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Chemistry Teachers' Perceived Benefits and Challenges of Inquiry-based Instruction in Inclusive Chemistry Classrooms

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ABSTRACT: Studies on inquiry-based instruction in inclusive science teaching have mainly focused on elementary and middle school levels. Little is known about inquiry-based instruction in high school inclusive science classes. Yet, such classes have become the norm in high schools, fulfilling the instructional needs of students with mild disabilities. This study explores high school chemistry teachers' perceived benefits and challenges of inquiry-based instruction in inclusive chemistry classes. The study also seeks to establish chemistry teachers' knowledge of inclusive teaching. Participants in this study are 61 chemistry teachers in different school districts across the United States. A questionnaire is used to collect data. Results show that most teachers have no training in inclusive teaching, lacked knowledge of chemistry teaching in inclusive classes, and have moderate confidence in teaching chemistry in inclusive classes. However, most teachers acknowledge that inquiry instruction in inclusive chemistry classes has several benefits and challenges to students. On the other hand, teachers believe there are more challenges on inquiry-based instruction for them than for students in inclusive chemistry classes. Results have implications on science teaching and learning and teacher education.

KEY WORDS: Inquiry-based instruction, teacher, chemistry, inclusive classrooms, benefits, challenges

INTRODUCTION

In the USA, the 2007 re-authorization of the *Individuals with Disabilities Education Act* [IDEA] requires that Students with Disabilities (SWD) receive instruction together with regular students. For this reason, inclusive science classes have become the norm in schools, fulfilling the instructional needs of SWD in regular classrooms (Kirch, Bargerhuff, Cowan & Wheatly, 2007; Mastropieri & Scruggs, 2001; Mumba & Chitiyo, 2008;

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Norman, Caseau & Stefanich, 1998; Reausen, Shoho, & Barker, 2001; Subban & Sharma, 2006). In this paper, inclusive classes are those that have both special education and regular students, while SWD are those individuals that have been identified with mild disabilities and receive special education services in schools. Such students have the cognitive abilities to construct scientific knowledge, participate in scientific investigations, and apply scientific reasoning for problem solving and decision making inherent in school science curricula (Mastropieri & Scruggs, 2001). These SWD are receiving science instruction from general education science teachers together with regular students (Maroney et al. 2003). Similarly, in high schools, SWD are receiving chemistry instruction from chemistry teachers. Yet, most high school chemistry teachers are not trained to teach special education students, or inclusive classes (Kearney & Durand, 1992). As such, science education and special education researchers have raised doubt on whether high school chemistry teachers can effectively execute their new role as inclusive classroom teachers (Mastropieri & Scruggs, 2001; Mumba & Chitiyo, 2008). In their new role as instructors for inclusive classes, high school chemistry teachers need to make instructional decisions that can promote effective science teaching and learning in such settings.

The idea of inclusive education is based on the principle that every child has the right to education (Jakupcak, Rushton, Jakupcak, & Lundt, 1996). Similarly, current US science education reforms accentuate scientific literacy for all students regardless of their age, gender, cultural or ethnic background, disabilities, aspirations, interest or motivation in science (American Association for the Advancement of Science [AAAS], 1993). Furthermore, these science education reforms recommend the use of an inquiry-based science teaching strategy by teachers in order to promote scientific literacy among all students. This recommendation is based on research studies that have continued to show that inquiry-based instruction is a more effective instructional strategy in science classrooms than the traditional knowledge transmission instructional strategies (Anderson, 2002; Maroney, Finson, Beaver & Jensen, 2003; Wang, 2011; Scruggs, Mastropieri & Boon, 1998). Inquiry is both a teaching approach and a learning goal (National Research Council [NRC], 1996). As a teaching approach, inquiry involves students learning how to ask questions, propose explanations, test those explanations against current scientific knowledge and sharing their ideas with others (Haefner, 2004; Kennedy, 2013); questioning their own observations, as well as those made by others (Moore, 1993; Huber, 2001), and dealing with the frustrations of experimental error, missing data and uncontrolled variables (Okebukola, 1988). Inquiry learning goals include abilities to undertake inquiry and an understanding of the foundations of inquiry (NRC, 1996).

