Introduction to Special Issue on Science Education and Students with Learning Disabilities

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William J. Therrien
University of Virginia
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University of Iowa
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Introduction to Special Issue on Science Education and Students with Learning Disabilities

William J. Therrien
University of Iowa
Charles Hughes
The Pennsylvania State University
Brian Hand
University of Iowa

We are pleased to have had the opportunity to put together a special issue of *LDRP* on science instruction for students with learning disabilities (LD). The topic is timely, with science education receiving recent nationwide attention. National leaders have strongly advocated for the need for improved science education with President Obama setting a goal of dramatically improving U.S. students' science achievement (White House, Office of the Press Secretary, 2011). The national commitment to improve science education is highlighted in the "Change the Equation" initiative that aims to improve Science, Technology, Engineering, and Math (STEM) instruction across the age span for all, with the goal of producing a new generation of highly skilled workers who can assume jobs in STEM fields (Change the Equation Organization, 2011).

The goal to increase student achievement in science and other STEM fields is critical both to the future of the United States as a whole and to each individual in our society. The U.S. Department of Labor predicts that there will be tremendous job growth in STEM fields, with 2 million hard-to-fill jobs open as soon as 2014 (Terrell, 2007). Individuals in STEM fields are much more likely to earn a high wage than individuals in other professions, with earnings in STEM fields on average 70 percent more than the overall U.S. mean (Terrell, 2007). Even the lowest-paying STEM jobs pay a livable wage, with a mean salary right around the overall average U.S. salary (Terrell, 2007). The potential to pursue a career in a STEM field is not only reserved to the academically gifted. Although STEM professions require post–high school education, many fields can be pursued through technical schools, with the vast majority of high school graduates potentially qualified to pursue a career in a STEM profession provided they obtained the prerequisite skills and knowledge in high school.

Unfortunately, we have a long way to go to ensure students have the skills and knowledge necessary to pursue careers in STEM fields. On the recent Program for International Student Assessment (PISA), only 29 percent of U.S. students scored at the proficient level, placing the average U.S. student science achievement behind that of 15 other countries (Fleischman, Hopstock, Pelczar, & Shelley, 2010). Science results on the National Assessment of Education Progress (NAEP) were just as poor, with only one-third of 4th-, 8th-, and 12th-grade students scoring at the proficient level in science (National Center for Education Statistics, 2011). Science achievement results were even more dismal for students with LD, with their achievement on the science section of the NAEP significantly lower than students without disabilities at all grade levels (National Center for Education Statistics, 2011).

Despite the current bleak picture of science education in the United States, particularly for students with LD, much is known on how to significantly improve students' science achievement. This special issue of *LDRP* attempts to consolidate this information in an effort to inform current science instruction for students with LD. Further, it is our hope that this issue will help spur the field to make a renewed effort to investigate and validate best practices in science education for students with LD. The vast majority of research in science instruction for students with LD was completed more than 10 years ago. Additional research is needed if we are to significantly impact students with LD science achievement and in turn provide them with the skills and knowledge necessary to pursue careers in STEM fields.

There are five articles in this special issue. The first article is by Therrien and colleagues, who conducted a meta-analysis of classroom-based science instruction for students with LD. Several important findings emerged from their analysis. First, results indicate that student with LD can be successful in regular education science inquiry classrooms. This success, however, often is dependent on one important caveat. Instead of pure inquiry instruction that is entirely student directed, the instruction provided needs to be structured and teacher directed. Important instructional components for students with LD within a structured inquiry approach include focusing on concepts instead of extraneous

Requests for reprints should be sent to William J. Therrien, University of Iowa, N 254 Lindquist Center, Iowa City, IA 52242. Electronic mail may be sent to bill-therrien@uiowa.edu.

facts, giving formative feedback, and providing students with the appropriate supports to ensure task engagement. Second, results indicate that special education teachers can enhance the success of students with LD in science through various supplemental programs. Mnemonics, in particular, was found to be extremely effective at increasing students' acquisition and/or retention of science factual knowledge. Along with mnemonics, several other supplemental programs have shown promise at increasing students with LD achievement in science including a peer tutoring model that using material tiered by difficulty. One last stark finding of the meta-analysis was the paucity of empirical research conducted on this topic. Although Therrien and colleagues examined 30 years of research (1980–2010), only 11 articles met criteria to be included in the review.

The second article, by Dexter, Park, and Hughes, examines the effectiveness of using graphic organizers (GOs) with students with LD in intermediate and secondary science classes. The authors conducted a meta-analysis of studies using GOs and findings included that, across immediate posttest and maintenance conditions, the use of graphic organizers was associated with increased vocabulary knowledge and factual comprehension measured by researcher-generated multiple-choice tests. The nature of the science material covered within the tests called for inductive thinking and inference from students with LD. This suggests that GOs may be effective in not only improving basic skills (e.g., factual recall), but also higher-level skills (e.g., inference). They provide some caution regarding these findings as there were only six studies included in the analysis. Conclusions, implications for future research, and classroom recommendations are included.

Reading and learning from science text has been noted as the most difficult of all academic tasks for students with LD. In the third article, Mason and Hedin describe the complexity of scientific information conveyed through print and the ensuing challenges in learning for struggling readers. Fortunately, effective research-based instructional approaches for fostering students' prior knowledge, for providing text enhancements, and for teaching reading comprehension strategies to improve science text reading comprehension have been developed for students with LD. The effectiveness of explicit strategy instruction, in combination with strategies for self-monitoring performance, is highlighted. Mason and Hedin also provide a depiction of research-based multicomponent procedural facilitators (e.g., instructional packages that include strategies for prior knowledge acquisition, comprehension monitoring, and summarization). Critical elements for developing science text understanding through effective instruction are illustrated through research findings and implications for classroom practice.

In 1985, Scruggs and Mastropieri began researching science instruction for students with LD and since then have published numerous articles on the topic. In the fourth article, Brigham, Scruggs, and Mastropieri provide a summary of their work, as well as the work of others, in developing effective instructional strategies and the impact of teacher behavior on learning disabled students' learning in science classrooms. They begin with a discussion of the nature of science instruction and curriculum as a lead-in to the characteristics of students with LD that impact their ability to learn from both text and the hands-on activities that are an integral part of typical science instruction. From there they provide a review of individual studies conducted at a variety of grade levels and for a variety of science content.

The last article of this special issue is written by two science education researchers and examines trends in science education and how these changes may impact students with LD. Villanueva and Hand discuss the difference between science literacy and science knowledge, stressing that, while both are important, a greater focus on science literacy in the classroom may be more beneficial for students with LD because it emphasizes problem-solving skills instead of pure rote memory. The authors provide an example of a contemporary instruction approach, the Science Writing Heuristic, that focuses primarily on science literacy and highlight instructional components of the approach and research results indicating that the Science Writing Heuristic has the potential to increase learning disabled students' science achievement.

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About the Authors

William J. Therrien is an associate professor and co-director of the Center for Disability Research and Education at the University of Iowa. His current research interests include science and reading instruction for students with learning disabilities.

Charles Hughes is a special education professor at the Pennsylvania State University. His research interests include the development and validation of instructional interventions for adolescents with learning and behavior problems.

Brian Hand is a science education professor at the University of Iowa. His research interest include writing to learn approaches to science and implementing science argumentation approaches to the learning of science.