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THE CONCEPTUAL CHANGE AND ATTITUDES OF STUDENTS WITHOUT DISABILITIES

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DEDICATION

This study is dedicated to my wife Canan, my son Selahaddin Yusuf, and my daughter Esma Seher who has fully supported me in this long journey over the years.

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For the support, love, and patience of my family, I can only say thank you. I would have never attempted to soar without your unwavering support and affection. Your encouragement and love kept me focused. Thank you.

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DISSERTATION ABSTRACT

As a philosophy and educational approach, inclusive education provides opportunities for all students to have effective conceptual understanding and positive social attitudes (Idol, 2006). With inclusion, educators incorporate students with disabilities into the regular classroom rather than exclude students from these environments (Norwich, 1999). Even though the centerpiece in inclusion is the academic development of all students (Dukes & Lamar- Dukes, 2006), the research literature mostly emphasizes the benefits of inclusion on students with disabilities and excludes their non-disabled peers.

The purpose of this study was to investigate the conceptual understanding and retention of students without disabilities and their attitudes towards students with disabilities in inclusive science classrooms at a charter middle school. This study included the collection and analysis of quantitative data using a non-equivalent quasi-experimental design to determine if students without disabilities in inclusive charter middle school science classrooms were positively or negatively affected by the process of being educated with their learning-disabled peers within inclusive science classrooms.

This study took place in a charter middle school in a large urban school district in a southwestern U.S. state. The participants of this study included 20 students without disabilities in two middle school science classrooms (one inclusive and one non-inclusive) per grade level (grades 6-8) with a total number of 120 students. The study included two science lessons on density, a density assessment tool, and an attitude measurement survey.

Analysis of the data occurred at three levels: (a) conceptual understanding, (b) conceptual retention, and (c) attitudes of students without disabilities toward students with learning disabilities. The study findings suggested that inclusive science education had a significantly positive effect on the conceptual understanding; a negative effect on conceptual retention; and a negative effect on the attitudes of students without disabilities towards their peers with disabilities in inclusive classrooms.

Chapter I: Introduction

Providing appropriate educational settings and services for students with disabilities has long been a controversial topic among educators in the U.S. (Anderson, 2010). The federal mandates require all schools to ensure that all individuals with disabilities must have access to general education classrooms and receive equal education that is provided to all students (Bateman & Bateman, 2001; Nolan, 2004). In addition, the laws and special education advocates suggest that the prevention of students with disabilities from the general education curriculum can be problematic in terms of having meaningful educational and learning opportunities (National Council on Disability, 2005). According to the Individuals With Disabilities Education Improvement Act (IDEIA, 2004), student disabilities include: autism, deaf-blindness, deafness, emotional disturbance, hearing impairment, intellectual disability, multiple disabilities, orthopedic impairment, other health impairment, specific learning disability, speech or language impairment, traumatic brain injury, and visual impairment. A learning disability is a disorder that involves one or more psychological processes in understanding or in using language, spoken or written, that may manifest itself in the imperfect ability to read, write, spell, listen, think, speak, or to do mathematical calculations (IDEIA, 2004).

Historical Perspective

Since the 1700s, advocates of people with disabilities have embarked on a long journey to secure the civil liberties of people with disabilities so that they can have the right to a public education (Hu, 2001). To promote progress toward integration, equality, and independence, legislation has shifted the focus of the special education community from the national level to the school level (Hu, 2001). Such changes have had a monumental impact on how students with disabilities are provided with educational services in their schools.

In the 1960s, as a result of the Civil Rights Movement, many U.S. schools exhibited a philosophical shift from segregating students with disabilities to mainstream settings, which are considered to be the least restrictive environment (LRE) (Fagan & Wise, 1994). Since then, there have been many federal laws and initiatives that have taken place to provide the most effective educational services for students with disabilities.

In 1975, the Education for All Handicapped Children Act (EHA) (Public Law 94-142) was enacted. This law mandated that students with disabilities would have a free and appropriate public education (FAPE) in the LRE. This movement emphasized the importance of mainstreamed settings, although these settings have been refined and clarified over time. However, educators have had mixed ideas for many years about what constituted LRE. Some researchers defined LRE as providing access of general education curriculum to students with disabilities to the most possible extent (Turnbull, Huerta, & Stowe, 2006). In order to comply with the EHA, school districts established a continuum of placement options (Kavale & Forness, 2000), which includes educating students in a variety of settings depending on their needs.

In 1986, the Regular Education Initiative (REI) was introduced (Will, 1986). The REI was considered monumental as it held both general education teachers and special education teachers responsible for the education of students who have special needs (Will, 1986). In addition, mainstreaming was defined for the first time as placing students with disabilities in regular education settings. The REI promoted the idea that regular education settings should be more accessible for students who are assigned to special education classrooms (Will, 1986).

In 1990, Congress replaced the EHA with the Individuals with Disabilities Education Act (IDEA) so that students with disabilities could have an Individualized Education Program (IEP) that includes the explanation of services, educational goals, and levels of student performances (Katsiyannis, Yell, & Bradley, 2001). As a result, the enactment of the IDEA indicated that free, appropriate education should be provided to students with disabilities in conformity with the IEP (Etscheidt, 2012).

The reauthorization of the IDEA in 1997 (U.S. Department of Education, 1997) placed a strong emphasis on improving outcomes for students with disabilities. This law has mandated that all students with disabilities should receive some or all of their instruction in general education settings (Kober, Jennings, Rentner, Brand, & Cohen, 2001). Before this legislation, the initial emphasis about how to provide services for students with special needs was placed upon the instructional setting. Students in special education had been markedly isolated from general education standards, curricula, and accountability (Hitchcock & Stahl, 2003).

After the IDEA 1997 amendment, a shift occurred that emphasized special needs students' access to the general education classroom and its curriculum (Zigmond, 2003). This focus enabled educators to push a movement toward instruction in the general education class with additional support provided within that class. The IDEA produced monumental changes in general classroom demographics when students with disabilities were mainstreamed into the general education classroom (Kober et al., 2001). The ramifications of IDEA 1997 resulted in fewer special education students being placed in a self-contained classroom while many more students with disabilities were incorporated in the general education settings (Villa & Thousand, 2003). These students were served in general education classrooms where they intermingled with the general education population and took part in the general curriculum with modifications as defined by their IEP (Van Reusen, Shoho, & Barker, 2000). After the IDEA, it was no longer enough for schools to assert that a student could have access to the general curriculum simply because they were placed in a general education classroom (Nolet & McLaughlin, 2000).

Since the enactment of the No Child Left Behind (NCLB) Act in 2002, students with disabilities have been spending an increasing amount of time in the general education setting. The NCLB 2002 called for increased levels of participation and progress in standards-based curriculum for all students. It mandated challenging academic content and achievement standards as measured by the attainment of *Adequate Yearly Progress* (AYP) goals. The NCLB required the use of research-based practices in all programs and ongoing student assessment to measure student achievement (Egnor, 2003). The accountability outlined in NCLB greatly increased pressure for general education teachers to share the task of educating all students, including students with disabilities. Accountability was no longer a matter of "your students" and "my students”; it means all students (Guetzloe, 1999). The NCLB enabled teachers to maximize access of the general education curriculum for all students with disabilities (Harris, Kaff, Anderson, & Knackendoffel, 2007).

In 2004, IDEA was amended again and renamed the Individuals with Disabilities Education Improvement Act (IDEIA) but kept many of the regulations regarding access to the general education settings (Karger, 2005). A key feature of the IDEIA 2004 is the continued inclusion of students with disabilities in the general education classroom (Turnbull, Huerta, & Stowe, 2006). According to this law, students with disabilities should have access to general education curriculum and participate in regular educational activities (Turnbull, Huerta, & Stowe, 2006). The IDEIA 2004 includes the section called LRE as well (Cosier & Causton-Theoharis, 2010). Within this section, the emphasis is that students with disabilities should be included in general education classrooms with the support of supplemental aids and services (Cosier, & Causton-Theoharis, 2010). This enactment stated that students with disabilities would participate in AYP requirements of NCLB (Thompson, Lazarus, Clapper & Thurlow, 2006). Therefore, the IDEIA 2004 emphasized that students with disabilities in regular education classrooms can successfully pass statewide student achievement tests (Karger, 2005). Both NCLB 2002 and IDEIA 2004 require students' access to the general education curriculum in the LRE (Berry, 2006).

Federal laws mandate public schools to make general education classrooms more accessible for students who receive special education. Due to these laws, general education teachers have more students with disabilities in their classrooms than in previous years (U.S. Department of Education, 2006). Historically, students with disabilities have received a combination of general and special education services in their education. In 1985, 25% of the students with disabilities were served in general education (all classes) 80% of the time (U.S. Department of Education, 2003). Moreover, this percentage increased to over 47% in 1999. The presence of students with disabilities served in general education classes is not sufficient. Public schools must meet the needs of students at all levels to comply with LRE, IDEA 1997, and IDEIA 2004 (Vaidya & Zaslavsky, 2000).

According to the U.S. Department of Education, the total enrollment (students with disabilities and students without disabilities) in public and private elementary and secondary schools (Pre-K through 12th grade) grew rapidly since the 1950s. The total enrollment in these schools was about 28 million in 1949–50 SY. By fall 2010, this number increased to 55 million (U.S. Department of Education, 2012). In contrast, the public school enrollment was 46 million by school year 1997-1998, and this number increased to 49 million in 2006-2007 SY (U.S. Department of Education, 2012).The number of students with disabilities has increased each year about 4 million in 1976 -77 SY in the U.S. (U.S. Department of Education, 2012) to 7 million in 2004-05 SY and to 6.5 million in 2009-10 SY (U.S. Department of Education, 2012). In 1990-91 SY, 33% of students with disabilities (about 5 million) spent their time in general education settings. In 2006-07 SY, this percentage increased to 57% (about 7 million). In 2009-10 SY, the percentage continued to increase to 59% (U.S. Department of Education, 2012).

Many students in special education receive combined services from a resource room within a self-contained special education classroom and from an inclusive classroom in the general education classroom where they receive special education services (Halvorsen & Neary, 2001). Inclusive education is a situation where students with disabilities are provided with all special education services within the general education classroom (Smoot, 2011). As a philosophy, inclusive education has become prevalent in the U.S. in both traditional public schools and charter schools (VanderHoff, 2008).

According to the 27th Annual Report to Congress in 2005, 9% of the students (age 6-21) in the U.S. public schools were being served under IDEA in 2003 (U.S. Department of Education, 2005). In addition, 50% of all students being served under IDEA (age 6-21) spend at least 80% of the school day in the general education setting while 19% of the students spend less than 21% of their time with their non-disabled peers in general education classrooms (U.S. Department of Education, 2003). Another report indicated that 96% of children with disabilities spend some time in a general education classroom (U.S. Department of Education, 2003).

Even though federal laws shifted the focus on how to effectively educate students with disabilities, it appears that these students continue to fall behind their non-disabled peers in regular education classrooms in many subjects including science (Mastropieri et al., 2006). The report from the National Assessment of Educational Progress (NAEP) shows that students in Grades 8 and 12 with disabilities scored lower than their non-disabled peers on the science test (U.S. Department of Education, 2005). NAEP 2005 results indicated that 73% of students with special needs scored lower on the most basic levels of the test. Although students without disabilities in Grade 8 scored higher on the NAEP 2011 than the NAEP 2009, the increment was only by two points (NAEP, 2011). Nonetheless, these results indicated that students with disabilities were behind their peers on science tests both in 2009 and 2011 (NAEP, 2011).

Science is a problematic subject not only for students with disabilities, but also for students without disabilities. When compared to students from other countries, all students from the U.S. score lower on international tests such as the Programme for International Student Assessment (PISA) and the Trends in International Mathematics and Science Study (TIMSS). On the PISA 2009, U.S. students ranked 23rd out of 72 countries (OECD, 2010). On the TIMSS 2007, U.S. students scored slightly above the average score (U.S. Department of Education, 2012). Although U.S. students scored seven points higher since the TIMSS 1995, they still lagged behind many OECD countries (U.S. Department of Education, 2012).

Since federal laws mandate schools to incorporate students with disabilities into mainstream classrooms, the numbers of students identified as having disabilities under the IDEIA have increased nationwide (Data Accountability Center, 2007). This increase is not only evident at national level, but also at state level. Reports show that the numbers of students with disabilities in Oklahoma public schools have increased over time. According to the National Dissemination Center for Children with Disabilities (NICHCY) (2012), the numbers of students (age 6-21) with disabilities in the state of Oklahoma have increased between the years of 2000-2011. In 2000, there were 79,184 students identified as having disabilities. This number increased by approximately 2% in 2001, 12% in 2005, and 14% in 2011 (NICHCY, 2012). The numbers of students (age 6-21) with disabilities in Oklahoma in 2001 represented 1.4% of the national average and in 2011 represented about 1.6% of the national average (NICHCY, 2012). This increase in the number of students with disabilities promoted educators in Oklahoma (NICHCY, 2012) and nationwide to advocate for the integration of all students with disabilities in the general education classroom regardless of need or ability (Lipsky & Gartner, 1996; Stainback, Stainback, & Ayers, 1996; Wang & Walberg, 1988).

Current reports show that students with disabilities in the U.S. are included more in mainstream classrooms and have more exposure to the general education curriculum than ever before (U.S. Department of Education, 2006). In traditional public schools, students with disabilities and their non-disabled peers develop conceptual understanding and positive attitudes in inclusive classrooms (Baker, Wang, & Walberg, 1994). Furthermore, students with disabilities who have access to general education classrooms make more academic progress than those students in special education settings (Peetsma, Roeleveld, & Karsten, 2001).

Failing to incorporate students with disabilities into inclusive classrooms may result in school dropouts and increased unemployment rates due to lack of conceptual understanding in core subjects. According to the Twenty Fourth Annual Report to Congress on the Implementation of the Individuals With Disabilities Education Act (U.S Department of Education, Office of Special Education Programs 2003), graduation rates for students with disabilities, although increasing, continue to be significantly lower than graduation rates of students without disabilities in traditional public schools. The report indicates that 62% of students with learning disabilities graduated with a diploma and 79% of students without disabilities graduated with a diploma. In other reports (Wagner, 1991), 28% of students with learning disabilities dropped out of high school before their fourth year. The dropout rate of students with learning disabilities are connected with factors such as lack of comprehension in core subjects and attitudinal issues (Dunn, Chambers, & Rabren, 2004; Kortering & Braziel, 2002). In addition, research shows that although employment rates for students with disabilities are increasing (45%), they continue to lag behind the rates of students without disabilities (63%) (Wagner, 2005).

Schools use different methods and educational philosophies to close the achievement gap between students with disabilities and their non-disabled peers. Federal enactments have mandated public schools to provide free and appropriate education for all students to prevent issues such as high dropout rates, low comprehension of core topics, and negative attitudes (Kortering & Braziel, 2002; Wagner, 2005). However, most public schools have had difficulty improving such issues for students with disabilities (Dunn et al., 2004). As a result, federal officials since the 1990s have promoted a new public school system called charter schools as a key mechanism to improve public education (VanderHoff, 2008).

Charter schools are primary and secondary schools funded by public money (VanderHoff, 2008). The number of traditional public schools and charter schools has increased over time. The number of traditional public schools in 2005-06 SY was 87,585, and in 2009-10 SY, the number of these schools increased to 89,018 (U.S. Department of Education, 2012). Conversely, the number of charter schools in 2005-06 SY was 3,780 with enrollment of 1,012,906 students, and in 2009-10 SY, the number of these schools increased to 4,952 with enrollment of 1,611,332 students (U.S. Department of Education, 2012).

All charter schools are accountable to all laws regarding education (IDEIA, 2004), they must provide special education services, and they cannot discriminate on the bases of ethnicity, race, and disability status (Ahearn, Lange, Rhim, & McLaughlin, 2001). However, charter schools enroll significantly lower numbers of students with disabilities than traditional public schools (Wilkens, 2009). The population of students with disabilities in charter schools matters because greater segregation of students with disabilities in charter schools represents a step backwards for public education due to lack of access to general education curriculum (Wilkens, 2009).

Problem Statement

It is evident that federal legislation regarding special education requires students with disabilities to have access to the general education curriculum and to be instructed alongside their non-disabled peers (IDEIA, 2004). These laws stress the use of evidence-based educational methods that result in deeper student understanding (Goswami, 2006). Reforms made by federal laws and advocacy organizations claim that public schools are accountable for the success of students with disabilities and school responsibilities must be demonstrated through an IEP, which outline specific instructional accommodations, modifications, and nondiscriminatory evaluations (Gartner & Lipsky, 1987; Schwartz, 1984). However, most public schools have neglected to provide special education services and address the specific educational needs of students with disabilities (Dunn et al., 2004). Therefore, state laws have promoted the charter school system as an alternative means to improve the public education system (VanderHoff, 2008). As regular public schools, charter schools are also accountable for all students' educational achievement and they need to make general education classrooms more accessible for students in special education (IDEIA, 2004; U.S. Department of Education, 2006).

Parents enroll their children in charter schools for several reasons. They consider charter schools as an alternative to traditional public schools (Schneider & Buckley, 2003; VanderHoff, 2008). Parents believe that charter schools have higher academic goals for their children (Imberman, 2011; Moores-Abdool, 2010; Smoot, 2011). Moreover, they believe that charter schools provide adequate services for students with disabilities (Allen, 2006). Researchers have examined the effects of inclusive education on students with disabilities, but the effects of inclusive education on the population of students without disabilities have been lacking in charter schools (Allen, 2006; Imberman, 2011; Moores-Abdool, 2010; Smoot, 2011; VanderHoff, 2008). Research suggests that students with disabilities in charter schools experienced positive effects of inclusion, such as improved social and learning skills as they take part in everyday life experiences with their non-disabled peers (Downing & Peckham-Hardin, 2007; Ferguson, Hanreddy, & Draxton, 2011; Howe & Welner, 2002; Lipsky & Gartner, 1997; Rhim, Ahearn, & Lange; 2007; Zimmer & Buddin; 2007).

Although several studies have been conducted on inclusive education and its effects on students with disabilities in charter schools, research that examines the effects of inclusive education on the population of students without disabilities in charter schools is limited. Furthermore, research on the population of students without disabilities in traditional public schools has mixed results about inclusive education. Kalambouka, Farrell, Dyson, and Kaplan (2007) found that inclusion had a positive effect on comprehension and attitudes of students without disabilities in traditional public schools while Salend and Duhaney (1999) found that inclusion had no effect on this population’s conceptual understanding and social attitudes. Other research revealed negative impacts of inclusion on conceptual understanding of students without disabilities in traditional public schools (Cook, Gerber, & Semmel, 1997; Gerber, 1995; Semmel, Gerber, & MacMillan, 1994).

Even though there is limited research on the effects of inclusion on students without disabilities in charter schools, the available research suggests that there are very few studies where the results concur (Lange & Ysseldyke, 1998; Swanson, 2005). Ferguson, Hanreddy, and Draxton (2011) found that most of the students without disabilities in a charter school responded that inclusion had a positive impact on their conceptual understanding and social skills. However, Drame (2011) indicated that there was no correlation between inclusion and the conceptual change of students without disabilities in charter schools (Drame, 2011). In addition, Downing, Spencer, and Cavallaro (2004) found that inclusion had no effect on improving negative attitudes of students without disabilities in charter schools, but inclusion did improve conceptual understanding of these students in all subjects including science.

In science classrooms, the concept named density is a challenging topic for many students (Cavallo & Laubach, 1998; Kang, Scharmann, & Noh, 2004; Raghavan, Sartoris, & Glaser, 1998).Generally, students have difficulty in making distinctions between mass, weight, density, balance of forces, and buoyancy (Hewson & Hewson, 1983; Posner, Strike, Hewson, & Gertzog, 1982; Raghavan, Sartoris, & Glaser, 1998). The goal to create an exchange between students' prior and current knowledge, and to establish a conceptual bridging on such knowledge about density will require science educators to provide effective science teaching that is integrating, engaging, and meaningful in regular education classrooms (Hewson & Hewson, 1983; Posner et al. 1982). Although providing an effective science lesson that leads to a meaningful conceptual understanding of density in regular science classrooms can be very difficult for most science teachers (Cavallo & Laubach, 1998; Kang et al., 2004; Raghavan et al., 1998), having students with disabilities in the same educational setting can be even more challenging as science instructors might have to use most of their effort on attitudinal problems associated with classroom management, differentiated instruction, and individualized instruction, (Kalambouka et al., 2007; Newman, 2006; Smoot, 2011). Therefore, the existence of students with disabilities in the regular science classroom can have an effect on the conceptual understanding and retention of science topics, in general, and on density, in particular, of students without disabilities, as well as on their attitudes towards students with disabilities in the inclusive classroom class (Drame & Frattura, 2011; Ferguson et al., 2011; Wolf, 2011).

Background and Need

Charter schools are required to implement inclusion in all classrooms as EHA 1975, IDEA 1997, NCLB 2002, and IDEIA 2004 emphasized that students with disabilities are legally entitled to FAPE and related instructional services in the LRE, which integrates them into the curriculum of the general education classrooms. Having access to the general education classrooms can help students with disabilities to gain higher comprehension of topics and exhibit positive social attitudes with their non-disabled peers (Imberman, 2011; Moores-Abdool, 2010).