Several studies have examined science teachers' conceptions of inquiry (Chabalengula & Mumba, 2013), use of inquiry activities in science classrooms (Staer, Goodrum & Hacking, 1998), challenges for implementing inquiry in regular science lessons (Boardman, & Zembal-Saul, 2000), the effect of inquiry activities on students' enjoyment and achievement (Haefner, 2004), and inquiry levels addressed by teachers in schools (Zion & Mendelovici, 2012). In general, studies report that most teachers do not have a complete understanding of inquiry. As such, inquiry-based instruction has been difficult for some teachers to accept and implement in their classrooms. For example, Staer *et al*. (1998) report that Australian high school teachers are generally not implementing open inquiry activities in science lessons even though they are aware of the multiple benefits of inquiry in high school classrooms.

Likewise, studies have reported the use of inquiry-based instruction in achieving the goals of science teaching for students in elementary and middle school inclusive science classrooms (Magnusen, 1997; Mastropieri, Scruggs, & Graetz, 2005; Mastropieri, Scruggs, Norland, Berkeley, McDuffie, Tornquist, & Connors 2006; Maroney et al, 2003; Scrugg, Mastropieri & Boon, 1998; Wang, 2011). Moin, Magiera and Zigmond (2008) also argue that SWD can succeed in science if they receive the kind of instruction they need. Scruggs and Matropieri, (1994) also contend that SWD achievement is significantly higher when teachers use inquiry-based approaches to teaching science than when they use the traditional approaches such as lectures. However, studies have also reported challenges faced by SWD in learning science, such as difficulties with working with numeric data, difficulties in spoken or written expressions, attention and behavioural issues, lack of ability to link ideas in chains of reasoning, and difficulties in using printed text especially for students with visual impairments (Mastropieri & Scruggs, 2001, Brigham, Scruggs, Margo, & Mastropieri, 2011).

Although studies have examined inquiry-based instructional practice in inclusive science classrooms most studies have mainly focused on elementary and middle school levels. Apart from the study by Mastropieri *et al.,* (2005) that has compared the effectiveness of peer tutoring and teacher directed instruction in inclusive high school chemistry classes, we did not find any study that has reported teachers' perceived benefits and challenges of inquiry-based instruction in high school inclusive science classroom. As such, there is a dearth of research on general education high school science teachers' perceived benefits and challenges of inquiry in high school inclusive science classrooms. Yet, the number of SWD being included in regular high school science classrooms is increasing (Mastropieri & Scruggs, 2001; Reausen, Shoho & Barker, 2001; Subban & Sharma, 2006; US Department of Education, 2011). Therefore, the success of providing effective inquiry instruction in inclusive science classrooms largely depends on what science teachers view as the benefits and challenges of inquiry in such classrooms, and how they overcome such challenges. As such, it is important to know what high school science teachers perceive as benefits and challenges of inquiry in inclusive science classes. Therefore, the purpose of this study is to explore high school chemistry teachers' perceived benefits and challenges of inquiry-based instruction in inclusive chemistry classes. The study also seeks to establish the participant chemistry teachers' knowledge of inclusive teaching.

Research Questions

This study is guided by the following research questions:

1. What are participant high school chemistry teachers' knowledge about teaching in inclusive classrooms?
2. What do participant high school chemistry teachers perceive to be the benefits and challenges of inquiry instruction in inclusive chemistry classrooms?

Significance of the study

The findings of this study are significant, not only for chemistry teacher educators but also for school administrators, teacher professional development providers, science curriculum designers and science education researchers. Furthermore, the results have implications on chemistry teaching and learning, and teacher education. For example, information on teachers' views on the benefits and challenges of inquiry in inclusive chemistry classes has the potential to contribute to better teacher preparation. Additionally, uncovering the challenges of inquiry in inclusive chemistry classrooms can help chemistry teachers take into account such challenges when planning inquiry instruction for inclusive chemistry classes. It is also anticipated that school administrators become more aware of how they are able to support their chemistry teachers to effectively use inquiry in inclusive chemistry classrooms. Furthermore, this study extends previous research on inclusive science teaching and learning by reporting on high school chemistry teachers' perceived benefits and challenges of inquiry in inclusive chemistry classrooms.

