homework assignment into smaller segments can also help SLD to complete the assignment before the due date (Freund & Rich, 2005).

One of the challenging tasks for science teachers is to provide modifications in science class as they include practicing test taking strategies and enhancing the performance of SLD. Collaboration between science teachers and special education teachers is a must as this task requires study time in science class. Teachers can start with a review for SLD so that they can focus and understand the importance of assessments in science class (Bos & Vaughn, 2006). Before starting any assessment, it is crucial that SLD are encouraged to preview the entire

assessment so they can allocate their time efficiently for each section (Bos & Vaughn, 2006). It is also important for educators to emphasize common vocabulary that appears on most assessments (Freund & Rich, 2005). For example, some of the most common vocabulary includes describe, explain, compare, contrast, track, support, summarize, analyze, and evaluate.

Conclusion

The ideas presented in this article on collaboration among teachers, setting high learning goals, effective teaching strategies, and providing modifications will help improve student performance on all tasks in science classrooms. The teaching strategies and modifications described in the article are easy to implement. On the contrary, using all these when appropriate will enhance the experience of SLD in the science classroom, and increase their chances of success. These teaching approaches are critical for many SLD but also promote effective science learning for *all* students.

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