As a philosophy and educational approach, inclusive education can provide opportunities for all students to have effective conceptual understanding and positive social attitudes (Idol, 2006). With inclusion, educators will incorporate students with disabilities into the regular classroom rather than exclude students from these environments (Norwich, 1999). These students will be socially accepted, gain a sense of belonging, and do the same things as their non-disabled peers through the general education curriculum (Booth, 1996). Even though, in inclusion, the centerpiece is the conceptual development of all students (Dukes & Lamar- Dukes, 2006), the research mostly emphasizes the benefits of inclusion on students with disabilities and excludes their non-disabled peers. However, in the inclusion model, students without disabilities gain knowledge and acceptance from interacting with students with special needs who differ in aptitude and achievement as well (O'Shea, 1999), but the research on this group of students is limited in charter schools. Moreover, there is limited research indicating that inclusion works for all students (Manset & Semmel, 1997). Research shows that there is no significant effect of inclusion on the conceptual understanding of students with disabilities and students without disabilities (Sharpe, York, & Knight, 1994). Staub and Peck (1994) concluded that inclusion had no impact on the achievement of students without disabilities. Another study suggested that inclusive educational programs have potential educational and social benefits on the population of students without disabilities (Harrower, 1999; Hunt & Goetz, 1997).

Purpose of the Study

The purpose of this study is to analyze the effects of inclusive science education on the general education population of charter middle school students' conceptual understandings and attitudes. Science is a challenging subject and students in the U.S. continue to lag behind their counterparts in OECD countries (U.S. Department of Education, 2005, 2012). There is research that suggests the effects of inclusive education on the population of both students with disabilities and their non-disabled peers in traditional public schools. In their study, Baker et al. (1994) found that students with disabilities and their non-disabled peers in inclusive settings established better conceptual understanding and social attitudes than comparable students in non-inclusive settings. In addition, there is research about the effect of inclusion on the special education population in charter schools (Downing & Peckham-Hardin, 2007; Jimenez, Browder, Spooner, & Dibiase, 2012). However, the research base is lacking when examining the effects of inclusive science education on the population of regular education students in charter schools (Schneider & Buckley, 2003; VanderHoff, 2008). The absence of research on how inclusive science education affects the general education population in charter schools is worthy of study and analysis. Even though research findings show inconclusive results about the effect of inclusive education on special education population in both traditional public schools and charter schools (Wolf, 2011), research fails to confirm this on the general education population in charter schools (VanderHoff, 2008). Therefore, a quantitative study will be designed as a quasi-experimental study to answer the following research questions.

Research Questions

This study sought to answer the following research questions:

1. How does inclusive science education affect the scientific conceptual understanding of general education students in a charter school?

2. What is the difference in retention of science concepts between students without disabilities in inclusive science classrooms and students in non-inclusive science classrooms after a-two-week inquiry science lesson?

3. How does inclusive science education affect the attitudes of general education students toward students with disabilities in a charter school?

Significance of the Study

Researchers and educators still have mixed feelings about the outcomes of inclusive education (Fuchs, Fuchs, & Fernstrom, 1993). There is sufficient information about the impact of inclusion on students with disabilities in charter schools, however lack of data and research fail to address the impact of inclusive education on general education population in charter schools (Schneider & Buckley, 2003; VanderHoff, 2008). Although the idea behind inclusive settings is to close the achievement gap between students with special needs and their peers in regular education settings, the lack of information on general education population has become problematic (Manset & Semmel, 1997). Research shows that inclusive practices have focused on diverse student populations that have specific needs, such as students in special education (Peetsma, Roeleveld, & Karsten, 2001). As a result, researchers have ignored the impact of inclusion on the general education population, which constitutes the majority of the classroom (Manset & Semmel, 1997). Does inclusive education negatively or positively affect the regular education population? Does the general education population benefit from learning while having students with special needs in the same settings? These questions can be answered in assessing the impact of inclusion on the population of general education students in inclusive settings in charter schools. As a result, this quantitative study aims to clarify the impact of inclusive science education on the conceptual change and attitudes of general education population of charter middle school students.

Definitions

Charter schools: Charter schools are primary and secondary schools funded by public money, often established by non-profit organizations, government entities, and universities. Although these schools are subject to some of the rules and regulations imposed on traditional public schools for the purposes of accountability (VanderHoff, 2008), they also have freedom from many of the state policies.

Children with disabilities: A child with mental retardation, hearing impairments (including deafness), speech or language impairments, visual impairments (including blindness), serious emotional disturbance, orthopedic impairments, autism, traumatic brain injury, other health impairments, or specific learning disabilities; and (ii) who, by reason thereof, needs special education and related services (IDEA, 1997).

Conceptual change: “Completely changing the ideas present in the students’ minds, correcting the wrong pre- knowledge that the students had, reaching the explanations that are accepted as scientifically true, acquiring the missing concepts, and going for a new cognitive restructuring” (Hewson,1992).

General education: “… refers to the curriculum that is used with non-disabled children” (IDEA, 34 C.F.R. Appendix A to Part 300 p. 12470, 1999).

Inclusion: “The practice of educating all or most children in the same classroom, including children with physical, mental, and developmental disabilities” (McBrien & Brandt, 1997).

Individualized Education Program (IEP): A legal contract written for each child with a disability. IEPs include student’s disability classification, student’s present level of performance, annual goals, an explanation of services, projected dates for duration of services, the extent to which a student will participate in the general education classroom, accommodations, and modifications (IDEIA, 2004).

Least Restrictive Environment (LRE). “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 special classes, separate schooling, or other removal of children with disabilities from the regular education environment occurs only when the nature or severity of the disability of a child is such that education in regular classes with the use of supplementary aids and services cannot be achieved satisfactorily” (IDEA, 1997).

Mainstreaming: “An effort to return students from special education classrooms to general education classrooms” (Ferguson, 2000).

Public schools: “A school that is funded by tax dollars, overseen by elected officials, operating with open admissions within its district”. (Higgins & Abowitz, 2011).

Regular Education Initiative (REI): "The nationwide effort to mainstream disabled students into regular education classrooms" (Peltier, 1993).

Resource room: Classrooms where a special education program can be delivered to a student with a disability; resource rooms are designed to provide a place where students with disabilities (whose primary placement is a general/regular classroom) can come for part of the school day to receive special, individualized or small group instruction based on their unique needs (Vaughn & Klingner, 1998).

Specific learning disability: "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, including conditions such as perceptual disabilities, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia. Specific learning disability does not include learning problems that are primarily the result of visual, hearing, or motor disabilities of mental retardation, of emotional disturbance, or of environmental, cultural, or economic disadvantage" (IDEIA, 2004).

Chapter II: Literature Review

Introduction

The Civil Rights movement in the 1950s and 1960s was the beginning of legislation for children with disabilities (Nolan, 2004). The case, *Brown vs. the Board of Education of Topeka, Kansas* in 1954 enabled the U.S. Supreme Court to determine that students with disabilities and their non-disabled peers have same rights to receive public education (Nolan, 2004). In addition, the U.S. Supreme Court determined that segregation based on race and disabilities could result in unequal educational opportunities (Nolan, 2004). The Court indicated that the existence of segregation can halt having equal educational opportunities in a learning environment (National Council on Disability, 2005).

The Education for All Handicapped Children Act (EHA) laid the foundation for current inclusive education because it guaranteed free and appropriate public education (FAPE) for all students with disabilities in the least restrictive environment (LRE) and secured these students' educational rights (Johnson, 1999; Nolan, 2004). The EHA was reauthorized by Congress in 1990 into the Individuals with Disabilities Education Act (IDEA) and suggested new kinds of disabilities, such as traumatic brain injury and autism were added to the list of eligible disabilities (Bateman & Bateman, 2001). Then, the IDEA 1997 stressed that inclusion of students with disabilities into the general education curriculum is crucial and that general education teachers are the mandatory members of the Individualized Education Program (IEP) team (Bateman & Bateman, 2001). Later, the enactment of the No Child Left Behind (NCLB) raised the expectations of disabled students (Cortiella, 2006). The law stressed the importance of setting high expectations of students with disabilities and making the general education curriculum accessible to the maximum extent possible for such student (Cortiella, 2006). The NCLB ensured that all students have equal opportunities to obtain high-quality education and reach proficiency on State standardized tests (Allbritten, Mainzer, & Ziegler, 2004; Cortiella, 2006). In 2004, IDEA was reauthorized and named the Individuals with Disabilities Education Improvement Act (IDEIA); and required that students with disabilities should have access to the general education curriculum (Goswami, 2006; IDEIA, 2004).

Federal laws require public schools to enable students with disabilities to receive instruction alongside students without disabilities (IDEIA, 2004). The laws claim that public schools will be held accountable for the achievement and comprehension of all students in all subjects (U.S. Department of Education, 2006). Public schools have used different educational approaches to increase all students' conceptual understanding (Wagner, 2005). In addition, these schools used different methods to close the achievement gap between students with disabilities and their non-disabled peers to comply with the laws (Kortering & Braziel, 2002). However, the public sector has had difficulty complying with the laws (Dunn et al., 2004). As a result, educational leaders passed a 1990 bill to promote a new public school system called charter schools, which are funded by public money and consist of primary and secondary schools (Vander Hoff, 2008). The number of charter schools have grown over time and reached to the enrollment of 1.6 million students in 2009-10 SY (U.S. Department of Education, 2012).

Although charter schools have been in existence more than two decades and have different regulations regarding their operation and establishment, they are held accountable to all laws regarding education (IDEIA, 2004). They cannot discriminate based on disability, and they must provide all services related to special education programs for students with disabilities (Ahearn, Lange, Rhim, & McLaughlin, 2001). Even though, charter schools enroll significantly lower numbers of students with disabilities than traditional public schools (Wilkens, 2009), they are still considered as alternative schools compared to traditional public schools for parents of students with disabilities (Schneider & Buckley, 2003). Most parents believe that charter schools set higher academic goals and provide necessary special education services for students with disabilities (Allen, 2006).

Even though research shows that the segregation of students with disabilities in charter schools prevents access to general education curriculum (Wilkens, 2009), there is research that indicates students with disabilities in charter schools have been included in inclusive classrooms (Downing & Peckham-Hardin, 2007) where they obtain crucial social and learning skills (Lipsky & Gartner, 1997). Although there is ample research about the outcomes of inclusion on the populations of students with disabilities and their non-disabled peers in public schools (Kalambouka, Farrell, Dyson, & Kaplan, 2007), research about students in charter schools, particularly those without disabilities in science classrooms is limited (Swanson, 2005). In addition, the available research on the population of students without disabilities in charter schools has mixed results (Downing, Spencer, & Cavallaro, 2004; Drame, 2011).

Although science is a difficult subject for many students, density is one of the most difficult topics, and can be very challenging as most students have difficulty learning the difference between mass and density, density and weight, or buoyancy and density in general education science settings (Cavallo & Laubach, 1998; Hewson & Hewson, 1983; Kang et al., 2004; Posner et al., 1982; Raghavan et al., 1998). Providing access to general education science classrooms for students with disabilities can make the science teaching and learning even more difficult as science teachers will have to shift their focus, attention and teaching methodology by having two different student populations in the same setting (Kalambouka et al., 2007; Newman, 2006; Smoot, 2011). Science teachers might have to challenge with issues related to classroom management and spend more time on helping and providing feedback to students with disabilities as this situation might cause students without disabilities to lose interest of the science topic and have negative attitudes towards their disabled peers (Drame & Frattura, 2011; Ferguson et al., 2011; Wolf, 2011). Therefore, having students with disabilities in inclusive science classrooms can have an impact on the conceptual understanding, retention and attitudes of students without disabilities (Aydeniz et al., 2012; Wild & Trundle, 2010).

This chapter consists of five sections. The first section of the literature review will address the theoretical framework that was employed for the research study. The second section of the literature review will address research related to the outcomes of the inclusive education on conceptual understanding and attitudes of students with disabilities and their non-disabled peers in traditional public schools. The third section of the literature review will address research related to the outcomes of the inclusive education on conceptual understanding and attitudes of students with disabilities and their non-disabled peers in charter schools. The fourth section of the literature review will address research related to the effect of science education on conceptual understanding and attitudes of students with disabilities. The fifth section of the literature review will address research related to the effect of science education on conceptual understanding and attitudes of students without disabilities.

Social Learning Theory

In formulation of a theoretical perspective for studying the conceptual understanding and positive attitudes of students without disabilities in science inclusion, social learning theory (Bandura, 1989) provides a useful prototype. This theory explains that variation in social structure, culture, and locations of individuals and groups in the social system explain variations in social attitudes (Morris & Higgins, 2010). Basically, this unified theoretical framework approaches the explanation of human attitudes in terms of reciprocal (continuous) interaction between cognitive, attitudinal, and environmental determinants (Bandura, 1989).

Social learning theory posits that human agents learn from each other by imitation, modeling, and observation (Bandura, 1989). Bandura (2001) stated that individuals do not need to learn everything directly because they can learn many things by observing other people's experiences. After the observation, the information gained through modeling and imitations are restored in a timely manner to serve as a guide for our actions (Grusec, 1992).

Social learning theory has been used in educational and clinical settings to address the techniques for learning and attitudinal modifications (Bandura, 2001; Bower

& Hilgard, 1981; Mischel, 1969; Rotter, 1954). In addition, social learning theory has also been applied to a wide range of social and pathological attitudes and conceptual competitiveness (Bandura & Walters, 1963; Mischel, 1969; Rotter, 1954; Staats, 1975).

By applying social learning theory to this scholarly research, the cognitive, attitudinal, and environmental determinants of continuous human interactions will be explained according to: (1) the social interactions among students (with and without disabilities) in an inclusive setting can have a positive effect on these students' cognitive development resulting in higher conceptual understanding; and (2) including students with different backgrounds (with and without disabilities) in a specific learning environment (inclusion) can result in positive social attitudes.

With the specific determinants of social learning theory, the reciprocal interaction between students with different backgrounds (students with disabilities and students without disabilities) can show that an increase in cognitive student achievement and positive social attitudes is the function of inclusive science classroom, which is the environmental setting in a social learning environment. As a result, the following statement represents the underlying logic for designing and conducting this scholarly research: If students with disabilities are included with students without disabilities in a charter middle school science classroom, then students without disabilities will attain higher conceptual understanding and demonstrate positive social attitudes.

Inclusive Education in Traditional Public Schools

Wehmeyer et al. (2003) examined the degree of classroom participation and access to the general curriculum that middle school students with a cognitive disability have in relation to their inclusive or self-contained classroom setting. The participants were 33 middle school students in grades six through nine from two schools. Researchers observed accommodations, adaptations and augmentations in the classrooms. First, they analyzed variances across 439 observations to determine if there was a difference between inclusion status of a student and what they were studying, either general education curriculum or accommodations in their IEP. Second, they examined class content being studied in different types of inclusive classrooms (like math, science/health, social studies, art/music, English/language arts, and history). They found that there was a positive correlation between amount of support required for and amount of time spent on a student accessing the general education curriculum. In addition, students, who required limited support, were engaged in activities related to the general curriculum in 87% of the intervals. Conversely, students requiring intensive support were engaged in activities related to accessing the general curriculum in only 55% of the intervals. As a result, 40% of students with disabilities in inclusion were more likely to be working on general curriculum than their counterparts in self-contained classrooms. However, students in self-contained classrooms were more likely to be working on IEP goals than students in inclusive settings.

Schwartz et al. (1998) used a case study methodology on students with autism who were in pre-school. The study was conducted at an early childhood education center at the University of Washington. The inclusive pre-school class contained 15 students, which included nine students who were diagnosed through autism or pervasive developmental disorder (PDD) and six students who were considered typically developing students. Three students participated in the case study. Researchers used a blend of applied attitude analysis and early childhood education/special education practices. All adaptations and modifications were provided as outlined in the students' IEP. In addition, teachers filled out an activity matrix for each child with a disability that was correlated to the objectives on the students' IEP. The findings of the study indicated that students in some cases were given physical prompting and continuous reinforcement to facilitate participation. Although the limitations of the case study included that there was no random selection, and these students were not representative of all of the students in the program, researchers indicated that three students in the case study exhibited conceptual understanding in the program as a result of specific instructional strategies that addressed academic needs of students with autism in inclusion.

Similar to Wehmeyer et al. (2003), Soukup et al. (2007) conducted a study to examine levels of general curriculum access for elementary students with a cognitive disability. Their sample included 19 elementary school students ages seven to 12 years old who were observed in either science or social studies class. Their observations were based on adaptations and accommodations provided in the general education setting. They used the Code for Instructional Structure and Student Academic Response (CISSAR) to collect data. Researchers found that students with disabilities received accommodations from paraprofessionals or peers 67% of the time. In addition, students who spent a greater amount of time in general education classrooms worked 98% of the time on grade level standards, but only worked 10% of the time on IEP goals. On the other hand, students, who sometimes were included in inclusive classrooms, spent almost 58% of their time working on IEP goals in self-contained classrooms. Lastly, researchers suggested that the greater inclusion of students with disabilities in inclusive settings was likely to result in higher access to the general curriculum and comprehension in science and social studies.

Newman (2006) conducted a study on students with learning disabilities and their access to inclusion. The participants included 1,000 students with learning disabilities. The researcher found that 94% of students with learning disabilities were taking at least one class in a general education classroom and had some type of instructional accommodation or classroom support. Of these included in general education classrooms, 35% received no curriculum modifications and instructional accommodations, 52% were reported as having some curriculum modifications, and 11% received substantial instructional modifications in the general education curriculum. The findings also indicated that 37% of these students received more frequent feedback from their general education teachers, which resulted in increased conceptual understanding of students in inclusive classrooms than non-inclusive ones.

Smoot (2011) conducted a study to measure how much general education peers socially accepted the students with disabilities in the general education setting. The participants of the study included 61 students with disabilities and their 286 general education peers. The findings indicated that there was no statistically significant difference in acceptance by gender of the student. In addition, only 43% of the students with disabilities were chosen by a non-disabled peer to work together. The study also suggested that having peer interactions resulted in higher understanding of students with disabilities as well as lower levels of negative attitudinal incidents in inclusion.

Conversely, Kalambouka et al. (2007) conducted research to examine manuscripts published on the impact of inclusive education (conceptual understanding, attitudes, and social outcomes) on students without disabilities. Researchers initially had a pool of 7,137 papers, which were identified through electronic databases. After having screened all journal titles and abstracts, they marked out a possible 119 journal articles. They then conducted further examination and reduced the numbers of articles to 26. After all extraction and synthesis process of articles, researchers obtained 71 findings from 26 different studies. The results indicated that there were no adverse effects of inclusion on students without disabilities and their disabled peers. Overall results suggested that 81% of the outcomes of inclusion were positive or neutral on conceptual understanding, attitudes, and social outcomes of all students. However, 9% of findings suggested that inclusive education had a negative impact on conceptual understanding, attitudes, and social outcomes of all students.

Siperstein, Parker, Bardon, and Widaman (2007) conducted a study to investigate the attitudes of students without disabilities toward inclusion of peers with intellectual disabilities. The participants included 5,837 middle school students from 47 school districts from 26 states. The findings suggested mixed results about the impact of inclusion on the population of students without disabilities. Researchers claimed that students without disabilities viewed inclusion as having both positive and negative effects on their comprehension and attitudes. Only 38% of these students reported having a schoolmate with disabilities, and about 10% of them reported having a current classmate with disabilities. In addition, students without disabilities had limited contact with students with disabilities, did not want to socially interact with them outside school, and exhibited negative attitudes towards them.

McDonnell et al. (2003) conducted research to investigate the impact of inclusive educational programs on the achievement of students with disabilities and their peers without disabilities. Researchers assessed changes in the adaptive behavior of 14 students with disabilities in a quasi-experimental design. In addition, the achievement of 324 students without disabilities in inclusion was compared to 221 students without disabilities in non-inclusive settings. All students' academic performance was measured using mandated state-level criterion referenced tests in reading and math. Researchers found that students with disabilities made significant gains in adaptive behavior. However, the results of one way Analysis of Variances (ANOVA) indicated that inclusion had no significant impact on the academic performance and conceptual understanding of students in inclusive and non-inclusive settings in both reading and math. Results also suggested that the presence of students with disabilities had no negative impact on the educational development of students without disabilities in inclusion.

Knesting, Hokanson, and Waldron (2008) conducted a qualitative study to examine the experiences of nine students with mild disabilities during their first year in an inclusive middle school in a Midwestern state of the U.S. The middle school had approximately 850 students, serving seventh and eighth grade students. The data were collected through classroom observations and interviews with parents, teachers, and students. At each grade level, two teams used inclusive instructional practices with the students with mild disabilities, while the third team sent students out of the general education classroom to either a resource or a self-contained room to receive special education services. After analyzing the data, researchers contended that students with mild disabilities preferred to be with their non-disabled peers in general education classrooms than being in self-contained special education rooms.

Smoot (2004) conducted a study that involved a simple sociometric assessment technique—a measurement that measures social interactions and relationships within a peer group—to measure how much students without disabilities socially accepted the students with disabilities in general education settings. The participants included 61 students with disabilities and 286 students without disabilities from five middle schools, two high schools, one elementary school, and one preschool. The total population in all five schools was 18,112 students. The findings suggested that only 43% of the students with disabilities were being preferred by their non-disabled peers. Conversely, students without disabilities preferred each other 85% of the time in inclusive settings ($p < .01$). In addition, results indicated that middle school students with disabilities were chosen for social activities in a positive manner by their peers without disabilities than either high school or elementary school students with disabilities.