METHODOLOGY

Participants

The sample comprised 61 high school chemistry teachers from different high schools across the United States. These teachers were enrolled in online graduate chemistry education courses in spring 2013, and fall 2013, at a research university located in the Midwest of the United States. There were 32 males and 29 females and their teaching experience ranged from 5 to 25 years. Twenty-one (21) teachers had bachelor degrees in biology with endorsement in chemistry, and 40 teachers had bachelor degrees in chemistry with endorsement in physics or biology, while 45 teachers had masters' degrees in education. All teachers had taken two or more online graduate courses in the chemistry teacher education program. The main goal of the online courses was to improve teachers' chemistry content knowledge and inquiry instructional knowledge and skills. These were content and pedagogy integrated courses. The topics covered in the courses were: chemical reactions, chemical kinetics, chemical equilibrium, atomic structure, acids and bases, gas laws, features of inquiry, inquiry levels and skills, demonstrations, target laboratory activities, learning cycle, constructivism, and conceptual change instructional model.

Data Collection

Data were collected using a modified questionnaire that was initially developed by Staer, Goodrum and Hackling (1998). Staer et al. used the initial questionnaire to explore Australian science teachers' perceptions of the benefits and difficulties of implementing more open inquiry laboratory work in regular classrooms. The original questionnaire had three parts. Part 1 had four items on demographics, and teaching specialization while part two had seven closed items on specific laboratory format information. Part three had two open-ended items on the benefits and difficulties for students and teachers doing laboratory in which students planned and carried out their own experiments. The modified version of the questionnaire had four sections. The first section included items on demographic data such as: gender, teaching experience, teaching certification, and experience in working with students with mild learning disabilities, number of special education in chemistry classrooms, and common learning disabilities among their students. The second section had two open-ended questions that asked participants to list the benefits and challenges of inquiry in inclusive chemistry classrooms for students and teachers. A third section included Likert-scale statements on the benefits of inquiry in inclusive chemistry classroom for teachers and students. Section four involved Likert-scale statements on the challenges of inquiry in inclusive chemistry classroom for teachers and students. Teachers were asked to select *Strongly Agree*, *Agree*, *Neutral, Disagree*, or *Strongly Disagree* with regard to the statements concerning benefits and challenges of inquiry in inclusive chemistry classroom. Each section of the instrument was made using Survey Monkey software. Then, links to the questionnaires were e-mailed to the participant chemistry teachers in two steps. In the first step, an email was sent out to participant teachers with a link to the first and second sections of the questionnaire. Participant teachers were given a week to respond to these two sections. A week later, a second email was sent to the same teachers with the link to sections three and four that had the Likert-scale items on the benefits and challenges of inquiry in inclusive chemistry classroom. Again, they were given a week to respond to the Likert-Scale.

A two-step process of data collection was conducted in order for teachers to list their own perceptions of benefits and challenges of inquiry in a chemistry inclusive classroom (in section 2) before seeing our suggested Likert-scale statements on benefits and challenges of inquiry in inclusive classroom (in third and fourth sections).

Validity and Reliability. Reliability of the Likert-scale sections of the questionnaire were determined by computing Cronbach's alpha (α) values. Cronbach's alpha values were 0.846 for the benefits of inquiry section of the questionnaire, and 0.934 for the challenges of inquiry section of the questionnaire. These values were acceptable measures of reliability because more than 0.70 the threshold value of acceptability was achieved as a measure of reliability (Cohen, 1988). Content and construct validities of the instrument were established with the help of one science education and one special education experts. These experts, independently, checked for the extent to which the items in the instruments elicited information on the benefits and challenges of inquiry in inclusive chemistry classroom. To ensure construct validity of the instrument, the experts looked at whether the items in the instruments were well constructed for the target audience. Feedback from the two experts was addressed and incorporated into the final version of the questionnaire.

Data analysis

Participant teachers' responses to open-ended items in the questionnaire were coded to identify emerging themes that formed categories (e.g. training in special education or inclusive teaching, confidence in teaching inclusive chemistry classes, knowledge of US laws on special education, experience in teaching SWD). Likert-scale items were scored by assigning 5 to "Strongly Agree", 4 to Agree, 3 to Neutral, 2 to Disagree, and 1 to Strongly Disagree. Descriptive statistics were computed for each data set.

RESULTS

Teachers' knowledge of inclusive Teaching

Most teachers said they had little knowledge about special education or inclusive teaching. Most attributed this to a lack of adequate training in special education. For example, Table 1 below shows all teachers had not received training in special education or inclusive teaching, though they were teaching inclusive chemistry classes. Similarly, most teachers

(57.38%) said they were not well acquainted with the US laws on special education. Despite the low level of knowledge on special education and the lack of training in inclusive teaching all participant teachers reported they had gained valuable experience in teaching inclusive chemistry classes over the years. For example, 75.41% had taught inclusive chemistry classes for more than 5 years, compared to 24.5% who had taught inclusive chemistry classes for less than 5 years. As shown in Table 1, most teachers had taught more than 10 SWD in their chemistry courses. Although teachers reported they had SWD in their chemistry courses, very few expressed high confidence in teaching chemistry in inclusive classes. Most teachers (59.02%) had moderate confidence in teaching chemistry in inclusive classes, while 24.59% expressed low confidence in such teaching.

Table 1 Experiences with Inclusive Teaching (N=61)

Category	Response	Number of Teachers	Percent (%)
Training in special education	Yes No	0 61	0 100
Training in inclusive teaching	Yes No	0 61	0 100
Knowledgeable about US laws on special education	Very well Well Not well Not very well	0 5 21 35	0 8.20 34.43 57.38
Confidence teaching inclusive chemistry classes	High Moderate Low	10 15 36	16.39 24.59 59.02
Years of experience teaching inclusive chemistry classes	Zero Less than 5 years More than 5 years	0 15 46	0 24.59 75.41
Number of chemistry SWD taught in past 5 years	Zero Less than 10 More than 10	0 18 43	0 29.51 70.49

Benefits and challenges of Inquiry Elicited from Open-ended Items Responses

The results in this section show the benefits and challenges of inquiry-based instruction in an inclusive chemistry classroom, identified by teachers.

Benefits of Inquiry: Table 2 lists the benefits identified through inquiry As such, these responses suggest that teachers see the benefits for their students in an inquiry-based instruction in an inclusive chemistry classroom but may not see the benefits for themselves.

Table 2 Benefits of Inquiry

Benefits	Percentage
Student engagement	87
Student seeks explanation through activities	76
Group work benefits both special education and regular students	70
Sparks interest	65
Students take ownership of the results	56

Challenges of Inquiry: Table 3 lists the major challenges of inquiry in inclusive chemistry classroom Most of the challenges are focused on the teachers. Thus, these responses suggest that teachers see the challenges they may encounter in their own classroom but may not see the challenges students face while integrating inquiry instruction in inclusive chemistry classes.

Table 3 Challenges of Inquiry

Challenges	Percentage
Meeting curricular goals (time & planning)	82
Class management especially with large classes	75
Special education students require extra time working on tasks	45
Students do not have same level of competence	41
Achieving good strong-weak student pairs	25

Benefits and challenges of Inquiry Elicited from Likert-Scale Responses

Benefits of Inquiry to Students: As shown in Table 4 below, most teachers strongly agreed or agreed with the statements on the benefits of inquiry to students in inclusive chemistry classes. For example, 86% of the teachers strongly agreed that inquiry instruction in inclusive chemistry class promotes the development of problem solving skills among students, and 57% strongly agreed that students learn scientific procedures and design.

Similarly, all teachers (100%) agreed that inquiry is useful to students of certain abilities; Inquiry motivates students to learn (85.7%); provides variety of activities (100%); and enhances their confidence (85.7%).