Inclusive Education in Charter Schools

Downing and Peckham-Hardin (2007) conducted a study to investigate the inclusion of students (preschool through grade 8) regardless of their disability in three schools through interviewing parents, teachers, and paraeducators. There were 58 participants including 18 parents, 23 teachers, and 17 paraeducators representing four students from preschool, nine from elementary school, and five from middle school. All students had moderate-severe and multiple disabilities. The study in the first school targeted a traditional public school that was fully inclusive with 62 children in four classrooms, 11 of whom had disabilities. The study in the second school targeted a charter elementary school that was fully inclusive with grades kindergarten through five, serving 220 children at the time of the study. Of the 220 children, 45 had IEP with 11 (5%) considered to have moderate-severe disabilities. The study in the third school targeted a charter middle school that was fully inclusive serving 203 students with 7 students (3.5%) having moderate-severe and multiple disabilities. Researchers asked participants to answer their research questions. The first question asked participants if they felt the targeted student(s) were successful in their programs or not and if so, how did they know? Participants indicated that the student they represented were successful in some way, either academically, socially, or both in inclusive settings. The second question asked participants to consider what represented a high quality education for students in inclusion. Participants suggested that it was crucial to have knowledgeable and highly qualified staff in the school. The third question asked participants to consider the impact of inclusion for the future life of all students. Participants indicated that inclusion is beneficial for students with disabilities and their non-disabled peers in terms of having a normal life that includes positive attitudes and tolerance of differences and enhanced empathy and compassion for others. In addition, researchers found that the majority of teachers (65%), eight parents (44%), and 13 paraeducators (77%) also felt that students without disabilities benefited from learning in an inclusive environment. Moreover, they included that peer mediation and high expectations towards all students were evident in three schools.

Rhim et al. (2007) conducted a study to investigate challenges associated with developing special education programs in charter schools as these schools are subject to federal laws and regulations. Researchers reviewed charter schools from 41 states. After collecting and analyzing data, researchers claimed that in 10 states including Arkansas, Hawaii, Iowa, Kansas, Michigan, New York, Oklahoma, Tennessee, Texas, and Wisconsin, there was ambiguity in the special education laws. Conversely, five states including California, District of Columbia, Massachusetts, New Jersey, and Ohio had specific language about accountability and special education services. Laws required these five states to report all violations regarding services of students with disabilities. As a result, researchers indicated that the lack of specificity may have contributed to confusion over roles and responsibilities of charter schools in terms of meeting the federal requirements and providing special education services to enhance conceptual understanding of students with special needs.

Charter schools are obligated to follow the principles of federal mandates in order to provide services for students in special education. Drame (2011) conducted a study to investigate the capacity of charter school operators to create environments and service delivery models that effectively address the needs of students with disabilities in Wisconsin charter schools. The participants included 173 administrators of the more than 185 charter schools in the state of Wisconsin listed on the Wisconsin Department of Public Instruction web site. Some of the administrators administered more than one charter school. The final sample of respondents included 45 respondents representing a 26% response rate. The data were collected during the 2005–2006 school years. Drame (2011) indicated that 78% of the charter school administrators lacked the core knowledge of special education laws and regulations needed to effectively administer charter school programs, particularly in the area of special education laws. The researcher also suggested that presence of attitudinal problems among students in charter schools interfered with learning of all students.

Zimmer and Buddin (2007) conducted a study to investigate how student achievement varies between charter schools and traditional public schools in California. Researchers used student-level achievement and survey data for both school types. They surveyed principals in all California charter schools and a matched set of traditional public schools. The survey questions focused on the operations of these schools and were designed to identify key features of schools that might have a bearing on the learning setting of the school. The sample of the study included 352 charter schools as of February 2002. Findings suggested that charter schools and traditional public schools that focused on the achievement of students with disabilities had lower test scores than other schools. In addition, researchers found that the reading and math scores are about three percentile points lower, respectively, in charter schools than in traditional public schools. Moreover, even though charter schools had more autonomy than traditional public schools, it had little effect on the performance of students with disabilities on test scores.

Howe and Welner (2002) conducted a study to investigate how school choice impacted the number of students with disabilities in charter schools compared to traditional public schools. Researchers collected data from 22 states and the District of Columbia on the number of students with disabilities in charter schools. Their findings indicated that 15 states and the District of Columbia had lower number of students with special needs in comparison to traditional public schools. In addition, researchers found that with the charter school movement, the exclusion of students from traditional public schools increased.

Wolf (2011) conducted a case study to investigate charter school admission and whether these schools provided inadequate services for students with disabilities in the Recovery School District (RSD) in New Orleans, Louisiana. The research design included both charter schools and traditional public schools. The participants included district personnel, parents, and community stakeholders from 33 traditional schools and 26 charters serving a total of 22,000 students in New Orleans. Participants were interviewed by email or phone. The findings suggested that traditional public schools had about 10% special education students, with some schools as high as 22%. On the other hand, charter schools had only about 6% of the students with special needs. In addition, some participants from charter schools indicated that they did not know how to provide special education services to increase achievement of students with special needs.

In their study, Drame and Frattura (2011) conducted a participatory qualitative research to examine the nature and workings of special education at a charter school. The charter school had 469 students and 21 staff members including only 2.6 full time special education staff. Participants included a total of 22 individuals including administrators, teachers, parents, and students. Interviews were conducted in person between September 2006 and April 2007. Researchers collected data to analyze attitudes of respondents toward inclusion in general, perceptions of special education, the nature of the special education service delivery system, and potential solutions to address concerns with special education service delivery in the charter school. They found that students with disabilities were included in inclusive settings for 80% or more of the day. However, researchers indicated that implementing inclusion to increase students' understanding in core subjects was a challenging task for the charter school. They indicated that students with disabilities had lower reading and writing levels and these students experienced frustration due to the advanced nature of general education curriculum. Moreover, researchers suggested that the general education curriculum had a lack of integration of hands-on learning activities for students with disabilities.

Ferguson et al. (2011) conducted a study to examine the participation of students with disabilities and their non-disabled peers in an inclusive Western state charter school in the U.S. The data were collected from an urban charter school that only had fully inclusive classrooms. The school had a total population of 380 students including two to four students with disabilities in each inclusive classroom. None of the students with special needs were receiving services outside of the general education setting. Students were interviewed and the compiled data from the interviews were shared with teachers. Findings of the study indicated that both students with disabilities and students without disabilities provided positive responses 75% of the time about a positive classroom environment. In addition, 76% of the time, all students indicated that they positively perceived themselves as active participants who comprehended challenging topics in inclusive classrooms. However, 46% of all students indicated that they felt isolated in inclusive classrooms.

Downing et al. (2004) conducted a study to examine a charter elementary school that was designed to implement specifically full inclusive classrooms. There were 30 participants including one principal, three general education teachers, three special education teachers, one school psychologist, eight parents, five paraprofessionals, and nine students (one without disabilities and eight with disabilities). Researchers used a qualitative research methodology and interviewed all of the participants, and then analyzed their data. All participants indicated that inclusion created positive outcomes such as friendship development, tolerance of diversity, comprehension of lessons and effective student interaction. However, all but two of the participants suggested that there was a positive attitude between students with disabilities and their non-disabled peers in inclusive settings. Moreover, researchers indicated that the charter school needed a more challenging curriculum that could enhance student learning.

Students with Disabilities and Science Education

Wild and Trundle (2010) conducted research to investigate the conceptual change of middle school students with visual impairments about seasonal change. Participants included seven students between 13 to 15 years of age. Students were divided into two groups including one inquiry and one comparison group. The comparison group included three Grade 7 students with disabilities. The inquiry group included four Grade 7 students with disabilities. The comparison group was assessed based on two pre-interviews and three post-interviews. In contrast, the inquiry group was assessed based on two pre-interviews and four post-interviews. The inquiry group received instruction that included process skills of observing, measuring, classifying, inferring, hypothesizing, engaging in controlled investigation, predicting, explaining, and communicating. The comparison group received traditional instruction. Researchers used a constant comparative analysis to analyze the data. The results showed that students with disabilities in the inquiry-based group tended to have a more scientifically accurate conceptual understanding of seasonal change after they participated in inquiry-based instruction in comparison to the control group.

Aydeniz, Cihak, Graham, and Retinger (2012) conducted research to examine the impact of inquiry-based science instruction on the conceptual change of students with learning disabilities. This study took place at an elementary school in the southeastern part of the United States. The participants included five elementary school students with learning disabilities. The students were selected for the study based on elementary school enrollment, qualifications for special education services, parental permission, and student agreement to participate. In addition, these students did not receive previous instruction regarding simple electric circuits. The intervention lasted six weeks and included a series of inquiry-based activities targeting conceptual and application-based understanding of simple electric circuits, conductors and insulators, parallel circuits, and electricity and magnetism. Researchers used *the Electric Circuits KitBook* with supporting activities, and quizzes. Each session lasted for 50 minutes. Students were presented a daily quiz at the beginning of each class. At the start of each session, students had 20 minutes to complete each quiz. The students' conceptual change was measured with a test developed by the researchers. The results indicated that students improved solving problems targeting simple circuits by 76%, insulators problems by 81.5%, parallel circuit problems by 87.5%, and series and parallel circuit problems by 92.8%.

In their research, Mastropieri et al. (2006) examined the outcomes associated with class-wide peer tutoring using differentiated hands-on activities vs. teachercentered instruction for students with mild disabilities in an inclusive Grade 8 science classroom in a traditional public school. In the study, thirteen classrooms (213 students), including 44 students with disabilities, participated in a 12-week randomized field trial design in which the experimental group received differentiated, peer-mediated, and hands-on learning activities, while the control group received traditional science instruction. Researchers found that both students with special needs and their non-disabled peers engaged and comprehended better in inclusive classrooms than those in non-inclusive classrooms.

Moin, Magiera, and Zigmond (2009) conducted research including qualitative classroom observations of lessons with interval note-taking, and teacher interviews to examine science lessons implemented in inclusive high school science classrooms. Researchers also investigated whether it was beneficial to have one science teacher and one special education teacher instead of having just one science teacher in inclusive education settings. They observed 53 high school science lessons from ten pairs of science and special education teachers who were responsible for delivering instruction to groups of students, some of whom were learning disabled. Each classroom had 18 to 36 students and the number of students with disabilities varied from 3 to 15. Research was conducted in ten inclusive science classrooms: six of them were biology for students in Grades 9 and 10, two classes were earth and space science for students in Grade 9, and two classes were general science for students in Grades 9 through 12. Researchers interviewed teachers and analyzed narrative notes collected in these lessons reflecting the organization of work, classroom activities, and the roles of teachers. Classroom activities included direct instruction, reading and writing tasks, lab investigations, creating diagrams, games, and problem solving tasks. The findings suggested that even with a special education teacher present in the class, students with learning disabilities usually did not receive effective science instruction that met their educational needs. In addition, researchers indicated that inclusive science classrooms made only a slight improvement on science understanding of students with disabilities over pull out programs.

Jimenez, Browder, Spooner and Dibiase (2012) examined the impact of inquiry and peer mediation on the academic skills of students with moderate intellectual disabilities in a sixth grade inclusive science classroom. Participants included six students without disabilities and five students with moderate intellectual disabilities. All of the participants were 11 years old. Participants implemented three inquiry science activities including vocabulary words, pictures, word and picture match, and concept statement. Findings suggested that although there was no effect of peer mediation on all students' science grade averages, all students exhibited positive social attitudes in inclusion.

McDuffie, Mastropieri, and Scruggs (2009) investigated the effects of inclusive science education on students with disabilities and students without disabilities. The science lesson included differentiated science curriculum materials for teaching genetics and life science containing a review of major concepts and vocabulary covered in the units. Along with differentiated instruction, instructors paired a disabled student with his/her non-disabled peer for peer tutoring in four co-taught and four traditional classrooms. The participants were students and teachers from two middle schools from two school districts. Four general education teachers, two special education teachers, one instructional assistant, and one substitute teacher and a total of 203 middle school students with disabilities and their non-disabled peers participated in the study. Findings of the study suggested that inclusive science education was beneficial for all students' science understanding and peer interaction. In addition, students in co-taught classrooms received more teacher support and feedback than students in non-co-taught classrooms. However, findings also indicated that students with disabilities received more teacher-initiated interactions, individual attention, interactions of greater length, and attitude-oriented interactions than students without disabilities in co-taught inclusive science classrooms.

Palincsar, Magnusson, Collins, and Cutter (2001) conducted a two-year research study to investigate the impact of guided inquiry science instruction in an inclusive setting. Their research included four upper-elementary classrooms of students including 22 students with mild disabilities. The interventions in the study included two phases: Phase 1 (year 1) and Phase 2 (year 2). After the interventions, researchers found that with advanced strategies such as mini-conferencing, rehearsals for oral presentations, glossary of terms, and journal entries being transcribed by peers or paraprofessional, students with mild disabilities demonstrated significant academic growth in conceptual understanding in Phase 2 over Phase 1 compared to their non-disabled peers.

Lynch et al. (2007) conducted research to examine the impact of a guided inquiry unit—Chemistry That Applies (CTA)—on the science comprehension of students with disabilities in Grade 8 inclusive science classrooms. CTA is based on conceptual change theory and highly rated according to the Project 2061 Curriculum Analysis. Researchers implemented CTA in five middle schools, and then compared results with other five middle schools that had similar demographics. The participants included 2,282 students including 202 students with disabilities. Researchers used two-way ANCOVA test and found that students who used CTA significantly outscored their comparison peers on the posttest, with a small to medium effect size. The adjusted mean score for students with disabilities in the CTA inclusive settings was higher than the mean score for students with disabilities in the comparison non-inclusive settings. Moreover, researchers suggested that using inquiry science lessons in general education classrooms requires working with educational materials and promotes all students' conceptual understanding and positive peer relations.

Students without Disabilities and Science Education

Yin et al. (2008) conducted research to examine the impact of formative assessments on students' science achievement and conceptual change. They designed and embedded formative assessments within an inquiry science unit. The participants included random selection of 12 middle school science teachers. The teachers and students were randomly assigned either to an experimental group (N = 6), provided with embedded formative assessment, or control group (N = 6). The experimental group employed embedded formative assessment while teaching a science unit; and another group taught the same unit without embedded formative assessment. A questionnaire and achievement assessments were developed as a pre-test and post-test to examine the impact of embedded formative assessment on students' conceptual change. Teachers were told that this study was to assist curriculum designers to improve the curriculum. Researchers asked the teachers to complete the unit in half a year, but teachers took varying days from 63 days to 249 days to complete the curriculum unit. On average, teachers in the experimental group took 24 more days than teachers in the control group to complete the unit. Results indicated that formative assessments had significant impact on the conceptual understanding of students in the control group than those in the experimental group.

Kang et al. (2004) conducted a study to examine the relationship between cognitive conflict and conceptual change in learning the concept of density. The participants included 171 Grade 7 girls from two middle schools in two cities. Their ages ranged from 13 to 14 years. Researchers administered tests regarding logical thinking ability, field dependence/independence, and meaningful learning approach. The conceptual change intervention included a computer-assisted instruction on a density unit. The results indicated that there was a significant correlation between cognitive conflict and conceptual change. In addition, the results suggested that the intervention did not make any significant change on the conceptual understanding of 32 (18.7%) students on the density unit.

Raghavan et al. (1998) investigated the Model-Assisted Reasoning in Science (MARS) curriculum to measure Grade 6 students' conceptual understanding on the density of floating objects. The MARS is a model-centered and computer-supported curriculum (Raghavan et al., 1998). The curriculum had three sections and students were interviewed after each section of the curriculum. Before the intervention, researchers asked the following questions after introducing the topic: "Suppose you have two identical balloons, both inflated and tied. One is filled with helium; the other contains an equal amount of air. If you hold them at the same height and release them at the same time, what will happen? Why?" Researchers asked these questions to elicit understanding of things such as balance of forces, volume, mass, density, weight, and floating and sinking. The study was conducted during the 1993–1994 school year. The participants included 110 students. The intervention was implemented 3–4 days a week from mid-September to mid-May. Researchers categorized answers of all students from level-one representing the lowest conceptual understanding to level-five representing the highest conceptual understanding. The results suggested that 69 % of the students scored at level-three or above and 56% scored at level-four or level-five. In addition, 83% of the students asserted that buoyant force depends on the volume and not the mass of the object or buoyant force is not affected by the material of the object.

Cil and Cepni (2012) conducted research to analyze the effectiveness of the conceptual change approach on the views toward the nature of science and conceptual change in a *Light Unit*. They employed a mixed methodology consisting of pre-test, post-test, and non-equivalent group design of the quasi-experimental method. In addition, they administered an open-ended questionnaire on the views of nature of science and a conceptual test of the *Light Unit* for the data collection. The sample included 66 students equally divided into three groups. Two of the groups were assigned to participate in the experimental study and the other group was assigned as a control group. The intervention lasted 18 class periods (each lesson was 40 minutes). Results showed that the conceptual change approach increased the conceptual understanding of students in the experimental groups by 50 % in *the Light Unit*. On the other hand, the control group only used the books provided the Turkish Ministry of Education. The books had only 10 % of increment on their conceptual understanding on the views toward the nature of science.

Wichaidit, Wongyounoi, Dechsri, and Chaivisuthangkura (2011) conducted a study to investigate the conceptual change of middle school students on learning photosynthesis. Their intervention included analogy and modeling. Their analogy included cooking food to target the concept of photosynthesis and they employed modeling after the analogy approach to demonstrate how plants use sugar to synthesize cellulose and starch. The participants included 58 Grade 7 students aged between 12 and 13 years from an urban school district in Thailand. A photosynthesis questionnaire was administered to assess students' prior knowledge on photosynthesis. In addition, a pre-test test before the instruction and a post-test after the instruction on photosynthesis was administered to determine how students' conceptions had changed. The result suggested that the students demonstrated better comprehension on the post-test than that of the pre-test. In addition, 47.37% of students gave the correct answer on the pre-test on a question about the substances needed for photosynthesis, and after the interventions, 84.21% of the students gave correct answers. Similarly, 61.40% of students gave the correct answer on the pre-test on a question about what substances were produced during photosynthesis, and after the interventions, 80.70% of the students gave correct answers.

Liao and She (2009) conducted a study using the Scientific Concept Construction and Reconstruction (SCCR) - a digital learning system-on 8th grade students' conceptual change on the topic of *atoms*. Their intervention included ten class periods over four weeks. Researchers administered Atomic Achievement Test (AAT), Atomic Dependent Reasoning Test (ADRT), and Scientific Reasoning Test (SRT) in a pre-test and post-test fashion to examine the conceptual change of 8th graders. The participants included a total of 211 8th grade students. The control group (N=100) received conventional instruction whereas the experimental group (N=111) received an SCCR web-based course. Results indicate that the experimental group significantly outperformed the conventional group on AAT (p = 0.007), ADRT (p = 0.000), and SRT (p = 0.006) scores.

O'Neill (2010) examined whether student ownership—pedagogy of service to students that requires knowledge of students, anticipation of needs, openness to student evaluation and feedback, and willingness to allow students to determine the strategies to meet the classroom expectations—in the context of school science fosters students' engagement in science class. In addition, O'Neill investigated the classroom structures that could support student ownership. Participants included an urban middle school in New York City serving 380 students in Grades 6–8 with class size averaging 30 students. The data included a variety of data forms including participatory observations, teacher reflective notes, student mid-year and end-of-year science class evaluations, ownership structure surveys, and student work. Data were collected over three academic years from 2005 to 2008 across each of the five inquiry units taught in Grade 7 science, and were analyzed using the grounded theory approach. The researcher suggested that classroom structures that allow students to expand their science understanding in their lives fostered student ownership in science classrooms. O'Neill also indicated that although there were still gaps in student understanding in science, student ownership increased student engagement in science learning activities.

Elliott and Paige (2010) conducted a study to examine student engagement in science class from five South Australian secondary schools. Participants included 35 secondary school students. Data were collected from focus group discussions. Findings suggested that the reason why students in secondary schools did not engage in science learning was that these students perceived science as a hard subject as they did not relate themselves to it due to lack of effective science learning in middle school years. In addition, researchers suggested that students engaged and had higher conceptual understanding in science when learning involved hands-on activities, from which students enjoyed conducting scientific experiments.

Ruby (2006) claimed that high percentages of middle school students achieve low levels of and have significant challenges in high school science. The researcher used the Talent Development (TD) model, which focuses on depth of understanding of a science topic and built around hands-on activities and requires student planning and analysis (Ruby, 2006). The researcher followed three Philadelphia middle schools using the TD model from the end of fourth grade through seventh grade and matched the results with three control schools and the 23 district middle schools serving a similar student population. The findings indicated that students using the TD model made significant gains in science understanding as it promoted hands-on science learning, and these students' conceptual comprehension levels in science were substantially greater than students at three matched control schools and the 23 district middle schools.

Swarat, Ortony, and Revelle (2012) conducted research to examine the need to place more emphasis on the role of activity in constructing engaging learning environments to increase students' interest in science. Participants included 533 middle school students: 187 students from Grade 6, and 346 from Grade 7 from a suburban school district near a major U.S. Midwest city. Researchers used questionnaires to identify student performance in scientific learning activities. After analyzing the data, researchers found that most of the students from both grade levels preferred hands-on learning as it enhanced students' science learning compared to purely cognitive science learning. Researchers indicated that science is an important part of scientific literacy and that school science has not been effective in meeting this goal. In addition, they suggested that the lack of knowledge about what makes science interesting (or not) to the students is the reason why schools fail in increasing scientific literacy among students. They suggested that activities that were hands-on in nature promoted higher student engagement and interest in science learning.

Mutch-Jones, Puttick, and Minner (2012) conducted a study to investigate the impact of the Lesson Study for Accessible Science (LSAS) - a professional development approach, which supports the systematic examination of practice and student understanding- on the improvement of inquiry science teaching of both science teachers and special education teachers who engages in collaborative work in inclusive science classrooms. The LSAS inquiry science approach included hands-on lab work followed by discussion and activities aimed at helping students to summarize and extend their understanding. Participants of the study included 16 active teams and were divided evenly between the intervention (8) and comparison (8) groups from school districts in the northeast U.S. There were 37 teachers on intervention teams and 46 teachers on comparison teams. The data were collected based on knowledge of teachers on science content. Results of the study indicated that all students receiving instruction from teachers, who were trained in LSAS projects were able to receive more accommodations as they increased their science content knowledge due to use of inquiry science approaches that increased student understanding in inclusive science classrooms.