However, some teachers were neutral on some statements. For example, 57.1% of the teachers expressed indifferent view on the idea that inquiry in inclusive chemistry class promotes self-esteem among students; 57.1% remained neutral on the statement that regular students learned from students with learning disabilities; and 57.1% of the teachers were neutral on whether students with disabilities learned from regular students. The last two ratings were in contrast with their response to one open-ended item where 70% of the teachers said group work benefits both special education and regular students.

Table 4 Benefits of inquiry to students in inclusive chemistry classes (N=61)

Item	**SA**	**A**	**N**	**D**	**SD**
Development of problem solving skills	85.7	14.3	0	0	0
Learning scientific procedures and design	57.1	28.6	14.3	0	0
Students have ownership of the results	42.9	57.1	0	0	0
Development of personal skills	42.9	42.9	14.3	0	0
Provides variety of activities	42.9	57.1	0	0	0
Greater understanding of concepts	42.9	28.6	28.5	0	0
Motivates students to learn	28.6	57.1	14.3	0	0
Promotes self-esteem	28.6	14.3	57.1	0	0
Students have a feel of real scientists work	28.6	28.6	28.6	14.3	0
Confidence enhancement	28.6	57.1	14.3	0	0
Students with disabilities learn from regular students	14.3	28.6	57.1	0	0
There is sense of achievement	14.3	85.7	0	0	0
Promotes creativity	14.3	57.1	28.6	0	0
Regular students learn from students with disabilities	14.3	28.6	57.1	0	0
Useful for students of certain abilities	0	100	0	0	0

SA-Strongly Agree, A-Agree, N-neutral, D-Disagree, SD-Strongly Disagree

Challenges of Inquiry to Students: Most teachers agreed that students have difficulties working with numeric data during inquiry activities. Similarly, most teachers agreed that student have difficulties with written expressions, lack abilities to link ideas in chains of reasoning, and have difficulties handling equipment especially students with motor coordination impairments. However, most teachers expressed a neutral response to the idea that students have difficulties following verbal instructions especially those who are deaf or hard to hear, and use of printed text, especially those who have visual impairments.

Table 5 Challenges of inquiry to students in inclusive chemistry classes (N=61)

Item	SA	A	N	D	SD
Difficulties in written expressions	14.3	71.4	14.3	0	0
Attention and behavioral issues	14.3	42.9	28.6	14.3	0
Ability to link ideas in chains of reasoning	14.3	71.4	14.3	0	0
Difficulties working with numeric data	0	85.6	0	14.3	0
Difficulties in spoken expression	0	57.1	42.9	0	0
Difficulties in participating in group work	0	57.1	14.3	14.3	14.3
Use of printed text for students with visual impairments	0	42.9	57.1	0	0
Difficulties following verbal instructions for students who are deaf or hard of hearing	0	42.9	57.1	0	0
Difficulties handling equipment by students with motor coordination impairments	0	71.4	28.6	0	0

SA-Strongly Agree, A-Agree, N-neutral, D-Disagree, SD-Strongly Disagree

Benefits of Inquiry to Teachers: Generally, most teachers agreed or strongly agreed with the statements on the benefits of inquiry to teachers in inclusive chemistry class (Table 6). Most teachers agreed with the idea that inquiry instruction help teachers to keep students more on task during class in inclusive chemistry classroom. Similarly, teachers agreed that inquiry promotes effective teaching, facilitates the achievement of curriculum objectives, brings personal job satisfaction, and enable teachers to present activities and concepts in a variety ways.

Challenges of Inquiry to Teachers: Most teachers agreed to the challenges of inquiry to teachers in inclusive chemistry class listed in Table 7 below. In particular, 71.4% of the teachers strongly agreed that there was a time constraint for covering the curriculum, and 85.7% agreed that teachers faced challenges of managing the number of students per experiment. Similarly, more than half of the teachers acknowledged that inquiry in inclusive chemistry required teacher effectiveness, demands for more equipment for lab activities, and it was difficult to assess students. Further, 57% of teachers acknowledged lack of training in special education as one of the challenges of inquiry in inclusive chemistry class. On the contrary, teachers (57%) disagreed with the statement that there was a negative attitude among special education students towards inquiry.

Table 6 Benefits of inquiry to teachers in inclusive chemistry classes (N=61)

Item	SA	A	N	D	SD
Students do not entirely depend on the teacher for explanations	42.9	28.6	14.3	14.3	0
Opportunity to observe and help students	42.9	42.9	14.3	0	0
Promotes effective teaching	28.6	57.1	14.3	0	0
Facilitates the achievement of curriculum objectives	28.6	57.1	14.3	0	0
Students are more on the task	28.6	71.4	0	0	0
Personal job satisfaction	28.6	57.1	14.3	0	0
Assessing students' understanding and skills on the spot	28.6	42.9	28.6	0	0
Teachers can identify students with learning disabilities	28.6	28.6	42.9	0	0
Promotes variety ways to present activities and concepts	28.6	57.1	14.3	0	0

SA-Strongly Agree, A-Agree, N-neutral, D-Disagree, SD-Strongly Disagree

Table 7 Challenges of inquiry to teachers in inclusive Chemistry Classes (N=61)

Item	SA	A	N	D	SD
Time constraints for covering the Curriculum	71.4	14.3	14.3	0	0
Safety management	42.9	28.6	28.6	0	0
Organization and preparation demand	42.9	42.9	14.3	0	0
Students at different levels of competency	42.9	42.9	14.3	0	0
Lack of training in special education	42.9	57.1	0	0	0
Behavior management	28.6	42.9	28.6	0	0
Students require more help	28.6	42.9	28.6	0	0
Requires Teacher effectiveness	28.6	57.1	14.3	0	0
Demand for more equipment for labs	14.3	57.1	28.6	0	0
Assessment	14.3	57.1	28.6	0	0
Management of number of students per experiment	0	85.7	14.3	0	0
Negative attitude by special education students	0	14.3	28.6	57.1	0

SA-Strongly Agree, A-Agree, N-neutral, D-Disagree, SD-Strongly Disagree

DISCUSSION

Most teachers had no training in inclusive teaching, lacked knowledge of chemistry teaching in inclusive classes, and had moderate confidence in teaching chemistry in inclusive classes. The lack of training in inclusive teaching among participant teachers was similar to those reported by Norman, Caseau, and Stefanich (1998) and Subban and Sharma (2006). Both studies reported that science teachers had low knowledge on special education. Teachers who possessed some training in teaching students with disabilities were more positive about inclusive teaching than those who didn't possess any form of training (Southerland & Gess-Newsome, 1999; Subban & Sharma, 2006). On the other hand, science teachers who lacked training and experience in teaching students with disabilities, were not knowledgeable on the best practices of teaching students with disabilities, and often held stereotypical views of the abilities of students with disabilities (Norman, Caseau, and Stefanich, 1998). Similarly, some challenges that both teachers and students faced in meeting the expectations of science education, especially for students with special education needs (Brigham, Scruggs, & Mastropieri, 2011; Norman, Caseau, & Stefanich, 1998; Reausen, Shoho, & Barker, 2001), were because of teachers' inadequate preparation to adjust instruction to suit both regular and special education.

Most teachers in this group acknowledged the benefits and challenges of inquiry to both students and teachers in an inclusive chemistry classroom. This finding was similar to those reported by Staer, Goodrum, and Hackling (1998). However, in their responses to open-ended items, the participant chemistry teachers reported more benefits of inquiry for students than to themselves, and more challenges of inquiry for teachers than to students. Similarly, earlier studies have reported that students with learning disabilities face challenges in learning science (Brigham, Scruggs, Margo, & Mastropieri, 2011; Wang, 2011), such as working with numeric data, difficulties in spoken or written expressions, attention and behavioral issues, ability to link ideas in chains of reasoning, and use of printed text for students with visual impairments. Such challenges represented barriers for quality inquiry in inclusive science classrooms. As such, the barriers needed to be addressed if chemistry teachers were to implement effective inquiry-based in their inclusive classrooms. Furthermore, the findings suggested that teachers needed more training in special education and inclusive teaching for them to develop more confidence in teaching inclusive chemistry classes and pedagogical knowledge for such classes. Explicit instruction on inclusive teaching should be provided to teachers by integrating effective instructional strategies for inclusive science classes in teaching methods courses and through chemistry teacher professional development programs. Such professional programs should aim at developing inquiry-based instructional skills among teachers for both regular and inclusive chemistry classes.