Lare-Alecio et al. (2012) conducted a study to investigate the effect of quasi-experimental research on fifth grade non-disabled students' achievement in state-mandated standards-based science and reading assessment. Participants of the study included 166 treatment students and 80 comparison students from four randomized intermediate schools from Southeast of Texas. The intervention included instructional science lessons with inquiry learning, vocabulary instruction, and integration of reading and writing tasks. Data were collected in the fall and spring of school year 2009–2010. Findings suggested that the treatment group had an average passing rate of 87% and 43% commended performance rate, and the comparison group had an average of passing of 78% and 32% commended performance rate in science tests. In addition, the treatment group had an average passing rate of 78.2%, and a commended performance rate of 25.1%. Similarly, the comparison group had an average of passing 84.6%, and a commended performance rate of 19.8% in reading tests. Moreover, standardized effect sizes were in small to moderate range, with larger magnitude in science than in reading. As a result, researchers indicated that inquiry based science learning was an effective approach as it helped students in the treatment groups to make significant academic improvements than students in comparison groups in district-wide curriculum-based science tests.

Chapter Summary

Federal laws such as NCLB and IDEA challenge schools to provide LRE in education for both students with disabilities and students without disabilities (Johnson, 1999; Nolan, 2004). With the reauthorization of the IDEA 2004, the new law, IDEIA, required that students with disabilities should have access to the general education curriculum (Goswami, 2006; IDEIA, 2004). This challenging task to educate all students in inclusion is one of the most frequently discussed topics in education (Johnson, 1999; Nolan, 2004).

This movement to include students with disabilities in inclusive settings began with the case *Brown v. Board of Education* (Cambron-McCabe, McCarty, & Thomas, 2004; Nolan, 2004; Zigmond, 2003). Subsequent legislation, i.e. IDEA, provided FAPE to students with disabilities in LRE (Allbritten et al., 2004; Bateman & Bateman, 2001; Cortiella, 2006). Moreover, the NCLB required all public schools to enable all students to have equal opportunities to obtain high-quality education and reach proficiency on standardized tests (Allbritten et al., 2004).

Research has indicated the impact of inclusion on the population of students with disabilities as in enhancements on conceptual understanding and attitudes in traditional public schools (Downing and Peckham-Hardin, 2007; Newman, 2006; Schwartz et al.,1998; Smoot, 2011; Soukup et al., 2007; Wehmeyer et al., 2003) and charter schools (Downing et al., 2004; Ferguson et al., 2011). In addition, research has also demonstrated the impact of inclusive education on the population of students without disabilities in core contents as in social embracing, great empathy, and positive attitude towards students with disabilities in traditional public schools (Kalambouka et al., 2007; Knesting et al., 2008; McDonnell et al., 2003; Siperstein et al., 2007).

As one of the core content areas, science education can be very challenging for both students with disabilities and their non-disabled peers (Aydeniz et al., 2012; Lara-Alecio et al., 2012; Mastropieri et al., 2006; McDuffie et al., 2009; Moin et al., 2009; Wild & Trundle, 2010). There is research showing that most students in traditional public schools experience difficulties in science education (Elliott & Paige, 2010; Kang et al., 2004; Mutch-Jones et al., 2012; O'Neill, 2010; Raghavan et al., 1998; Ruby, 2006; Swarat et al., 2012; Yin et al., 2008). However, there are limited number of current studies that examine the impact of inclusive science education on the conceptual understanding and attitudes of students without disabilities in charter schools (Schneider & Buckley, 2003; Vander Hoff, 2008).

As a result, this study will make a substantial contribution to the literature by providing answers to the following questions: How does inclusive science education affect the scientific conceptual understanding of general education students in a charter school? What is the difference in retention of science concepts between students without disabilities in inclusive science classrooms and students in non-inclusive science classrooms after a-two-week inquiry science lesson? and How does inclusive science education affect the attitudes of general education students toward students with disabilities in a charter school?

The null hypothesis for each research question will be as follows:

Research Question 1: How does inclusive science education affect the scientific conceptual understanding of general education students in a charter school?

Ho1: There is no relationship between the effect of inclusive science education and the understanding of science concepts in students without disabilities in a charter school.

Research Question 2: What is the difference in retention of science concepts between students without disabilities in inclusive science education and students in non-inclusive science education after a two-week science inquiry lesson?

Ho2: There is no relationship between the effect of inclusive science education and the difference in retention of science concepts between students without disabilities in inclusive science education and students without disabilities in non-inclusive science education after a-two-week science inquiry lesson.

Research Question 3: How does inclusive science education affect the attitudes of general education students toward students with learning disabilities in a charter school?

Ho3: There is no relationship between the effect of inclusive science education and attitudes of general education students toward students with learning disabilities in a charter school.

Chapter III: Methods

Introduction

The main purpose of this chapter is to explain the methodology used in this quasi-experimental study. In this chapter, the researcher used a quantitative research design because the study measured facts and objectives (Taylor & Bogdan, 1984), such as conceptual change and attitudes of students without disabilities in inclusive science classrooms in a charter middle school. The study employed statistical methods to explain changes in social groups (inclusive and non-inclusive) (Taylor & Bogdan, 1984); it included correlational or quasi-experimental designs to reduce the bias (Cronbach, 1975) and presented the outcomes objectively (Powdermaker, 1966).

Federal mandates claim that public schools will be held accountable for the success of all students (Gartner & Lipsky, 1987). These mandates require public schools to provide access to general education classrooms for students with special needs (U.S. Department of Education, 2006). As a result, traditional public schools took action to comply with laws in order to increase student understanding in all subjects and prevent attitudinal issues among students and to provide free appropriate education (FAPE) for all students (Wagner, 2005). However, most traditional public schools have had difficulties overcoming such issues (Dunn, Chambers, & Rabren, 2004). As a result, federal authorities promoted charter schools, which are elementary and secondary schools funded by the state, as an alternative to traditional public school systems in the early 1990s (VanderHoff, 2008).

Research shows that the charter school system has been successful in providing access to a general education curriculum for students with disabilities (Moores-Abdool, 2010). There is research showing the impact of inclusive education on conceptual change and attitudes of all students in traditional public schools (Cook, Gerber, & Semmel, 1997; Kalambouka, Farrell, Dyson, & Kaplan, 2007; Salend & Duhaney, 1999) and on the population of students with disabilities in charter schools (Downing & Peckham-Hardin, 2007). However, there is a lack of research on the conceptual understanding and attitudes of students without disabilities in inclusive science classrooms within charter schools.

The research questions include: (a) How does inclusive science education affect the conceptual understanding of science in general education students in a charter school? (b) What is the difference in retention of science concepts between students without disabilities in inclusive science classrooms and students without disabilities in non-inclusive science classrooms after a two-week inquiry science lesson? and (c) How does inclusive science education affect the attitudes of general education students toward students with disabilities in a charter school?

Setting

This study took place in a charter middle school in a large urban school district. The school was founded by a non-profit entity in 2001. The charter school is composed of 479 students of which 63% of the population is Hispanic and 12% is African-American. The charter school is also listed as 83% economically disadvantaged (on free and reduced lunch due to qualifying with limited income). In addition, the charter school includes approximately 4% of students with special needs. The school currently implements inclusion in a few mathematics and reading classes. Most of the students with special needs receive their education in a resource room. For the inclusive and non-inclusive science classrooms, the researcher manipulated the classroom arrangements for this study. The study was implemented in two Grade 6, two Grade 7, and two Grade 8 science classrooms. For each grade level, there was one inclusive science classroom and one non-inclusive science classroom.

Sample

Before conducting the study, permission from the Institutional Review Board (IRB) at the degree-granting institution and from the officials at the charter school was obtained. As soon as permission was received from the necessary authorities, a consent letter was sent to the parents of all students who were invited to participate in the study. Student assent forms were distributed to students. All consent and assent documents are included in the Appendices.

The research sample was selected using a non-equivalent groups design such that participants of the study were not randomly assigned to conditions (Gay, Mills, & Airasian, 2006). This design is considered to be quasi-experimental rather than experimental because it included non-random samples of one control group (non-inclusive) and one experimental group (inclusive) (Gay et al., 2006). In the study, the researcher manipulated the classroom arrangements by assigning 20 students without disabilities to non-inclusive science classrooms and 20 students without disabilities and two students with disabilities to inclusive science classrooms. Although the researcher collected data from both students without disabilities and students with learning disabilities, the researcher did not analyze data and communicate the findings from students with learning disabilities because this study focused on the effect of inclusive education on students without disabilities. However, collecting data from students with learning disabilities allowed them to participate in all learning activities and not to be recognized by students without disabilities due to confidentiality of students receiving special education services. As a result, the participants of this study included 20 students without disabilities in each classroom with a total number of 120 students from a total of six middle school science classrooms. The study included two classrooms (one inclusive and one non-inclusive) for each grade level (6, 7, and 8). About 60% of these students were Hispanic, 50% were male, and 80% received free or reduced lunch. In addition, ages ranged from 11 to 15 years.

Intervention

This quantitative study was designed as a quasi-experimental study to answer the research questions. The goal of the research was to determine whether students without disabilities in an inclusive charter middle school classroom were positively or negatively affected by the process of being educated with students with learning disabilities within inclusive science classes. In this design, the intervention included assigning and then including two students with learning disabilities in general education science classrooms to create one inclusive science classroom for each grade.

Two lessons on density were provided to determine the conceptual understanding and attitudes of students without disabilities towards disabled students. Understanding density is a difficult science topic for many middle school students (Cavallo & Laubach, 1998; Kang et al., 2004; Raghavan et al., 1998). Establishing and retaining a meaningful conceptual understanding of density can be challenging for students without disabilities in general education science classrooms, as these students have difficulty making a distinction between mass and density, weight and density, and buoyancy and density (Hewson & Hewson, 1983; Posner et al., 1982; Raghavan et al., 1998). Conversely, having difficulty with a science concept and the inclusion of students with disabilities in science classrooms might have even more adverse of an impact on the attitudes of students without disabilities towards disabled students (Drame & Frattura, 2011; Ferguson et al., 2011; Wolf, 2011).

Therefore, the researcher assigned two students with disabilities as a treatment to the inclusive science classrooms to measure the effect of inclusive science education on the conceptual understanding and attitudes of students without disabilities towards students with learning disabilities. The researcher taught two science lessons (science lesson 1 and science lesson 2) for two weeks to both inclusive and non-inclusive science classes. A density assessment tool was used to determine the conceptual change of students without disabilities in both classroom settings before the science lessons, after the science lessons, and one week after science lesson 2. In addition, an attitude measurement survey was conducted for all non-disabled students to determine the attitudes of students without disabilities towards students with learning disabilities in inclusive science classrooms before and after the science lessons. In this quasi-experimental study, there were two dependent variables: conceptual change and attitudes of students without disabilities towards students with learning disabilities in inclusive science classrooms. The independent variable was the type of classroom setting, which contained two levels or groups (inclusive science classrooms and non-inclusive science classrooms). The non-inclusive science classrooms served as the control group.

Materials

In the study, two lessons on density were implemented to all students in the inclusive and non-inclusive classrooms (see Appendix A). The first lesson was developed by Cavallo and Laubach (1998) and included a teacher guide and a student guide. This research-supported lesson is based on the learning cycle and includes introduction, exploration, concept development, concept application, and authentic assessment (Marek & Cavallo, 1997). The introduction included three questions as a pre-assessment about students' knowledge of and interest in masses of different objects with the same size. The exploration involved student discovery through hands-on learning and had three parts.

In the first part of the exploration, students worked in groups to observe a metal ball and Styrofoam ball of the same size and shape but different mass and listed five similarities and differences between the two balls. Next, a student from each group duplicated their lists on the board and circled similar items. After classroom discussion, students determined that the mass was the most different and the size of the balls was the most similar feature. Similarly, in the second part of the exploration, students made comparisons between two different liquids such as water and alcohol that had the same volume but different mass. In the last part of the exploration, they made comparisons between a crispy rice cereal and a grainy nut cereal of similar volume but different mass. Overall, the exploration part had eight questions for students to answer.

In the concept development, students reviewed and compared their responses to the three exploration questions. They discussed common factors that make two balls, liquids, and cereals similar to and different from each other. After the discussion, students realized that there was a different amount of matter (mass) in the same amount of space (volume). In addition, students determined that there was a special relationship between the amount of matter (mass) in a given substance and the amount of space (volume) this substance occupies. Then the researcher helped students to label this special relationship as density, or mass per unit volume of any object. Concept development included eight questions to refine students' understanding about their discovery.

In the concept application, students performed a variety of science activities in which they expanded and applied their basic understanding of density in real-life situations. First, the researcher challenged students to use their data and construct a mathematical formula that could be used to determine an object's density. Students analyzed their data and concluded that density = mass/volume. Students used this formula to measure the density of each cereal. They then dropped a handful of each cereal into a beaker of water and made careful observations. They observed that the crispy rice cereal floated and the other cereal sank. Through this activity, the researcher allowed students to observe what happened physically and mathematically.

In similar concept application activities, students compared the density of equal volumes of solutions including salt water and tap water. In addition, they compared the equal volumes of a can of diet soda and regular soda in a bucket full of water. As a result, concept application included seven questions that examined how students applied their science understanding in similar situations.

Lastly, in authentic assessment, the instructor assigned an activity to measure students' basic understanding of density. In the activity, each group of students had five raisins and a beaker half-filled with a carbonated beverage. Students placed the raisins in the beaker and observed that they would sink. Then, as bubbles collected on the raisins, the raisins rose to the top and then sank again. Students were asked four questions to formulate this meaningful observation in terms of density.

The second lesson was an inquiry lesson on density and was conducted during the second week of the study. The lesson was developed by Smith, Snir, and Grosslight (1992) so that students could make a distinction between weight and density and move from a qualitative understanding of density to a quantitative understanding. The lesson was also used by Holveck (2012) in her dissertation. This lesson had five parts and a homework assignment (see Appendix A). In part A, the researcher started the lesson by asking students to discuss their findings on density from the previous week and answer six questions. After the classroom discussions, students were asked to answer the formal definition for density, discuss the importance of density, explain the formula used to measure density, units used for the mass and the volume to measure density, and number of steps used to measure density. Students recorded their answers in their science journals. This part of the lesson assessed students' knowledge of density through mathematical calculations.

Part B included four questions and allowed students to work in groups to find the density of aluminum, copper, a solid block, and an irregularly shaped object. In part C, students answered two questions that included finding the density of aluminum, iron, copper, silver, lead, and gold in data tables by using the known mass and volume of each metal. In part D, students answered four questions to find the density of water, ice, glass, alcohol, mercury, plastic, wood (oak), and cork in data tables by using their known mass and volume. Part E asked students four questions in which they compared the density of materials from part D in a data table and determined whether such materials could sink or float in the water.

The homework component of the lesson required students to compare given densities of different solids and liquids and then determine which solids could float in liquids such as water, seawater, alcohol, glycerin, turpentine, mercury, and gasoline. The homework component included 9 questions (see Appendix A).

Measurement Instruments

This study included two measurement instruments (see Appendix B). Scantron answer sheets were used with each instrument to record and analyze students' answers. One instrument was used to measure the conceptual change of students without disabilities in inclusive and non-inclusive science classrooms in a charter school. The second instrument was used to measure regular education students' attitudes toward students with disabilities before and after the inclusion of students with disabilities in a regular science classroom.

The conceptual understanding of students was measured using the *Density Assessment* (Holveck, 2012). Although Smith et al. (1992) used this instrument in a 12-week study that examined 6^{th} and 7^{th} grade students' conceptual change on density, there was no published reliability or validity data for this instrument (Holveck, 2012). However, because this assessment was formulated and pilot-tested by Smith et al. (1992) and used in other research, there was some evidence to support the adequacy of the assessment for capturing density knowledge, reducing concerns related to systematic error (Holveck, 2012).

The attitudes of students without disabilities towards students with disabilities were measured using the *Inclusion Survey for Middle School Students* (Aragon, 2007). This Likert-scale survey included 30 questions that assessed the attitudes of students without disabilities in a middle school towards students with disabilities in inclusive classrooms. The survey was pilot-tested with 15 middle school students to determine the readability and suitability for middle school students. Aragon (2007) calculated the coefficient alpha (Cronbach, 1951) to assess the reliability of the instrument with her sample. After the pilot testing, she found that the survey was reliable, as the coefficient alpha was 0.73.

Conceptual Change Measurement Tool

The conceptual change of students without disabilities was measured using the *Density Assessment*, which was developed by Smith et al. (1992) and also used by Holveck (2012) in her dissertation about seventh-grade students' conceptual change on density. Students without disabilities and those with learning disabilities in inclusive science classrooms, and students without disabilities in non-inclusive science classrooms were assessed with this instrument. Students' conceptual understanding on density was examined through 20 multiple-choice questions. Questions 1 through 7 were about comparing the density of two objects; one was made of GALT (pseudonym), and the other one was made of LIDIUM (pseudonym). Questions 8 and 9 assessed students' knowledge on density of objects that have the same size or made from same materials. Questions 10 through 20 mainly asked students to use the formula on density to measure the density of different objects through mathematical calculations. The instrument was implemented before science lesson 1 (pre-test), after science lesson 2 (post-test), and one week after the science lessons (post-post-test). After each test, students' scores were recorded, and the correct answers were not provided.

Attitude Measurement Tool

The attitudes of students without disabilities towards students with disabilities were measured by the *Inclusion Survey for Middle School Students* (Aragon, 2007) in inclusive science classrooms in a charter middle school. The instrument was developed by Aragon (2007) and used in her dissertation to assess the attitudes of students without disabilities towards students with disabilities in inclusive middle school classrooms. Including the first two questions that solicited students' demographic information and the next two questions that asked for students' previous experiences with students with disabilities either in their home or school settings, the survey included a total of 30 questions. The remaining 26 questions were written as statements using a 5-point Likert scale, with 1 indicating strong disagreement, 2 indicating disagreement, 3 indicating neither disagreement or agreement, 4 indicating agreement, and 5 indicating strong agreement. Students filled in the bubble corresponding to the correct answer choice. These questions addressed initial reactions of students without disabilities towards students with disabilities. In addition, the questions also addressed the perceptions of students without disabilities about students with disabilities in inclusive science classrooms and their interactions with each other.

The original instrument was modified by changing verb tense from present to future before students with disabilities were included in the regular science classrooms and before beginning the density lessons (pre-test). At the conclusion of both density lessons (after two weeks), the original instrument (using past tense) was administered to students in both groups (post-test).

Data Collection and Procedures

In data collection and interpretation, the researcher used strategies that included the location of data collection, identification and cataloguing statistics, and the analysis of the data and its authenticity. In this study, the exchange of information between the researcher and the participants required analytical collaboration. After the data collection, the data needed to be preserved in order to make a meaningful and complete understanding of the complete data for data analysis.

Prior to the study, necessary permission from the IRB, the charter school, and parents and students was obtained by the researcher to conduct research. Seven of the parents did not give permission for their children to be a participant in the study. Therefore, the researcher re-sent seven consent forms to new parents and obtained their consent for research.

The names and identification numbers of all students were added to a student folder before the study. All survey and test results were collected by the researcher. In addition, one special education coordinator and two science teachers from the charter school helped to collect necessary student data. Data collectors were instructed to secure confidentiality of all students. Instead of having the names of all students, their identification numbers were obtained to ensure confidentiality. The school's database and help from both the special education teacher and science teachers from the school were used to identify all students in the intervention. For each student in inclusive and non-inclusive settings, an assessment folder was created. This folder contained all necessary documentation regarding each specific student. The information in these folders was used to analyze and determine the progress of students without disabilities in the areas of conceptual change and attitudes in science inclusion.

Two measurement instruments were used in this study. First, the researcher used the *Density Assessment* before science lesson 1 as a pre-test and then as a post-test after science lesson 2, and last as a post-post-test one week after science lesson 2 to measure the conceptual change of students without disabilities in inclusive science classrooms in comparison to students without disabilities in non-inclusive classrooms. The length of each science lesson was one week, and each lesson was delivered in each classroom 50 minutes every day. As a result, the researcher spent five hours in a total of six classrooms each day. The answers of the students were not discussed after each assessment. Between each conceptual change measurement, the researcher delivered a different lesson on density. Second, students answered questions on the *Inclusion Survey for Middle School Students*, which was designed as a Likert scale to measure the attitudes of students without disabilities towards students with learning disabilities in science inclusion in comparison to students without disabilities in non-inclusive settings before and after the science lessons.

All collected data were recorded in a data collection form. The data collection form was designed to document information for each student that was selected for the study group. The school's superintendent, principal, the special education coordinator, and science teachers were contacted and consulted to establish specific school district policies. The times and hours of data collection were discussed with the school principal. Even though the researcher was familiar with the district's policies and procedures, a training meeting was requested so that there was a clear understanding pertaining to procedures for the collection and handling of student data according to school district policies. Data collectors were provided binders that contained forms to establish effective data collection. Starting on the first day of data collection, data collectors were expected to adhere to all district policies. Abiding to all district regulation and confidentiality policies maintained consistency and increased the integrity of the research study. Last, the results of the data collection were used to compile a database centrally located in the school's common drive folder that involved all records for all subjects in the study. This database and a spreadsheet program were used to monitor, track, and analyze the overall collected data.

Data Analysis

For the data collection, answer sheets were used for both students with and without disabilities during the 2013-2014 school year. The researcher collected data from both students without disabilities and students with learning disabilities. The researcher did not analyze data and communicate the findings from students with learning disabilities because this study focused on the effect of inclusive education on students without disabilities. However, collecting data from students with learning disabilities allowed them to participate in all classroom activities, density assessments, and surveys. Participating in all learning activities helped students with learning disabilities not to be recognized by students without disabilities due to confidentiality of students receiving special education services. SPSS was used for descriptive and inferential statistical analysis. Data first were entered onto the answer sheets by each participant and then were scanned by the researcher at each data collection point. Upon the completion of data collection, the data set was imported into the SPSS software for further analysis.

Data analysis provided answers for the following research questions and null hypotheses:

> Research Question 1: How does inclusive science education affect the scientific conceptual understanding of general education students in a charter school?
>
> Ho1: There is no relationship between the effect of inclusive science education and the understanding of science concepts in students without disabilities in a charter school.

The researcher conducted several analyses in SPSS to answer this research question. First, the researcher ran an independent-samples *t*-test to determine the sample mean differences on conceptual understanding (pre-test) in both groups. Second, a paired samples (dependent) *t*-test was conducted to examine significant differences on conceptual change (pre-test to post-test, post-test to post-post-test, and pre-test to post-post-test) within inclusive classrooms and independently for non-inclusive classrooms. Third, a multivariate group analysis test was conducted to investigate significant differences in conceptual change (pre-test, post-test, and post-post-test) of students between inclusive and non-inclusive classrooms.

> Research Question 2: What is the difference in retention of science concepts between students without disabilities in inclusive science education and students in non-inclusive science education after a two-week science inquiry lesson?
>
> Ho2: There is no relationship between the effect of inclusive science education and the difference in retention of science concepts between students without

disabilities in inclusive science education and students without disabilities in non-inclusive science education after a-two-week science inquiry lesson.

The answer for the research question on conceptual change also helped the researcher determine whether inclusive science education had an effect on the difference in retention of science concepts between students without disabilities in inclusive science classrooms and students in non-inclusive science classrooms. As a result, a paired samples (dependent) *t*-test was conducted to examine significant differences in retention of science concepts (pre-test to post-test, post-test to post-post-test and pre-test to post-post-test) within inclusive classrooms and independently for non-inclusive classrooms.

Research Question 3: How does inclusive science education affect the attitudes of general education students toward students with learning disabilities in a charter school?

Ho3: There is no relationship between the effect of inclusive science education and attitudes of general education students toward students with learning disabilities in a charter school.

First, the researcher ran an independent-samples *t*-test to determine the sample mean differences on attitudes (pre-test) in both groups. Second, a paired samples (dependent) *t*-test was conducted to examine significant differences on attitudes (pre-test and post-test) within inclusive classrooms and independently for non-inclusive classrooms. Third, a multivariate group analysis test was conducted to investigate significant differences in attitudes (pre-test and post-test) of students between inclusive and non-inclusive classrooms.

Chapter IV: Results

Federal mandates such as the Individuals with Disabilities Education Improvement Act (IDEIA) require schools to provide access of general education settings for students with disabilities to receive instruction with students without disabilities in the same environment (IDEIA, 2004). Legal mandates hold public schools accountable to establish the success of students with disabilities and school responsibilities must be demonstrated through an Individualized Education Program (IEP), which outline all learning goals such as specific instructional accommodations and modifications (Schwartz, 1984). Although federal mandates required traditional public schools to provide special education services for students with disabilities, most of them have challenged to address the specific educational needs of students with disabilities (Dunn et al., 2004). As a result, legal authorities have promoted the charter school system as an alternative means to improve the public education system (VanderHoff, 2008). Because charter schools are part of the public school system and are also accountable for all students' educational achievement, they are required to make general education classrooms more accessible for students in special education (U.S. Department of Education, 2006).

Charter schools have been preferred by parents as they see these schools as an alternative to the traditional public school system (Schneider & Buckley, 2003; VanderHoff, 2008). Parents believe that charter schools, when compared to traditional public schools, set higher academic goals for all students (Moores-Abdool, 2010; Smoot, 2011) and provide adequate special education services for students with disabilities (Allen, 2006). There is research about the effect of inclusion on students with disabilities in charter schools (Downing & Peckham-Hardin, 2007; Ferguson, Hanreddy, & Draxton, 2011; Howe & Welner, 2002); however, there is limited research about the effect of inclusion on students without disabilities in charter schools (Lipsky & Gartner, 1997; Rhim, Ahearn, & Lange; 2007; Zimmer & Buddin; 2007). Little research conducted about the effect of inclusion on students without disabilities in charter schools suggest mixed results on conceptual understanding and the attitudes of students without disabilities towards students with disabilities in core courses such as math and science (Cook, Gerber, & Semmel, 1997; Gerber, 1995; Kalambouka et al., 2007). Drame (2011) found that there was no correlation between inclusion and the conceptual change of students without disabilities in charter schools (Drame, 2011). Downing et al. (2004) suggested that inclusion had no effect on improving negative attitudes of students without disabilities in charter schools, but inclusion did improve conceptual understanding of these students in all subjects including science.

In science, most students have difficulty in making distinctions between mass, weight, density, balance of forces, and buoyancy (Hewson & Hewson, 1983; Posner, Strike, Hewson, & Gertzog, 1982; Raghavan, Sartoris, & Glaser, 1998). For example, density, as a scientific topic, can be challenging for both students with disabilities and students without disabilities (Kang, Scharmann, & Noh, 2004; Raghavan, Sartoris, & Glaser, 1998). In general, education science classrooms where the teaching and learning is integrated, engaging, and meaningful, science teachers must be able to establish a conceptual bridging of knowledge about density for all students (Hewson & Hewson, 1983; Posner et al. 1982). Even though creating a meaningful conceptual understanding on density among all students in general education science classrooms can be very difficult for most science teachers (Cavallo & Laubach, 1998; Kang et al., 2004; Raghavan et al., 1998), having students with disabilities in the same educational setting can be even more challenging as science instructors might have to use most of their effort on attitudinal problems associated with classroom management, differentiated instruction, and individualized instruction, (Kalambouka et al., 2007; Newman, 2006; Smoot, 2011). For such reasons, the existence of students with disabilities can have an influence on the conceptual understanding, retention, and comprehension of students without disabilities on density and the change in their attitudes towards students with disabilities in inclusive classrooms (Drame & Frattura, 2011; Ferguson et al., 2011; Wolf, 2011).

This study examined the conceptual understanding of students without disabilities and their attitudes towards students with disabilities in inclusive science classrooms at a charter middle school. The study was designed to address three research questions that guided the collection and analysis of quantitative data concerning the conceptual understanding of students without disabilities and their attitudes towards students with disabilities in science inclusion. Each research question included a null hypothesis. Conceptual understanding, attitudes, and retention within and between groups was treated as significant when $p < .05$.

The study included the following research questions:

1. How does inclusive science education affect the scientific conceptual understanding of general education students in a charter school?

2. What is the difference in retention of science concepts between students without disabilities in inclusive science classrooms and students in non-inclusive science classrooms after a-two-week inquiry science lesson?

3. How does inclusive science education affect the attitudes of general education students toward students with disabilities in a charter school?

This study followed a quantitative, quasi-experimental design to answer the research questions to determine if students without disabilities in an inclusive charter middle school science classroom were positively or negatively affected by the process of being educated with students with learning disabilities. This research study lasted three weeks. The design included assigning and then including two students with learning disabilities in general education science classrooms to create one inclusive science classroom for each Grade 6, Grade 7, and Grade 8 levels. The inclusive classrooms included 20 students without disabilities and two students with disabilities. Conversely, non-inclusive classrooms included 20 students without disabilities. This research included two dependent variables: conceptual change and attitudes of students without disabilities towards students with learning disabilities in inclusive science classrooms. The independent variable included the type of classroom setting, which contained two levels or groups (inclusive science classrooms and non-inclusive science classrooms). The non-inclusive science classrooms served as the control group. The study included two science lessons (science lesson 1 and science lesson 2), which lasted two weeks for both inclusive and non-inclusive science classes. The length of each science lesson was one week and each lesson was implemented in each classroom 50 minutes every day.

Science lessons were provided to determine the conceptual understanding and attitudes of students without disabilities towards disabled students in inclusive science classrooms. The first lesson was an inquiry lesson on density, which was developed by Cavallo and Laubach (1998) that included a teacher guide and a student guide (see Appendix A). It was conducted during the first week of the study. The lesson was based on the learning cycle and included introduction, exploration, concept development, concept application, and authentic assessment (Marek & Cavallo, 1997). The introduction included three questions as a pre-assessment about students' knowledge of and interest in masses of different objects with the same size. The exploration involved student discovery through hands-on learning and had eight questions for students to answer. Students reviewed and compared their responses to the three exploration questions in concept development. In concept application, students did a variety of science activities in which they expanded and applied their basic understanding of density in real-life situations. Lastly, students were asked four questions to formulate their meaningful understandings about density in authentic assessment.

The second lesson was also an inquiry lesson on density, which was developed by Smith, Snir, and Grosslight (1992) and used by Holveck (2012) (see Appendix A). It was conducted during the second week of the study so that students could make a distinction between weight and density. The lesson included five parts and a homework assignment. In part A, the researcher asked questions to students to discuss their findings on density from the previous week and answer six questions. In part B, students answered four questions to work in groups to find the density of aluminum, copper, a solid block, and an irregularly shaped object. Part C included two questions for students to find the density of aluminum, iron, copper, silver, lead, and gold in data tables by using the known mass and volume of each metal. Part D included four questions for students to find the density of water, ice, glass, alcohol, mercury, plastic, wood (oak), and cork in data tables by using the known mass and volume for each material. In part E, students used a data table involving materials from part D to determine whether the materials would float or sink in water. Lastly, the homework part included nine questions and required students to compare given densities of different solids and liquids and determine which solids could float in liquids such as water, seawater, alcohol, glycerin, turpentine, mercury, and gasoline. In addition to two science lessons, this research also included one density assessment and one inclusion survey.

The *Density Assessment* (see Appendix B) was used to measure the conceptual change of students without disabilities in inclusive and non-inclusive science classrooms in a charter school. Smith et al. (1992) formulated and pilot-tested this instrument then used it in a 12-week study to examine 6^{th} and 7^{th} grade students' conceptual change on density. This instrument was used in other research (Holveck, 2012), which showed that there was some evidence that supported the adequacy of the assessment, reducing concerns related to systematic error. This assessment included 20 multiple-choice questions. Questions 1 through 7 were about comparing the density of two objects. Questions 8 and 9 assessed students' knowledge on density of objects that were made from same materials. Questions 10 through 20 mainly asked students to use the formula on density to measure the density of different objects. The assessment was conducted before the science lessons (pre-test), right after the science lessons (post-test), and one week after the science lessons (post-post-test) to determine the conceptual change of students without disabilities. The density assessment took 20 minutes to complete.

The second instrument, *Inclusion Survey for Middle School Students* (see Appendix C), was used to measure regular education students' attitudes toward students with disabilities before and after the inclusion of students with disabilities in a regular science classroom (Aragon, 2007). The survey was pilot-tested with 15 middle school students to determine the readability (coefficient alpha = 0.73) and suitability for middle school students (Aragon, 2007). The survey included 26 questions as in 5-point Likert scale, with 1 indicating strong disagreement, 2 indicating disagreement, 3 indicating neither disagreement nor agreement, 4 indicating agreement, and 5 indicating strong agreement. The survey was conducted before the first science lesson (pre-test) and after the second science lesson (post-test) to determine the attitudes of students without disabilities towards students with learning disabilities. The survey took 15 minutes to complete.

In this section of research, study variables were summarized using descriptive and inferential statistical analysis through SPSS. First, the researcher provided the descriptive statistics on conceptual understanding for all grade levels for both inclusive and non-inclusive classrooms. Second, the researcher analyzed the effect of the scientific conceptual understanding of general education students in inclusion by running independent-samples *t* test, paired samples *t* test, and multivariate group analysis test. Third, the researcher provided the descriptive statistics on the attitudes of general education students toward students with learning disabilities for all grade levels for both inclusive and non-inclusive classrooms. Fourth, the effect of inclusion on the attitudes of general education students toward students with learning disabilities were analyzed through independent-samples *t* test, paired samples *t* test, and multivariate group analysis test. Lastly, the difference in retention of science concepts between students without disabilities in inclusive science education and students in non-inclusive science education after a-two-week science inquiry lesson was analyzed using a paired samples *t* test.

Conceptual Change

The Levene's test for homogeneity was conducted to measure the differences in pre-test mean scores of conceptual understanding between students in inclusive and non-inclusive classrooms at each grade level before performing data analyses. This approach was used to determine whether independent groups included normally distributed populations and that the variances in the populations were equal. If the significant value was greater than .05, then the researcher assumed that the variances in one condition did not vary too much more than the variances in the second condition and that the researcher had confidence in the validity of the *t* test result. Otherwise, the researcher needed to proceed with caution to analyze further data. Table 1 provides the summary of ranges, means, and standard deviations on the pre-test, post-test, and post-post-test measures for the density assessment.

Twenty students without disabilities from each classroom were tested for each grade level. Students scored 5 points for each correct answer on the twenty-item density assessment. The possible range is 0-100. The mean scores for students in the 6^{th} grade inclusive science classroom were 33.00 (*SD = 9.23)* on the pre-test, 39.30 (*SD* = 8.60) on the post-test, and 38.85 (*SD* = 9.27) on the post-post-test. Students in the 6th grade non-inclusive classroom had a lower mean score of 29.50 (*SD = 10.87*) on pre-test, but a higher mean scores of 53.25 (*SD = 12.28*) on post-test and 50.25 (*SD = 9.24*) on post-post-test compared to students in the 6th grade inclusive classroom.

Students in the 7th grade inclusive science classroom had a mean score of 37.50 (*SD = 8.96*) on the pre-test, 48.25 (*SD = 9.36*) on the post-test, and 47.75 (*SD = 11.52*) on the post-post-test. Students in the 7th grade non-inclusive classroom had higher mean scores of 43.25 (*SD = 8.47*) on pre-test, 62.25 (*SD = 14.64*) on post-test, and 66.25 (*SD = 13.17*) on post-post-test compared to students in the 7th grade inclusive classroom.

Students in the 8th grade inclusive science classroom had a mean score of 35.75 (*SD = 10.30*) on pre-test, 46.50 (*SD =10.53*) on the post-test, and 42.25 (*SD = 11.86*) on the post-post-test. Students in the 8th grade non-inclusive classroom had higher mean scores of 37.75 (*SD = 9.24*) on the pre-test and 47.75 (*SD = 12.51*) on the post-post-test, but a lower mean score of 45.00 (*SD = 11.35*) on the post-test compared to students in the 8th grade inclusive classroom.

Table 1

Summary of Ranges, Means, and Standard Deviations for DA Scores

		Pre		Post		Post-Post	
Group	*n*	Min-Max	*M (SD)*	Min-Max	*M (SD)*	Min-Max	*M (SD)*
6th Inc.	20	10-50	33.00 (9.23)	25-60	39.30 (8.60)	20-55	38.85 (9.27)
6th Non-inc.	20	10-45	29.50 (10.87)	35-80	53.25 (12.28)	40-75	50.25 (9.24)
7th Inc.	20	20-50	37.50 (8.96)	35-70	48.25 (9.36)	30-70	47.75 (11.52)
7th Non-inc.	20	25-55	43.25 (8.47)	25-85	62.25 (14.64)	50-85	66.25 (13.17)
8th Inc.	20	20-60	35.75 (10.30)	35-85	46.50 (10.53)	25-65	42.25 (11.86)
8th Non-inc.	20	20-50	37.75 (9.24)	30-65	45.00 (11.35)	30-70	47.75 (12.51)

Note. DA = Density Assessment. This construct consisted of 20 multiple choice items with a possible score of 0-100. Inc. = Inclusive, Non-inc. = Non-inclusive.

6th Grade Inclusive and Non-Inclusive Science Classrooms

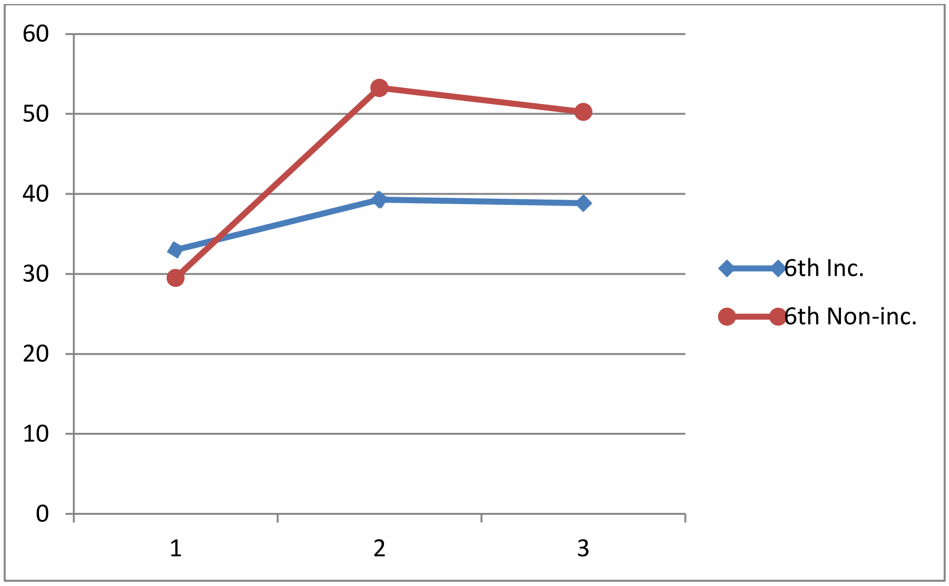
Before implementing the two science lessons on density, the researcher performed an independent samples *t* test for pre-test scores to determine the differences on conceptual change between students in inclusive and non-inclusive classrooms in 6th grade classrooms. Levene's test for homogeneity indicated that group variance was non-significant (p = .35). Therefore, the assumption of equality of variances was satisfied for all analyses. This test is important to determine statistical significance on means between two groups. If the significant value is greater than .05, then we assume that the variances in one condition do not vary too much more than the variances in the second condition and that we can have confidence in the validity of our *t* test result. There was statistically no significant difference on the measures of conceptual understanding between students inclusive and students in non-inclusive classrooms (p = .28) on pre-test density assessment.

A paired samples *t* test was conducted to examine significant differences of mean scores on conceptual change (pre-test to post-test, post-test to post-post-test and pre-test to post-post-test) within the inclusive 6^{th} grade science classroom. There was a significant difference in the scores for pre-test (*M* = 33.00, *SD = 9.23*) and post-test (*M* = 39.30, *SD = 8.60*) conditions, $t(19) = -7.73$, $p < .001$. There was not a significant difference in the scores for post-test and post-post-test (*M* = 38.85, *SD = 9.27*) conditions, $t(19) = 0.71$, $p = .48$). However, there was a significant difference in the scores for pre-test and post-post-test conditions, $t(19) = -7.01$, $p < .001$.

A paired samples *t* test was also conducted to examine significant differences in mean scores on conceptual change (pre-test to post-test, post-test to post-post-test and pre-test to post-post-test) within the non-inclusive 6^{th} grade science classroom. There was a significant difference in the scores for pre-test (*M* = 29.50, *SD = 10.87*) and post-test (*M* = 53.25, *SD = 12.28*) conditions, $t(19) = -7.62$, $p < .001$. There was not a significant difference in the scores for post-test and post-post-test (*M* = 50.25, *SD = 9.24*) conditions, $t(19) = 0.99$, $p = .34$. However, there was a significant difference in the scores for pre-test and post-post-test conditions, $t(19) = -6.73$, $p < .001$. Figure 1 shows a graphical comparison in mean scores between students in the 6^{th} grade inclusive classroom and the 6^{th} grade non-inclusive classroom on the density assessments.

Figure 1

Comparison in Mean Scores between Students in 6th Grade Inclusion and 6th Grade Non-inclusion on Density Assessments



Note. S1 = Pre-test Density Assessment, S2 = Post-test Density Assessment, S3 = Post-post-test Density Assessment, Inc. = Inclusive, Non-inc. = Non-inclusive.

The researcher conducted a multivariate group analysis test to examine significant differences on conceptual change (pre-test, post-test, and post-post-test) of 6th grade students between inclusive and non-inclusive classrooms. After running paired samples *t* tests within the 6th grade inclusive and 6th grade non-inclusive classroom, the multivariate group analysis test results showed the differences in mean scores on conceptual change (pre-test, post-test, and post-post-test) of students between inclusive and non-inclusive classrooms. The researcher conducted Levene's test and found that the group variance for pre-test density assessment (p =. 35), post-test density assessment ($p = .13$), and for post-post-test density assessment ($p = .86$) were non-significant. Therefore, the assumption of equality of variances was satisfied meaning that the variances in one condition do not vary too much more than the variances in the second condition and that we can have confidence in the validity of our *t* test result for pre-test density assessment, post-test density assessment, and post-post-test density assessment. The results with observed power of .19 showed that there was no significant difference on conceptual change between 6th grade students in inclusive and non-inclusive science classrooms on the pre-test density assessment $F(1, 38) = 1.20$, $M\Delta = 3.50$, $p = .28$, $\eta^2 = .03$. However, there was a significant difference on conceptual change between students in inclusive and non-inclusive classrooms on the post-test density assessment $F(1, 38) = 17.32$, $M\Delta = 13.95$, $p < .001$, $\eta^2 = .31$ with observed power of .19, and post-post-test density assessment $F(1, 38) = 15.17$, $M\Delta = 11.40$, $p < .001$, $\eta^2 = .28$ with observed power of .97. As a result, there were significant differences on conceptual understanding between students in inclusion and non-inclusion on post-test density assessment and post-post-test density assessment, but not on pre-test density assessment.