This study only examined teachers' perceived benefits and challenges for inquiry-based instruction in inclusive chemistry classes, and their knowledge about special education, and inclusive teaching. Future studies should examine high school science teachers' inquiry instructional practices in inclusive classes, and their curriculum and instructional decisions for such classes, and the factors that influence their instructional practices and decisions.

CONCLUSIONS

This study explored high school chemistry teachers' perceived benefits and challenges of inquiry in inclusive chemistry classes, and chemistry teachers' knowledge of inclusive teaching. All participant chemistry teachers from different school districts across the USA had no training in special education or inclusive teaching, and little or no knowledge about the US laws on special education, and inclusion. Furthermore, teachers reported moderate confidence for inquiry chemistry teaching in inclusive classes. They might have gained this moderate confidence in teaching chemistry in inclusive classes, because of their teaching experiences in schools.

Despite the lack of training in inclusive teaching, most teachers acknowledged that inquiry instruction in inclusive chemistry classes had several benefits and challenges to students and teachers. On the other hand, teachers' responses to open-ended items showed that teachers saw the benefits of inquiry for their students but might not acknowledge the benefits for their own instruction. Furthermore, their responses showed they recognized the challenges they might face but might not understand the challenges students faced.

REFERENCES

American Association for the Advancement of Science (AAAS) (1993). *Science for all Americans: Project 2061*. New York: Oxford University Press.

Anderson, R.D. (2002). Reforming science teaching: What research says about inquiry. *Journal of Science Teacher Education*, *13*(1), 1- 12.

Brigham, F. J., Scruggs, T. E., & Mastropieri, M. A. (2011). Science education and students with disabilities. *Learning Disabilities Research and Practice*, *26*(4), 223 – 232.

Boardman, L. & Zembal-Saul, C. (2000). *Exploring prospective teachers' conception of scientific inquiry*. Paper presented at the annual meeting of the National association for Research in Science Teaching (NARST), New Orleans, LA.

Chabalengula, V. M. & Mumba, F. (2013). Inquiry-based Science Education: A scenario on Zambia's High School Science Curriculum. *Science Education International*, *23* (4), 307-327.

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences*. Lawrence Erlbaum Associates, Publishers, Hillsdale, NJ.

Haefner, L. A. (2004). Learning by doing? Prospective elementary teachers' developing understandings of scientific inquiry and science teaching and learning. *International Journal of Science Education*, 26(13), 1653-1674.

Huber, R. A. (2001). A model for extending hands-on science to be inquiry based. *School Science and Mathematics, 101*(1), 32-42.

Individuals with Disabilities Education Act [IDEA] (2007). http://www.cde.ca.gov/sp/se/lr/ideareathztn.asp

Jakupcak, Z., Rushton, R., Jakupcak, M. & Lundt, J. (1996). Inclusive Education. *The Science Teacher, 40*(5), 40-43.

Kearney, C. A., & Durand, V. M. (1992). How prepared are our teachers for mainstream classroom settings? A survey of postsecondary schools of education in New York State. *Exceptional Children, 59*, 6-11.

Kennedy, D. (2013). The role of investigations in promoting inquiry-based science education in Ireland. *Science Education International*, *2*(4), 282-305.

Kirch, S. A., Bargerhuff, M. E., Cown, H., & Wheatly, M. (2007). Reflections of educators in pursuit of inclusive science classrooms. *Journal of Science Teacher Education, 18*, 663 – 692.