7th Grade Inclusive and Non-Inclusive Science Classrooms

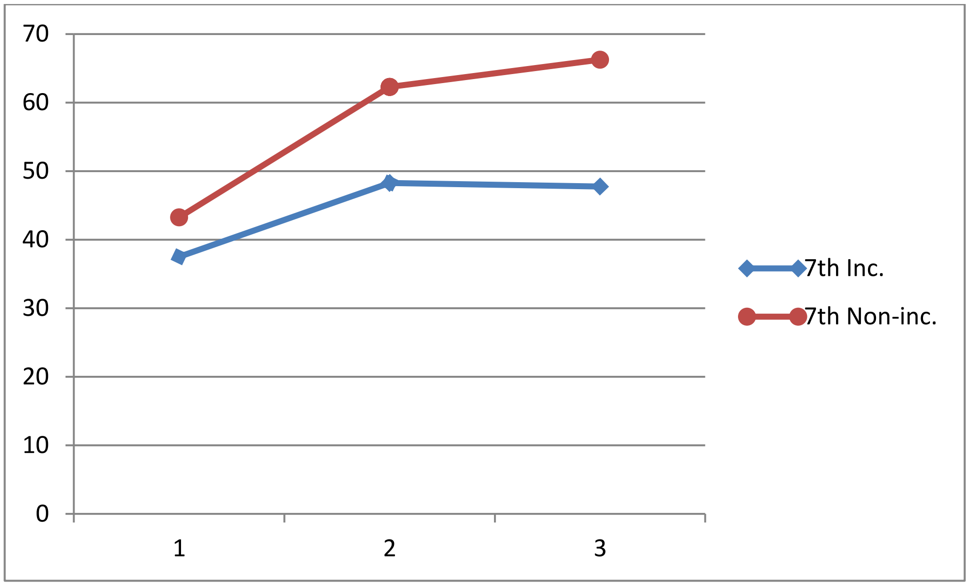
Students in both 7th grade inclusive science and non-inclusive science classrooms were assessed by an independent samples *t* test for pre-test scores to determine their conceptual understanding. The Levene's test for homogeneity showed that the group variance was non-significant (p = .76). Therefore, the assumption of equality of variances was satisfied for all analyses. The Levene’s test showed that the significant value is greater than .05; therefore, we assume that the variances in one condition do not vary too much more than the variances in the second condition and that we can have confidence in the validity of our t test result. Students in non-inclusion scored higher on pre-test density assessment than students in inclusion.

The researcher then conducted a paired samples *t* test to examine significant differences on conceptual change (pre-test to post-test, post-test to post-post-test and pre-test to post-post-test) within inclusive 7^{th} grade science classrooms and independently for non-inclusive 7^{th} grade classrooms. The paired samples *t* test that was conducted for 7^{th} students in inclusive science classrooms showed that there was a significant difference in the scores for pre-test (M = 37.50, $SD = 8.96$) and post-test (M = 48.25, $SD = 9.36$) conditions, $t(19) = -4.40$, $p < .001$. There was not a significant difference in the scores for post-test and post-post-test (M = 47.75, $SD = 11.52$) conditions, $t(19) = .62$, $p = .54$. However, there was a significant difference in the scores for pre-test and post-post-test conditions, $t(19) = -3.69$, $p = 0.002$.

A paired samples *t* test was conducted to measure the conceptual understanding of 7^{th} grade students in a non-inclusive science classroom. The results indicated that there was a significant difference in the scores for pre-test (M = 43.25, $SD = 8.47$) and post-test (M = 62.25, $SD = 14.64$) conditions, $t(19) = -11.54$, $p < .001$. There was a significant difference in the scores for post-test and post-post-test (M = 66.25, $SD = 13.17$) conditions, $t(19) = -2.22$, $p = .04$. In addition, there was a significant difference in the scores for pre-test and post-post-test conditions, $t(19) = -15.20$, $p < .001$. Figure 2 shows the comparison in mean scores between students in 7^{th} grade inclusion and 7^{th} grade non-inclusion on density assessments.

Figure 2

Comparison in Mean Scores between Students in 7th Grade Inclusion and 7th Grade Non-inclusion on Density Assessments



Note. S1 = Pre-test Density Assessment, S2 = Post-test Density Assessment, S3 = Post-post-test Density Assessment, Inc. = Inclusive, Non-inc. = Non-inclusive.

The multivariate group analysis tests were conducted to investigate significant differences on conceptual change (pre-test, post-test, and post-post-test) of 7th grade students between inclusive and non-inclusive classrooms. The Levene's test stated that that the group variance for pre-test density assessment (p =.76), post-test density assessment (p =.27), and for post-post-test density assessment (p =.17) was non-significant. Therefore, the assumption of equality of variances was satisfied meaning that the variances in one condition do not vary from the variances in the second condition and that we can have confidence in the validity of our t test result for pre-test density assessment, post-test density assessment, and post-post-test density assessment.

The test results showed that there was a significant difference on conceptual change on pre-test density assessment $F(1, 38) = 4.349$, $M\Delta = 5.75$, $p = .04$, $\eta^2 = .10$

with observed power of .53, post-test density assessment $F(1, 38) = 12.98$, $M\Delta = 14.00$, $p < .001$, $\eta^2 = .25$) with observed power of .94, and post-post-test density assessment $F(1, 38) = 12.98$, $M\Delta = 22.36$, $p < .001$, $\eta^2 = .37$ with observed of .99 between students in 7th grade inclusive science classroom and those in non-inclusive science classroom. As a result, there were significant gains on conceptual understanding between students in inclusion and non-inclusion on all measures of density assessments.

8th Grade Inclusive and Non-Inclusive Science Classrooms

The independent samples *t* test was conducted for pre-test scores to determine the differences in mean scores on conceptual change between students in 8th grade inclusive science and non-inclusive science classrooms. The assumption of equality of variances was satisfied for all analyses as significant value in Levene's test showed the value of $p = .90$. This meant that the variances from different groups were normally distributed and that we can have confidence in the validity of our t test result for pre-test density assessment, post-test density assessment, and post-post-test density assessment. Test results indicated that there was statistically no significant difference on conceptual change between students in inclusive and students in non-inclusive classrooms ($p = .52$) on pre-test density assessment.

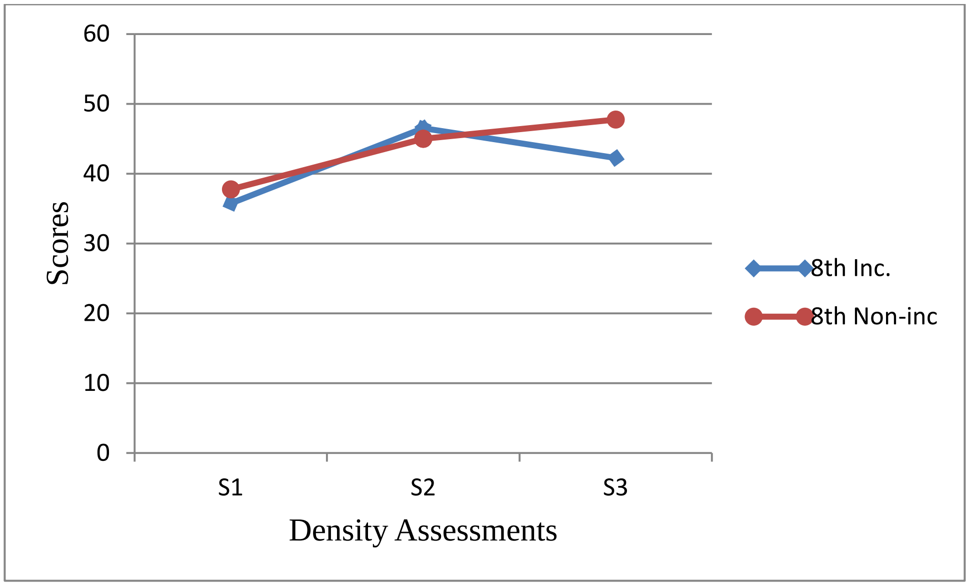
The researcher then conducted a paired samples *t* test to examine significant differences on conceptual change (pre-test to post-test, post-test to post-post-test and pre-test to post-post-test) within inclusive 8th grade science classrooms and independently for non-inclusive 8th grade classrooms. The paired samples *t* test that was conducted for 8th students in inclusive science classrooms showed that there was a significant difference in the scores for pre-test ($M = 35.75$, $SD = 10.30$) and post-test (*M*

= 46.50, *SD = 10.53*) conditions, *t*(19) = -8.83, *p* < .001. There was a significant difference in the scores for post-test and post-post-test (*M* = 42.25, *SD = 11.86*) conditions, *t*(19) = 2.74, *p* = .01. In addition, there was a significant difference in the scores for pre-test and post-post-test conditions, *t*(19) = -7.93, *p* < .001.

The researcher conducted a paired samples *t* test to examine the conceptual understanding of 8^{th} grade students in a non-inclusive science classroom. There was a significant difference in the scores for pre-test (*M* = 37.75, *SD = 9.24*) and post-test (*M* = 45.00, *SD = 11.35*) conditions, *t*(19) = -6.17, *p* < .001. There was a significant difference in the scores for post-test and post-post-test (*M* = 47.75, *SD = 12.51*) conditions, *t*(19) = -2.46, *p* = .02. In addition, there was a significant difference in the scores for pre-test and post-post-test conditions, *t*(19) = -10.42, *p* < .001. Figure 3 shows the comparison in mean scores between students in 8^{th} grade inclusion and 8^{th} grade non-inclusion on density assessments.

Figure 3

Comparison in Mean Scores between Students in 8th Grade Inclusion and 8th Grade Non-inclusion on Density assessments



Note. S1 = Pre-test Density Assessment, S2 = Post-test Density Assessment, S3 = Post-post-test Density Assessment, Inc. = Inclusive, Non-inc. = Non-inclusive.

The significant differences on conceptual change (pre-test, post-test, and post-post-test) of 8th grade students between inclusive and non-inclusive classrooms were examined using multivariate group analysis tests. Levene's test of equality of error variances showed that the group variance for pre-test density assessment (p = .90), post-test density assessment (p = .31), and post-post-test density assessment (p = .80) was not significant. This meant that the variances from different groups were normally distributed and that we can have confidence in the validity of our t test result for pre-test density assessment, post-test density assessment, and post-post-test density assessment.

The test results suggested that that there was no significant conceptual change on pre-test density assessment $F(1, 38) = .42$, $M\Delta = 2.00$, $p = .52$, $\eta^2 = .01$ with observed power of .10, post-test density assessment $F(1, 38) = .19$, $M\Delta = 1.50$, $p = .67$,

$\eta^2 = .00$ with observed power of .07, and post-post-test density assessment $F(1, 38) = 2.03$, $M\Delta = 5.50$, $p = .16$, $\eta^2 = .05$ with observed power of .28 between students in 8th grade inclusive science classroom and those in non-inclusive science classroom. Although students made no significant gains on conceptual understanding on all measures of density assessments, the highest difference in mean scores between 8th grade students in inclusion and students non-inclusion was from the post-post-test density assessment.

Retention of Science Concepts

The researcher conducted a paired samples (dependent) *t* test to investigate significant differences in retention of science concepts (post-test to post-post-test) within inclusive and independently for non-inclusive classrooms after a-two-week science inquiry lesson. The researcher examined retention of science concepts in both inclusive and non-inclusive classrooms at each grade level.

Retention of science concepts between students in the 6th grade inclusive science classroom and the non- inclusive science classroom were examined. Students without disabilities in the 6th grade inclusive science classroom had a lower mean score on the post-post density assessment than the post-test density assessment than the post-post-test density assessment. However, this decrease in mean score was not significant ($p = .48$). Students in the 6th grade non-inclusive science classroom had a lower mean score on the post-post density assessment than the post-test density assessment. However; this decrease was not significant ($p = .34$).

Students without disabilities in the 7th grade inclusive science classroom had a higher mean score on post-test science than post-post-test density assessment. Retention of science concepts was not significant for students in the 7th grade inclusive science classrooms between the scores of post-test density assessment and post-post-test density assessment (*p* = .54). Alternatively, students in 7th grade non-inclusive science classroom had higher mean score on post-post-test density assessment than post-test density assessment. Therefore, retention of science concepts was significant for students in 7th grade non-inclusive science classrooms between the scores of post-test density assessment and post-post-test density assessment (*p* = .04).

Students without disabilities in 8th grade inclusive science classrooms had a higher mean score on post-test science than post-post-test density assessment. Although they made significant conceptual changes between the scores of post-test density assessment and post-post-test density assessment (*p* = .01), students in 8th grade inclusive science classrooms did not retain science concepts as they scored lower on post-post-test density assessment. Conversely, students in 8th grade non-inclusive science classroom had a higher mean score on post-post-test density assessment than post-test density assessment. Retention of science concepts was significant for students in 8th grade non-inclusive science classrooms on the scores of post-test density assessment and post-post-test density assessment (*p*=.02).

Student Attitudes

The attitudes of students without disabilities towards students with disabilities were analyzed through a 26 question survey using a 5-point Likert scale, with 1 indicating strong disagreement, 2 indicating disagreement, 3 indicating neither disagreement or agreement, 4 indicating agreement, and 5 indicating strong agreement. The possible range of the survey is 26-130. The attitude score for each student was calculated and then divided by the total number of survey questions to derive an average score for each question. The Cronbach's alpha (α) value for this survey was .83, which indicated a strong reliability ($\alpha \geq 0.70$).

The Levene's test for homogeneity was conducted to measure the differences in pre-test attitudes of students without disabilities towards students with disabilities between students in inclusive and non-inclusive classrooms at each grade level before performing data analyses. This approach was used to determine whether independent groups included normally distributed populations and that the variances in the populations were equal. If the significant value was greater than .05, then the researcher assumed that the variances in one condition did not vary too much more than the variances in the second condition and that the researcher had confidence in the validity of the *t* test result. Otherwise, the researcher needed to proceed with caution to analyze further data.

Twenty students without disabilities from each classroom were tested for each grade level. Table 2 shows mean scores on the pre-survey and post-survey measures. The mean score for the students in the 6th grade inclusive science classroom was 3.60 (*SD = .57*) on pre-survey test and 3.42 (*SD = .55*) on the post-survey test. Students in the 6th grade non-inclusive classroom had a lower mean score of 3.38 (*SD = .45*) on both pre-survey test and 3.22 (*SD = .42*) post-survey test compared to students in the 6th grade inclusive science classroom.

Students in the 7th grade inclusive science classroom had a mean score of 3.55 (*SD = .37*) on pre-survey test and 3.41 (*SD = .56*) on the post-survey test. Alternatively, students in the 7th grade non-inclusive classroom had a lower mean score of 3.52 (*SD =*

.*25*) on both pre-survey test and 3.32 (*SD* = .*33*) post-survey test compared to students in the 7th grade inclusive science classroom.

Students in the 8th grade inclusive science classroom had a mean score of 3.47 (*SD* = .*44*) on the pre-survey test and 3.19 (*SD* = .*44*) on the post-survey test. Students in the 8th grade non-inclusive classroom had a higher mean score of 3.66 (*SD* = .*33*) on both the pre-survey test and 3.21 (*SD* = .*54*) post-survey test compared to students in the 8th grade inclusive science classroom.

Table 2

Summary of Ranges, Means, and Standard Deviations for ISMSS Scores

Group	*n*	Pre		Post	
		Min-Max	*M (SD)*	Min-Max	*M (SD)*
6th Inc.	20	2.77-4.65	3.60 (.57)	2.50-4.54	3.42 (.55)
6th Non-inc.	20	2.69-4.27	3.38 (.45)	2.62-4.15	3.22 (.42)
7th Inc.	20	2.92-4.19	3.55 (.37)	2.12-4.46	3.41 (.56)
7th Non-inc.	20	3.15-4.08	3.52 (.25)	2.77-4.54	3.32 (.33)
8th Inc.	20	2.69-4.58	3.47 (.44)	2.46-4.27	3.19 (.44)
8th Non-inc.	20	3.04-4.23	3.66 (.33)	2.23-4.50	3.21 (.54)

Note. ISMSS = The Inclusion Survey for Middle School Students. This construct consisted of 26 Likert scale items with a possible score of 1-5, Inc. = Inclusive, Non-inc. = Non-inclusive.

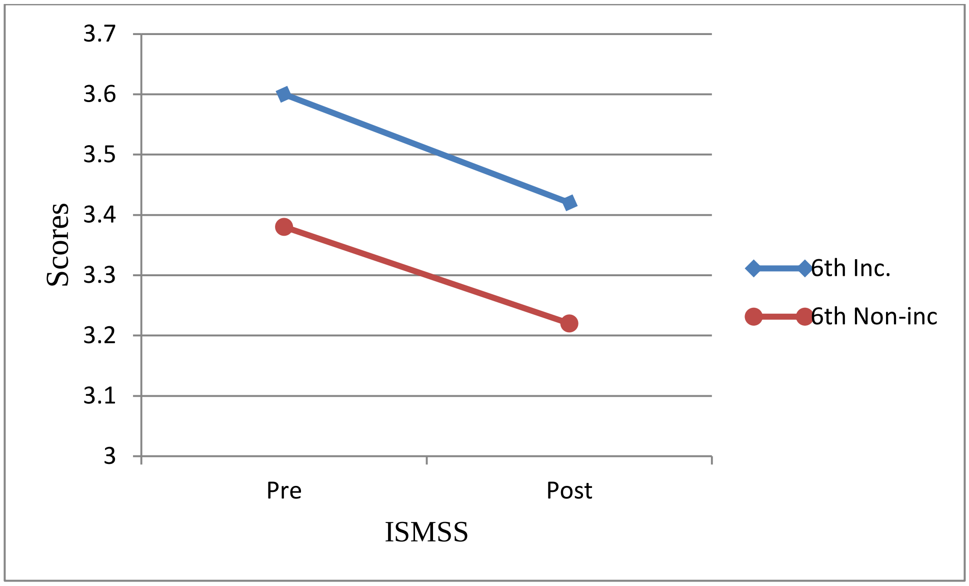
6th Grade Inclusive and Non-Inclusive Science Classrooms

The independent samples *t* test showed whether there were any significant changes between 6th grade students without disabilities in an inclusive classroom and those in a non-inclusive classroom about their attitudes towards students with disabilities on pre-survey tests. Levene’s test resulted in no violations being observed among sample variances about the experiences of students without disabilities towards students with disabilities (p = .21). This test showed that the variances from different groups were normally distributed and that we can have confidence in the validity of our *t* test result for pre-survey test and post-survey test.

A paired samples *t* test was conducted to examine significant differences on attitudes (pre-survey test and post- survey test) of 6th grade students without disabilities within inclusive and independently for non-inclusive classrooms. The test results indicated that there was not a significant difference in the scores of 6th grade students without disabilities within inclusive science classrooms for pre-survey (*M* = 3.60, *SD* = *.57*) and post-survey (*M* = 3.42, *SD* = *.55*) conditions, $t(19) = 1.82$, $p = .08$. In addition, a paired samples *t* test was conducted to examine significant differences on attitudes (pre-test and post-test) of 6th grade students in non-inclusive classrooms. There was not a significant difference in the scores of 6th grade students without disabilities within non-inclusive science classrooms for pre-survey (*M* = 3.38, *SD* = *.45*) and post-survey (*M* = 3.22, *SD* = *.42*) conditions, $t(19) = 1.19$, $p = .25$. Figure 4 shows the comparison in mean scores between students in 6th grade inclusion and 6th grade non-inclusion on surveys.

Figure 4

Comparison in Mean Scores between Students in 6th Grade Inclusion and 6th Grade Non-inclusion on ISMSS Scores



Note. ISMSS = The Inclusion Survey for Middle School Students, Pre = Pre-survey, Post = Post-survey, Inc. = Inclusive, Non-inc. = Non-inclusive.

The multivariate group analysis tests indicated whether there were any significant changes in means on pre-survey and post-survey tests on attitudes between 6th grade students in inclusion and students in non-inclusion. The results suggested that there was no significant change on pre-survey $F(1, 38) = 1.74$, $M\Delta = .21$, $p = .19$, $\eta^2 = .04$ with observed power of .25 and post-survey tests on attitudes $F(1, 38) = 1.71$, $M\Delta = .20$, $p = .19$, $\eta^2 = .04$ with observed power of .25 between 6th grade students in inclusion and students in non-inclusion.

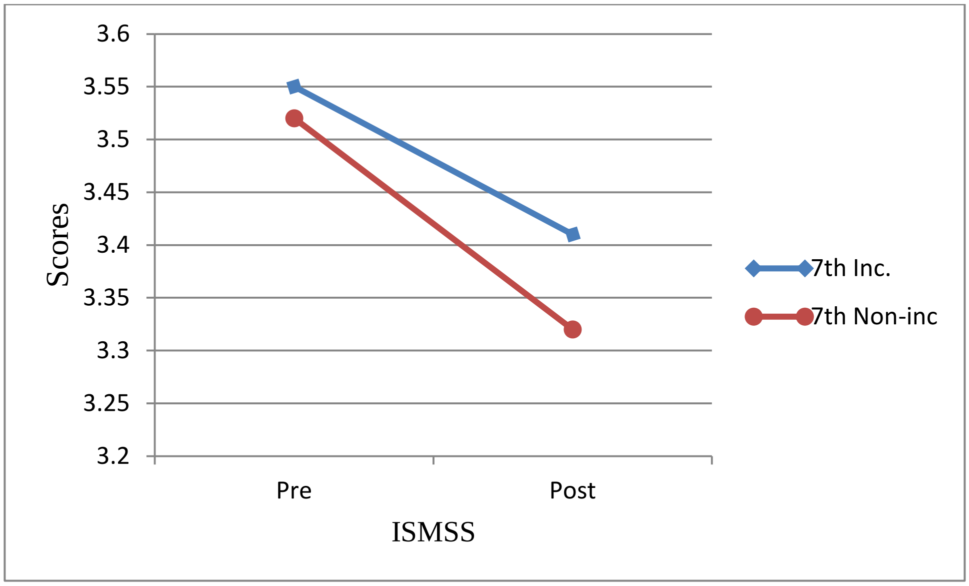
7th Grade Inclusive and Non-Inclusive Science Classrooms

The researcher conducted an independent samples *t* test to show whether there were any significant changes between 7th grade students without disabilities in inclusion and those in non-inclusion about their attitudes towards students with disabilities on pre-survey tests. The Levene's test indicated that equality of variances were not assumed on pre-survey tests on attitudes (p=.01) for 7th grade students without disabilities in inclusive science classroom and students without disabilities in non-inclusive science classroom. The Levene's test showed that the variances from different groups were not normally distributed and that we should proceed with caution to analyze further data.

A paired samples *t* test was conducted to examine significant differences on attitudes (pre-test and post-test) of 7th grade students without disabilities within inclusive and independently for non-inclusive classrooms. The results suggested that there was not a significant difference in the scores of 7th grade students without disabilities within inclusive science classrooms for pre-survey (M = 3.55, SD = *.37*) and post-survey (M = 3.41, SD = *.56*) conditions, $t(19)$ = .90, p = 0.38. In addition, the paired samples *t* test indicated that there was a significant difference in the scores of 7th grade students without disabilities within non-inclusive science classrooms for pre-survey (M = 3.52, SD = *.25*) and post-survey (M = 3.32, SD = *.33*) conditions, $t(19)$ = .3.22, p = 0.004. Figure 5 shows the comparison in mean scores between students in 7th grade inclusion and 7th grade non-inclusion on surveys.

Figure 5

Comparison in Mean Scores between Students in 7th Grade Inclusion and 7th Grade Non-inclusion on ISMSS Scores



Note. ISMSS = The Inclusion Survey for Middle School Students, Pre = Pre-survey, Post = Post-survey, Inc. = Inclusive, Non-inc. = Non-inclusive.

The multivariate group analysis tests suggested that there was not a significant change in means on pre-survey test $F(1, 38) = .04$, $M\Delta = .02$, $p = .83$, $\eta^2 = .00$ with observed power of .05 on attitudes between 7th grade students in inclusion and students in non-inclusion. The mean scores on pre-survey test was the lower than post-survey. In addition, there was no significant change in means on post-survey test $F(1, 38) = .42$, $M\Delta = .09$, $p = .52$, $\eta^2 = .01$ with observed power of .09 on attitudes between 7th grade students in inclusion and students in non-inclusion.

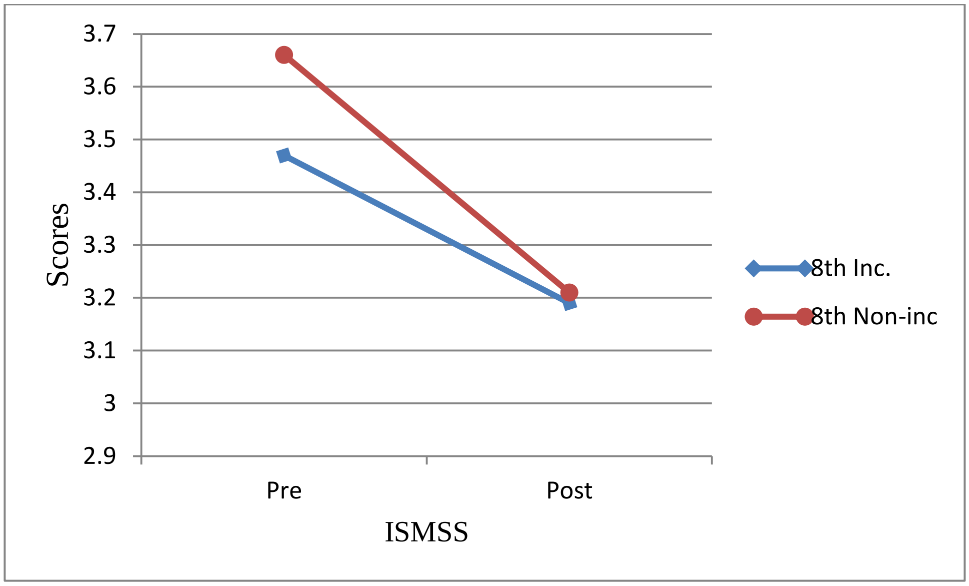
8th Grade Inclusive and Non-Inclusive Science Classrooms.

The independent samples *t* test showed that Levene's test for equality of variances were assumed on pre-survey test scores on attitudes ($p = .35$) for 8th grade students without disabilities in inclusive science classroom and students without disabilities in non-inclusive science classroom. This test showed that the variances from different groups were normally distributed and that we can have confidence in the validity of our *t* test result for pre-survey tests and post-survey tests.

A paired samples *t* test was conducted to examine significant differences on attitudes (pre-test and post-test) of 8th grade students without disabilities within inclusive and independently for non-inclusive classrooms. The results suggested that there was a significant difference in the scores of 8th grade students without disabilities within inclusive science classrooms for pre-survey (M = 3.47, SD = .44) and post-survey (M = 3.19, SD = .44) conditions, $t(19) = 6.06$, $p < .001$. In addition, the paired samples *t* test results showed that there was a significant difference in the scores of 8th grade students without disabilities within non-inclusive science classrooms for pre-survey (M = 3.66, SD = .33) and post-survey (M = 3.21, SD = .54) conditions, $t(19)$ = .3.06, $p = 0.006$. Figure 6 shows the comparison in mean scores between students in 8th grade inclusion and 8th grade non-inclusion on surveys.

Figure 6

Comparison in Mean Scores between Students in 8th Grade Inclusion and 8th Grade Non-inclusion on ISMSS Scores



Note. ISMSS = The Inclusion Survey for Middle School Students, Pre = Pre-survey, Post = Post-survey, Inc. = Inclusive, Non-inc. = Non-inclusive.

The multivariate group analysis tests showed the mean scores on attitudes between 8th grade students without disabilities in inclusion and students without disabilities in non-inclusion on pre-survey and post-survey test. The multivariate group analysis tests indicated that there was no significant difference in mean scores on pre-survey test $F(1, 38) = 2.64$, $M\Delta = .20$, $p = .11$, $\eta^2 = .06$ with observed power of .35 on attitudes of students without disabilities. Results also indicated that there was no significant difference in mean scores on post-survey test $F(1, 38) = .01$, $M\Delta = .02$, $p = .91$. $\eta^2 = .00$ with observed power of .05 on attitudes between students without disabilities in inclusion and those in non-inclusion.

Chapter V: Discussion, Recommendations, and Conclusions

Introduction

Public schools are mandated by federal laws to provide access to general education classrooms for students with disabilities. The law requires all students to receive instruction in the same educational setting (IDEIA, 2004). Public schools are held accountable for the success of students with disabilities and students without disabilities (Schwartz, 1984). However, most public schools have struggled to provide the required special education services, which are outlined through an Individualized Education Program (IEP) of students with disabilities. Due to this struggle, federal and state authorities have promoted the charter schools as an alternative to improve public education (VanderHoff, 2008). As part of the public education system, charter schools are held accountable for the success of all students (U.S. Department of Education, 2006). Additionally, they are required to promote access to general education curriculum for students with disabilities (U.S. Department of Education, 2006). Many parents consider charter schools as an alternative to traditional public schools because many believe that charter schools have higher academic goals, provide access to general education classrooms with more effective special educations services, and better address the educational needs of students with disabilities (Schneider & Buckley, 2003; Smoot, 2011).

The effect of inclusion on students with disabilities in charter schools is evident (Ferguson, Hanreddy, & Draxton, 2011; Howe & Welner, 2002); however, research is limited as to the effect of inclusion on students without disabilities in charter schools (Ahearn, & Lange; 2007; Zimmer & Buddin; 2007). In addition, available research is inconclusive. For example, inclusion had no effect on improving negative attitudes of students without disabilities in charter schools, but it did improve conceptual understanding of these students in all subjects including science (Downing et al., 2004).

Many students have difficulty understanding scientific concepts (Hewson & Hewson, 1983). As an example, density is a very challenging concept for many students as they have difficulty in making distinctions between density and mass, density and weight, and density and buoyancy (Posner, Strike, Hewson, & Gertzog, 1982; Raghavan, Sartoris, & Glaser, 1998). Although teaching the concept of density in a regular science classroom can be challenging for many science teachers, having students with disabilities in the same classroom can be even more challenging as science teachers might have to use most of their effort on attitudinal problems associated with classroom management, differentiated instruction, and individualized instruction (Newman, 2006; Smoot, 2011). For these reasons, it is worthy to analyze the effects upon the conceptual understanding and retention of students without disabilities in regards to such concepts as density, as well as to attitudinal changes toward students with disabilities in inclusive science classrooms.

This study investigated the conceptual understanding of students without disabilities and their attitudes towards students with disabilities in inclusive science classrooms at a charter middle school. It included the collection and analysis of quantitative data using a quasi-experimental design to answer the research questions to determine if students without disabilities in inclusive charter middle school science classrooms were positively or negatively affected by the process of being educated with students with learning disabilities within inclusive science classrooms.

Discussion

The literature review of this scholarly research indicated that students without disabilities and those with disabilities may have a positive or a negative effect on one another's conceptual understanding and attitudes. As the theoretical framework of this study, the social learning theory of Bandura was used to explain the attitudes of human in terms of reciprocal (continuous) interaction between cognitive, attitudinal, and environmental determinants (Bandura, 1989). By applying social learning theory to this research, the cognitive, attitudinal, and environmental determinants of continuous human interactions concluded that: (1) the social interactions among students (with and without disabilities) in an inclusive setting can have a positive effect on these students' cognitive development resulting in higher conceptual understanding; and (2) including students with different backgrounds (with and without disabilities) in a specific learning environment (inclusion) can result in positive social attitudes.

This quantitative quasi-experimental study answered the research questions on the conceptual understanding and retention of science concepts of students without disabilities in inclusive science classrooms at a charter middle school. In addition, it focused on the attitudes of students without disabilities towards students with disabilities in the same setting through three research questions:

1. How does inclusive science education affect the scientific conceptual understanding of general education students in a charter school?

2. What is the difference in retention of science concepts between students without disabilities in inclusive science classrooms and students in non-inclusive science classrooms after a-two-week inquiry science lesson?

3. How does inclusive science education affect the attitudes of general education students toward students with disabilities in a charter school?

This study included two students with learning disabilities as treatments into general education science classrooms in order to create one inclusive science classroom for each Grade 6, Grade 7, and Grade 8 levels. It was conducted during regular class time for three weeks and included two science lessons on density, a Density Assessment (20 multiple choice questions), and an Inclusion Survey for Middle School Students (26 questions as a Likert Scale). The length of each science lesson was one week and each lesson was implemented in each classroom 50 minutes every day. All Students answered questions on a given Density Assessment (before, right after, and one week after two science lessons) and the Inclusion Survey for Middle School Students (before and right after two science lessons). The assessment took about 20 minutes and the survey took about 15 minutes to complete.

The assessment (pre, post, and post-post) and the survey (pre and post) were administered to 20 students without disabilities and two students with learning disabilities in inclusive science classroom and 20 students without disabilities in a non-inclusive science classroom at each grade level. The results for students with learning disabilities were not reported as the study only focused on the effect of inclusive science education on students without disabilities.

A variety of test measures were used to analyze the results from this research study. First, the descriptive statistics on conceptual understanding for all grade levels for both inclusive and non-inclusive classrooms were provided. Second, the effect of the scientific conceptual understanding of general education students in inclusion was analyzed by running independent-samples t-test, paired samples t-test, and multivariate group analysis test. Third, the descriptive statistics on the attitudes of general education students toward students with learning disabilities for all grade levels for both inclusive and non-inclusive classrooms were provided. Fourth, the researcher analyzed the effect of inclusion on the attitudes of general education students toward students with learning disabilities through independent-samples t-test, paired samples t-test, and multivariate group analysis test. Fifth, the researcher analyzed the difference in retention of science concepts between students without disabilities in inclusive science education and students in non-inclusive science education after a-two-week science inquiry lesson using multivariate group analysis test.

Conceptual Change

The following null hypothesis was developed to address the research question that assessed how inclusive science education affected the scientific conceptual understanding of students without disabilities in a charter middle school:

> Ho1: There is no relationship between the effect of inclusive science education and the conceptual understanding of science concepts in students without disabilities in a charter school.

In response to the first research question, the researcher examined the scores on conceptual understanding between pre-test density assessment and post-test density assessment after a-two-week science lesson for students without disabilities in inclusive science classrooms and students without disabilities in non-inclusive science classrooms at 6^{th} grade, 7^{th} grade, and 8^{th} grade levels.

The overall range of mean scores on conceptual change for all students in both inclusive science classrooms and those in non-inclusive science classrooms was 29.50 – 43.25 (out of 100) for the pre-test density assessment and 39.30 – 62.25 (out of 100) for the post-test density assessment. These low scores may exist because these students find density too abstract to understand and apply to meaning in their lives. Hitt (2005) supports this finding in his study. He found that the concept of density is confusing because it is derived from two other concepts: mass and volume. Even though middle school students have some understanding of mass and volume, they do not develop a conceptual understanding of density. This is because students relate density mainly to the concentration and particles of mass, but they do not connect volume with density.

With respect to conceptual understanding, 6^{th} grade students without disabilities in inclusive science classroom and those in non-inclusive science classroom had a significant increase ($p < .001$) between pre-test density assessment and post-test density assessment. This result showed that there was a significantly positive relationship between the effect of inclusive science education and the understanding of science concepts in students without disabilities in inclusive science classroom. This study supports findings from previous studies that students without disabilities improved their conceptual understanding over the intervention period regardless of classroom setting (Hitt, 2005; Smith et al., 1987). The researcher/teacher found that students participated in a two-week science lesson and right after the science lessons while their knowledge was still fresh; they scored higher on the post-test density assessment resulting in higher conceptual understanding. This supports findings from Hewson and Hewson (1983). They found that when a unit was designed to promote conceptual change through experimentation and demonstrations on density on continuous days, students improved their conceptual understanding.

An interesting finding from these data was that 6th grade students in non-inclusive science classroom had a higher conceptual understanding ($p < .001$) on the post-test density assessment compared to 6th grade students in the inclusive science classroom. The researcher/teacher observed that students with disabilities demanded more of the teacher's time and effort. Past research shows that students with learning disabilities demand more remediation from the teacher in the inclusive classrooms (Agne, 1999). The researcher/teacher observed that this situation caused students without disabilities becoming bored, and exhibiting behavioral issues and disengagement in the inclusive setting. Agne (1999) supports these findings on her study on inclusive education. She found that teachers paying more attention to the accommodations of students with disabilities in the inclusive classrooms created a less focused and less engaged classroom environment.

Students without disabilities in the 7th grade inclusive science classroom and those in the non-inclusive science classroom had a greater increase on conceptual understanding ($p < .001$) between pre-test density assessment and post-test density assessment. This result showed that there was a significantly positive relationship between the effect of inclusive science education and the understanding of science concepts in students without disabilities in inclusive science classroom. The researcher/teacher observed that after learning a particular science concept, practicing on the same science concepts constantly can result in higher learning. This finding follows the study of Hewson and Hewson (1983). They found that practicing science learning through hands-on lab activities may result in improved conceptual understanding regardless of learning environment. It is also important to indicate that with respect to conceptual understanding, 7th grade students without disabilities in non-inclusive classroom scored significantly higher on pre-test density assessment (p = .04) than those in inclusive science classroom. In addition, the researcher/teacher observed that compared to all other classes in the study, this classroom was the most motivated, focused, and engaged in all science learning activities regardless of the amount of support from the science teacher. This finding follows the study of Wehmeyer et al. (2003). They found that students requiring the least amount of support from the teacher were engaged in all learning activities.

It was interesting that 7th grade students in non-inclusive science classroom had a higher conceptual understanding ($p < .001$) on the post-test density assessment compared to 7th grade students in the inclusive science classroom. The researcher/teacher observed that the existence of students with learning disabilities within the inclusive classroom may have caused the science teacher to spend most of his time and effort on these students. This issue may have caused students without disabilities to become bored and disengaged from science learning. This finding supports the study of Agne (1999). She suggested that when teachers provide more help and individual attention to students with learning disabilities, it may create a less engaged learning environment.

Analyzing the conceptual understanding, both 8th grade students without disabilities in inclusive science classroom and those in non-inclusive science classroom had a greater increase ($p < .001$) between pre-test density assessment and post-test density assessment. This result showed that there was a significantly positive relationship between the effect of inclusive science education and the understanding of science concepts in students without disabilities in inclusive science classroom. The two-week science lesson helped both 8th grade students without disabilities in the inclusive classroom and those in non-inclusive classroom to increase their conceptual understanding on the post-test density assessment. These findings support the studies of Hitt (2005) and Smith et al. (1987). They found that regardless of classroom settings, all students increased their conceptual understanding over the intervention period. The researcher/teacher found that students without disabilities in inclusive classroom and those in non-inclusive classroom grasped a better understanding of the concept of density after the science lessons due to continuous hands-on learning and demonstrations. This result supports the findings of Hewson and Hewson (1983). They indicated that all students obtain higher conceptual understanding after they receive constant feedback from the teacher through experiments and scientific demonstrations during the intervention period.

An interesting finding from these data was that 8th grade students in the inclusive science classroom had a slightly higher conceptual understanding (p = .67) on the post-test density assessment compared to 8th grade students in the non-inclusive science classroom. This result supports the findings of Baker et al. (1994). They found that students without disabilities in inclusive settings established better conceptual understanding than comparable students in non-inclusive settings. The researcher/teacher observed that the reciprocal interaction between students without disabilities and those with learning disabilities in the inclusive classroom established an acceptance of one another resulting in engagement and increased conceptual understanding of the concept of density. This result supports the findings of Bandura (1989). He suggested that the reciprocal interaction between students with different backgrounds (students with disabilities and students without disabilities) can show an increase in cognitive student achievement within the same environmental setting. Another explanation for the aforementioned findings may be that the researcher/teacher observed that the social interactions between all students in the inclusive classroom dictated peer support. This resulted in less time and effort of the teacher on students with learning disabilities creating more teaching and more effective classroom management. These findings support the study of Mastropieri et al. (2006) on curriculum enhancement in inclusive middle school science classrooms. Their results indicated that social interactions between students without disabilities and students with learning disabilities in the inclusive classrooms resulted in peer-support, engagement, and better comprehension of science concepts.

Retention of Science Concepts

The following null hypothesis was developed to address the research question that assessed the difference in retention of science concepts between students without disabilities in inclusive science classrooms and students without disabilities in non-inclusive science classrooms after a-two-week inquiry science lesson at a charter middle school:

> Ho2: There is no relationship between the effect of inclusive science education and the difference in retention of science concepts between students without

disabilities in inclusive science education and students without disabilities in non-inclusive science education after a-two-week science inquiry lesson.

In response to the second research question, the researcher examined the scores on retention of science concepts between post-test density assessment and post-post-test density assessment for students without disabilities in inclusive science classrooms and students without disabilities in non-inclusive science classrooms at 6th grade, 7th grade, and 8th grade levels.

With respect to retention of science concepts, 6th grade students without disabilities in inclusive science classroom ($M\Delta = .45$, $p = .48$) retained more on science concepts than those in non-inclusive science classroom ($M\Delta = 3.00$, $p = .34$) between post-test density assessment and post-post-test density assessment. This result showed that there was non-significant relationship between the effect of inclusive science education and retention of science concepts in 6th grade students without disabilities in inclusive science classroom. The researcher/teacher observed that although inclusion of students with learning disabilities did not result in higher scores of students without disabilities on post-test density assessment compared to their non-disabled peers in non-inclusive classroom, in the long run students without disabilities obtained more retention of science concepts between post-test density assessment and post-post-test density assessment than their peers in non-inclusive science classroom as they were establishing friendships within the classroom. This finding supports the study of Ferguson et al. (2011). They found that inclusion of students with learning disabilities improved the social skills of students without disabilities in inclusive science classroom and had a positive effect on their learning long-term.

Students without disabilities in 7th grade inclusive science classroom ($M\Delta = .50$, $p = .54$) retained more on science concepts than those in non-inclusive science classroom ($M\Delta = 4.00$, $p = .04$) between post-test density assessment and post-post-test density assessment. This result showed that there was non-significant relationship between the effect of inclusive science education and retention of science concepts in 7th grade students without disabilities in the inclusive science classroom. The researcher/teacher observed that as students without disabilities started working together in science learning and establishing meaningful relationships with their disabled peers in inclusive classrooms, such friendship may have contributed to comprehension of concepts long-term. This finding follows the study of Ferguson et al. (2011). They suggested that inclusive education improves social skills of all students and contribute to their understanding of concepts.

Analyzing the retention of science concepts, 8th grade students without disabilities in inclusive science classroom ($M\Delta = 4.25$, $p = .01$) retained less on science concepts than those in non-inclusive science classroom ($M\Delta = 2.75$, $p = .02$) between post-test density assessment and post-post-test density assessment. Although there was a significantly negative relationship between the effects of inclusive science education and retention of science concepts in 8th grade students without disabilities in inclusive science classroom, the students in the inclusive science classroom retain less regarding science concepts in comparison to their non-disabled peers in non-inclusive science classroom. The researcher/teacher observed that the lack of peer interactions and cooperation in science activities may eliminate learning in the long run. This finding supports the study of Drame (2011). He found that the lack of social skills between students without disabilities and those with learning disabilities in inclusive classrooms may create attitudinal problems among all students and interfere with their learning.

Student Attitudes

The following null hypothesis was developed to address the research question that assessed how inclusive science education affected the attitudes of students without disabilities towards students with disabilities in a charter middle school:

> Ho3: There is no relationship between the effect of inclusive science education and attitudes of general education students toward students with learning disabilities in a charter school.