Magnusen, M. (1997). *Use of 'dudley, the functioning torso' as a supplement to textbook instruction*. Unpublished Masters Project. West Lafayette, IN: Purdue University, Department of Educational Studies.

Maroney, S.A., Finson, K.D., Beaver, J.B., & Jensen, M.M. (2003). Preparing for successful inquiry in inclusive science classrooms. *Teaching Exceptional Children*, *36*(1), 18 – 25.

Mastropieri, M.A., & Scruggs, T.E. (2001). Promoting inclusion in secondary classrooms. *Learning Disability Quarterly*, *24*(4), 265 – 274.

Mastropieri, M. A., Scruggs, T. E., & Graetz, J. (2005). Cognition and learning in inclusive high school chemistry classes. In T. E. Scruggs & M. A. Mastropieri (Eds.), *Cognition and learning in diverse settings: Advances in learning and behavioral disabilities (*Vol. 18, pp. 99–110). Oxford, UK: Elsevier.

Mastropieri, M. A., Scruggs, T. E., Norland, J. J., Berkeley, S., McDuffie, K., Tornquist, E. H., & Connors, N. (2006). Differentiated curriculum enhancement in inclusive middle school science: Effects on classroom and high-stakes tests. *The Journal of Special Education*, *40*(3), 130 – 137.

Moin, L.J., Magiera, K., & Zigmond, N. (2008). Instructional activities and group work in the US inclusive high school co-taught science class. *International Journal of Science and Mathematics Education, 7*, 677 – 697.

Moore, J. A. (1993). *Science as a way of knowing*. Cambridge, Massachusetts: Harvard University Press.

Mumba, F & Chitiyo, M. (2008). High school Chemistry Teachers' Curriculum and Instruction Decisions for Inclusive Classroom. In: Lamanausakas, V. (Ed.). *Problems of Education in the 21st Century: Recent Issues in Science and Technology Education*, Vol. 9, 74-80. Scientific Methodical Center, Lithuania.

National Research Council (NRC). (1996). *National science education standards*. Washington, DC: National Academy Press.

Norman, K., Caseau, D., & Stefanich, G.P. (1998). Teaching students with disabilities in inclusive science classrooms: Survey results. *Journal of Science Education, 82*, 127-146.

Okebukola, P. A. (1988). An assessment of the structure and skill level of the tasks in the Nigerian integrated science project. *Journal of Research in Curriculum, 6*, 1-6.

Reausen, K.V., Shoho, A.R., & Barker, K.S. (2001). High school teacher attitudes toward inclusion. *High School Journal, 84*(2), 7 – 14.

Scruggs, T. E. & Mastropieri, M. A. (1994). Successful mainstreaming in elementary science classes: A qualitative investigation of three reputational cases. *American Educational Research Journal, 31*, 785–811.

Scruggs, T. E., Mastropieri, M. A. & Boon, R. (1998). Science education for students with disabilities: A review of recent research. *Studies in Science Education, 32*, 21 – 44.

Southerland, S. A., & Gess-Newsome, J. (1999). Pre-service teachers' views of inclusive science teaching as shaped by images of teaching, learning, and knowledge. *Journal of Science Education, 83*, 131 – 150.

Staer, H., Goodrum, D., & Hacking, M. (1998). High school laboratory work in western Australia: Openness to inquiry. *Research in Science Education, 28*(2), 219-228.

Subban, P. & Sharma, U. (2006). Primary school teachers' perceptions of inclusive education in Victoria, Australia. *International Journal of Special Education, 2*(1), 42 – 52.

US Department of Education (2011, March). *Preparing students with disabilities for success: Secretary Duncan's remarks to the American association for people with disabilities*. Retrieved January 27, 2012, from http://www.ed.gov/news/speeches/all-means-all-secretary-duncans-remarks-american-association-people-disabilities.

Wang, Y. (2011). Inquiry-based science instruction and performance literacy for students who are deaf or hard of hearing. *American Annals of the Deaf, 153*(3), 239 – 254.

Zion, M. & Mendelovici, R (2012). Moving from structured to open inquiry: Challenges and Limits. *Science Education International*, *23* (4), 383-399.