In response to the third research question, the researcher examined the scores on attitudes between pre-survey tests and post-survey tests after a-two-week science lesson for both students in inclusive science classrooms and students in non-inclusive science classrooms at 6^{th} grade, 7^{th} grade, and 8^{th} grade levels.

The overall range of mean scores on attitudes for all students in both inclusive science classrooms and those in non-inclusive science classrooms was 3.38 – 3.66 from pre-survey test and 3.19 – 3.42 from post-survey test. Considering a score of 3.00 on attitudes as a neutral point on the Likert scale, all students without disabilities from both inclusive classrooms and non-inclusive classrooms from each grade level demonstrated slightly positive attitudes towards students with learning disabilities on pre-survey test and post-survey test. The researcher/teacher observed that students without disabilities in both classroom settings exhibited social embracing towards students with learning disabilities. This finding supports the study of Kalambouka et al. (2007) on the impact of placing students with special education needs in general education classrooms and their effect on the attitudes of students without disabilities. They found that the effect of students with disabilities on their non-disabled peers was neutral or positive 81% of the time.

With respect to student attitudes, 6th grade students without disabilities in the inclusive science classroom had a lower mean score (p = .08) between pre-survey test and post-survey test. This result showed that there was a non-significant relationship between the effect of inclusive science education and attitudes of general education students toward students with learning disabilities in a charter school. In addition, 6th grade students without disabilities in non-inclusive science classroom had a lower mean score (p = .25) between the same measures. The researcher/teacher observed that although students without disabilities did not have negative attitudes towards those with learning disabilities regardless of classroom setting, they preferred to establish interactions with students with the same abilities. This finding supports the study of Agne (1999). She found that students without disabilities remained under-challenged, bored, and disengaged when the teacher spend most of his time and effort to provide assistance to students with learning disabilities. The researcher/teacher observed that this may be the reason why students without disabilities did not prefer to work with students with learning disabilities in scientific learning activities.

It was interesting to find that 6th grade students without disabilities in the inclusive science classroom had a higher mean score in attitudes (p = .19) on post-survey test compared to those in the 6th grade non-inclusive science classroom. The researcher/teacher observed that although students without disabilities did not establish a meaningful engagement in science lessons, they exhibited positive social interactions with their disabled peers in the inclusive science classroom compared to students without disabilities in non-inclusive science classroom. This supports the findings of Downing and Peckham-Hardin (2007). They found that inclusive education is beneficial for students without disabilities as it improves their attitudes towards students with learning disabilities. Another reason observed by the researcher/teacher was that students without disabilities knew that they had to construct social relationships with their disabled peers as they all had to work together and communicate while in groups conducting experiments in inclusive science classroom. This finding follows the study of Ferguson et al. (2011). They found that students without disabilities improved their social skills with their disabled peers as they all took part in everyday learning experiences.

Students without disabilities in the 7^{th} grade inclusive science classroom had a lower mean score ($p = .38$) between the pre-survey test and post-survey test. This result showed that there was a non-significant relationship between the effect of inclusive science education and attitudes of general education students toward students with learning disabilities in a charter school. In addition, 7^{th} grade students without disabilities in the non-inclusive science classroom had a lower mean score ($p = 0.004$) between the same measures. The researcher/teacher observed that students without disabilities preferred to engage in learning activities with their non-disabled peers than their disabled friends regardless of the classroom setting. This finding supports the study of Agne (1999). She found that students without disabilities preferred maintaining more social interactions with their non-disabled friends than those with disabilities in learning via group work.

An interesting finding was that 7th grade students in the inclusive science classroom had a higher mean score on attitudes (p = .52) from post-survey test compared to those in the 7th grade non-inclusive science classroom. The researcher/teacher observed that although students without disabilities were less engaged in science learning, they established more friendships with students with learning disabilities than those in non-inclusive science classrooms. This follows the findings of Ferguson et al. (2011). They found that students without disabilities in inclusive settings construct more meaningful relationships with their disabled peers than comparable students in non-inclusive settings.

Analyzing the student attitudes, 8th grade students without disabilities in the inclusive science classroom had a lower mean score (p < .001) between the pre-survey test and post-survey test. This significant result showed that there was a significantly negative relationship between the effect of inclusive science education and attitudes of general education students toward students with learning disabilities in an inclusive classroom. The researcher/teacher observed that engaging in science learning with disabled students did not positively change the feelings of students without disabilities toward students with learning disabilities in the inclusive classroom. This finding supports the study of Siperstein et al. (2007). They found that although students without disabilities and their non-disabled peers worked together in classroom activities, only 10% of them established friendships in the inclusive classroom. Moreover, they did not want to socially interact outside of their classrooms. In addition, 8th grade students without disabilities in non-inclusive science classroom had a lower mean score (p = 0.006) between the same measures. The researcher/teacher observed that non-disabled students' lack of knowledge about their disabled peers might have contributed to their negative feelings towards disabled students. This finding supports the study of Marchant (1990) on useful resources for learning disabled students. He found that lack of knowledge about students with learning disabilities may dictate negative feelings of fellow students toward them.

It was interesting to find that 8^{th} grade students in the inclusive science classroom had a slightly lower mean score on attitudes ($p = .91$) compared to those in the 8^{th} grade non-inclusive science classroom. The researcher/teacher observed that due to classrooms procedures, students without disabilities in the inclusive science classroom had to work and collaborate with students with learning disabilities in classroom activities even though they preferred working with their non-disabled peers. This finding supports the study of Downing et al. (2004) on the development of an inclusive charter elementary school. They found that although inclusive education improved the conceptual understanding of students without disabilities, it did not improve their attitudes towards students with learning disabilities.

Limitations

This study includes several limitations. Consideration must be given to limitations of the study and the impact it may have had on the results. The first limitation involves the lack of random sampling. This limitation was evident as this study was a nonequivalent quasi-experimental study. The failure to randomize in sampling can cause a researcher not to be able to create a true experimental study environment that includes internal validity threats.

A second limitation was associated with the density assessment results on the pre-test density assessment between students without disabilities in the 7th grade inclusive science classrooms and those in the non-inclusive science classroom. The students in the 7th grade non-inclusive classroom had a significant difference on the pre-test density assessment (p = .044) that assessed conceptual understanding, compared to those in the inclusive science classroom. Therefore, these nonequivalent scores between the students in the 7th grade inclusion and 7th grade non-inclusion on the pre-test density assessment present a possible validity issue, which includes internal validity threats.

A third limitation involves a limited number of students with disabilities in the inclusive science classrooms. Increasing the number of students with disabilities in inclusive classrooms might have a positive or a negative effect on the conceptual understanding and attitudes of students without disabilities (Mastropieri et al., 2006). In their study, Downing et al. (2004) found that inclusion of students with disabilities did not improve the attitudes of students without disabilities. However, Ferguson et al. (2011) indicated that it may create positive social relationships among all students.

A fourth limitation is the reliability of the study. Even though the density assessments in this study were based on similar assessments used by Smith et al. (1987), there was no published reliability or validity data for these instruments. Unreliability of a study can potentially contribute to both random and systematic error. However, because the test was used in other research, and was previously pilot-tested by the researcher, there was some evidence to support the adequacy of the assessments for capturing density knowledge, reducing concerns related to systematic error. Another reliability issue is related with scoring the assessments and entering the data into SPSS.

Reducing measurement error was a difficult task in this study because there were five tests (pre-test, post-test, and post-post-test measures for the density assessment and pre-survey test and post-survey test for the surveys) for each classroom at each grade level. Even though it is ideal for a researcher to co-score all these tests with another science teacher, this was not a practical possibility in this study. However, reliability of scoring the assessments and entering the data into SPSS was high, as the researcher double-checked and scored all of the tests.

A fifth limitation includes the reality that the size of the study precludes some generalization regarding the study. The relatively small sample and the fact that the sample was recruited from a single charter school limits generalization somewhat, although it was representative of the schools in the Midwestern U.S. The ability to generalize may have been limited further as the sample size was reduced to create greater uniformity between the comparison and sample groups. In addition, it is evident that strong general assertions about the results of a study cannot be made when there are reduced numbers of participants in a study.

Recommendations for Future Research

This current study focused on a charter middle school in the Midwestern U.S. The study answered research questions on the conceptual understanding and retention of science concepts of students without disabilities in inclusive science classrooms at a charter middle school. In addition, it answered research questions on the attitudes of students without disabilities towards students with disabilities in the same setting. Based on this study, it is suggested that further research should be explored so as to add to the limited body of knowledge regarding the effects of inclusive science education on populations of students without disabilities in a charter middle school. Many key questions cannot be easily answered due to a lack of comprehensive data. Suggestions for further research include:

1- Research how using a population of students with moderate or severe disabilities in inclusive classrooms may affect the conceptual understanding and attitudes of students without disabilities.
2- Research using a larger sample size to be able to generalize the findings.
3- Research using a mixed methodology for more detailed effects of inclusive education.
4- Compare the effect of inclusive education on students without disabilities between elementary and middle levels at charter schools.
5- Compare the effect of inclusive education on students without disabilities between traditional public schools and charter schools from different states in the U.S.
6- Compare the effects of inclusive education on students without disabilities between co-taught classrooms including one science teacher and a special education teacher versus classrooms including only a science teacher.
7- Compare the effects of inclusive education on students without disabilities between classrooms including a researcher only and those with a researcher and a regular education teacher.
8- A future study could look at the comparison of different teaching strategies implemented at different inclusive classrooms.
9- A final recommendation would be that a study on the length of interventions at

different inclusive classrooms would add to the literature.

Conclusion

The overall findings of the study indicated that the effect of inclusive education includes mixed results on the conceptual understanding, retention of science concepts, and attitudes of students without disabilities in inclusive settings at a charter middle school in Midwestern U.S. The study findings suggested that inclusive science education had a significantly positive effect on the conceptual understanding of all students without disabilities in inclusive classrooms from all grade levels. In addition, inclusive science education had a negative effect on the retention of science concepts of students without disabilities in inclusive science classrooms. Moreover, inclusive science education had a negative effect on the attitudes of students without disabilities towards their peers with disabilities in inclusive classrooms. As a result, although this study indicated some benefits of inclusive science education on the population of students without disabilities in inclusive classrooms on conceptual understanding, retention of science concepts and attitudes, the findings are inconclusive. Therefore, the study does not support or endorse that inclusive science education is an appropriate education placement for all students in charter middle school science classrooms.

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Appendix A

Lesson #1: Defining Density (Teacher Guide)

Introduction
This section will include three questions as a pre-assessment about students' knowledge and capture their interest in mass of different objects with the same size.

1. What is mass?
   The amount of matter in an object.
2. What is volume?
   The amount of space occupied by an object.
3. What is the mathematical relationship between mass and volume?
   Density = Mass/Volume

Exploration A: Let's Play Ball

Materials: (per group)
One Styrofoam ball
One metal ball
Two clear plastic cups
Triple beam balance
String
Rulers
Graduated cylinder
Water
Weights

In this part, students will be working in groups to observe a metal ball and Styrofoam ball and list five similarities and differences between the two balls. A student from each group will then duplicate their lists and address similarities and differences of items on the board. After classroom discussion, students will determine that the mass of the balls is the most different and the size of the balls is the most similar feature.

1. What is the most obvious similarity between the balls?
   They both have the same size.
2. What is the most obvious difference between the balls?
   The metal ball is heavier than the Styrofoam ball.

Exploration B: Mystery Liquids

Materials: (per group)
Water
Rubbing alcohol
Two clear plastic cups
Triple beam balance
String
Rulers
Graduated cylinder
Ice

In this part of the exploration, students will make comparisons between an equal volume of two different liquids such as water and alcohol.

1. Measure the masses of both liquids. What do you observe?
   Solution A weighs more.
2. Add ice in each liquid. What did you observe happen in two cups?
   Ice floats in Solution A and sinks in Solution B.
3. Draw a picture of your observation on the board. What are the similarities and differences between two cups?
   The volume of each liquid is the same, but the mass of each one is different.

Exploration C: A Balanced Breakfast

Materials: (per group)
Rulers
Graduated cylinder
Water
Weights
Crispy rice cereal
Grainy nut cereal
250 ml beaker
Graph paper

In this part, students will make comparisons between a crispy rice cereal and a grainy nut cereal. Overall, the exploration part will have three questions for students to answer.

1. Which values on the graph are the same for each cereal?
   The volume of each cereal.
2. Which measurements on the graph are the same for each cereal?
   The volume of each cereal.
3. Why is the mass different for each cereal?
   Due to difference in density.

Concept Development

Students will review and compare their responses to 10 questions from Exploration A, Exploration B and Exploration C. They will then answer the following concept development questions:

1- What makes two balls similar and different from each other?
They have similar sizes but different masses.
2- What makes two liquids similar and different from each other?
They have the same volume but different masses.
3- What makes two cereals similar and different from each other?
They occupy the same volume but have different masses.
4- Discuss #1, #2, and #3 in groups.
Answers may vary.
5- Describe why each cereal has different lines on the graphs.
They have different masses.
6- Describe mass and volume using your observations.
Mass is the amount of matter in an object, and the volume is the space occupied by an object.
7- What does mass per unit volume indicate for each material?
Density.

Answering those questions will allow students to discuss common factors that make two balls, liquids, and cereals similar to and different from each other. After the discussion, students will realize that there were different amounts of matter in the same amount of space. In addition, students will determine that there was a certain amount of matter (mass) in a given amount of space (volume). The researcher will then help students label this fact as density, or mass per unit volume of any object. Concept development will include seven questions to refine students' understanding about their discovery.

Concept Application

This section will include seven questions to examine how students apply their science understanding in similar situations.

1- How can you formulate the relationship between mass, volume, and density?
Density = Mass/Volume
2- Using this formula, calculate the density of balls, liquids, and cereals.
Answers may vary.
3- Find the average density for each item and include your results on a line graph paper.
Answers may vary.
4- When you put both cereals in water, which will sink or float? Why?
The crispy rice cereal will float and the grainy nut cereal will sink due to differences in their masses.
5- Put a can of diet soda and a can of regular soda in water. What do you observe?

Although they both have same volume, the diet soda will float, and the regular soda will sink due to differences in their masses.

6- Which soda sinks or floats? Why?
The diet soda will float, and the regular soda will sink because the regular soda is heavier.

7- Which soda is denser? Why?
The regular soda is denser because it has more mass than the diet soda.

Answering those questions will help students gain abilities to do a variety of science activities in which they can expand and apply their basic understanding of density in real-life situations. First, the researcher will challenge students to use their data and construct a mathematical formula that will measure an object's density. Students will use their data and conclude that density=mass/volume. Students will use this formula to measure the density of each cereal. Next, they will drop a handful of each cereal into a beaker of water and make careful observations. They will observe that the crispy rice cereal will float and the other cereal will sink. By this activity, the researcher will allow students to observe what happens physically and mathematically. In similar activities, students will compare the density of salt water and tap water and a can of diet soda and regular soda.

Authentic Assessment

Students will be asked four questions to formulate this meaningful observation in terms of density. The questions include:

1- Put five raisins in carbonated soda. What do you observe immediately?
They sink.
2- After 5 minutes, what do you observe?
They start floating.
3- Why do raisins sink first and then float?
At first, they were heavier and sank. After five minutes, they had bubbles attached to their surface, which allowed the raisins to have bigger volumes. Having bigger volumes allowed them to be less dense and, therefore, float.
4- When the raisins move up, why do they sink again?
They sank again as bubbles on the raisins popped and caused loss in their volumes.

By answering the questions, the researcher will be able to measure students' basic understanding on density. In the activity, each group of students will have five raisins and a beaker half-filled with carbonated soda. Students will place the raisins in the beaker and observe that they will sink. As bubbles collect on the raisins, they will rise to the top and then sink again.

Rubric

Question	Beginning	Developing	Competent	Accomplished
1	Answer was not clear, and no evidence was provided.	Answer was somewhat clear, and some evidence was provided.	Answer was clear, and some evidence was provided.	Answer was thorough, and evidence was provided in detail.
2	Answer was not clear, and no evidence was provided.	Answer was somewhat clear, and some evidence was provided.	Answer was clear, and some evidence was provided.	Answer was thorough, and evidence was provided in detail.
3	Answer was not clear, and no evidence was provided.	Answer was somewhat clear, and some evidence was provided.	Answer was clear, and some evidence was provided.	Answer was thorough, and evidence was provided in detail.
4	Answer was not clear, and no evidence was provided.	Answer was somewhat clear, and some evidence was provided.	Answer was clear, and some evidence was provided.	Answer was thorough, and evidence was provided in detail.

Lesson #2: Calculating Density (Teacher Guide)

Introduction

Often, when density is taught, the teacher goes right to the density formula without addressing the conceptual misunderstandings that students hold about density, such as that larger objects weigh more and are therefore denser. Building a qualitative understanding of density can occur as a student explores his or her own world. Students have some understanding of materials that are heavy or light for their size, but translating that into a quantitative understanding is hard. The reason is that quantitative density is an abstract concept. It is not directly measurable because it is a ratio between mass and volume. In this activity, students will take their qualitative understanding of density as "heavy for its size" and translate that into a number. For example, this piece of metal is more than six time as dense as this piece of wood, or the density of this metal is 5.5 g/cm^3 and the density of this wood is .9 g/cm^3. As students have worked through the most common misunderstandings about density in the previous lessons, they are now ready to be given the formula and to calculate density of different matters.

Objectives for this activity

Students will gain a quantitative understanding of density. In addition, students will learn and apply the density formula.

Materials (per group):

Calculator

Calculating Density Worksheet

Lesson Plan

1. "Which is heavier, a kg of gold or a kg of feathers?"

The answer is of course, "Both are equally heavy."

2. "If both objects are the same size, which is heavier, a bar of gold or an equal volume of feathers?"

You would say, "Gold". When we compare the heaviness of two different materials, we must refer to the same volume of each material. This leads to the concept of density. The density of a substance is defined as its mass per unit volume.

Part A

Students and teacher discusses the density concept from lesson 1.

1. Give the formal definition for density.
Density is the mass per unit volume of an object.
2. Discuss why density is important.
Density is important because it allows you to compare different types of matter.
3. Discuss the formula used to calculate density.
Density = Mass/Volume
4. What are the units for density?
g/cm^3, kg/m^3, and g/mL.
5. Use the formula in steps to calculate density:
If 96.5 g of gold has a volume of 5 cm^3, what is the density of gold?

Step 1: Write the formula.	Density = $\frac{\text{Mass}}{\text{Volume}}$
Step 2: Substitute given numbers and units.	Density = $\frac{96.5\ g}{5\ cm^3}$
Step 3: Divide 96.5g by 5 cm^3. That equals $\frac{19.3g}{cm^3}$	or 19.3g/cm^3
Step 4. The answer = the density of gold is 19.3 g/cm^3	

6. Explain what this result means in words: *The mass of gold for per unit volume is 19.3 g.*

Part B

In this part, the class practices together using the formula with the aluminum and copper questions, and the whole class shares their answers.

Directions: Working together as a class, let's practice using the density formula. <u>Show your work!</u>

1. If 157.5 g of aluminum has a volume of 35 cm^3, what is the density of the aluminum?
Step 1: Density = Mass/Volume
Step 2: Substitute given numbers and units: Density = 157.5 g /35 cm^3
Step 3: Divide numbers = 4.5 g/cm^3 (the density of aluminum).
2. If 125.44 g of copper has a volume of 14 cm^3, what is the density of the copper?
Step 1: Density = Mass/Volume
Step 2: Substitute given numbers and units: Density = 125.44 g /14 cm^3
Step 3: Divide numbers = 8.96 g/cm^3 (the density of copper).
3. A solid block measures 18 cm^3 and has a mass of 27 grams. What is its density?
Step 1: Density = Mass/Volume

Step 2: Substitute given numbers and units: Density = 27 g /18 cm^3
Step 3: Divide numbers = 1.5 g /cm^3 (the density of the solid block).

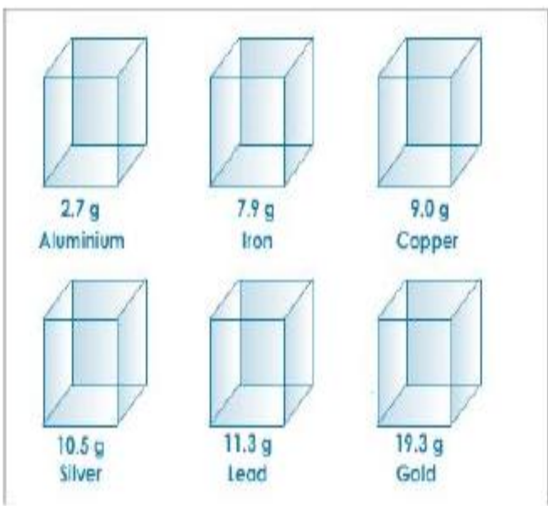
4. An irregularly shaped object displaces 35 mL of water in a graduated cylinder; the object has a mass of 42 grams. What is the density of the object?

Step 1: Density = Mass/Volume
Step 2: Substitute given numbers and units: Density = 42 g /35 mL
Step 3: Divide numbers = 1.2 g /mL (the density of the object).

Part C

Directions: Do the following assignments individually in class or as homework, and then check your answers with partner or table group.

1. If the volume of each of the cubes below was 1 cm^3, what is the cube's density?



Cube	Density
Aluminium	
Iron	
Copper	
Silver	
Lead	
Gold	

Each cube's density will be as in the following table.

Cube	Density
Aluminum	2.7 g/cm^3
Iron	7.9 g/cm^3
Copper	9.0 g/cm^3
Silver	10.5 g/cm^3
Lead	11.3 g/cm^3
Gold	19.3 g/cm^3

2. If one object has exactly the same volume as another object and it is heavier, will it always have a greater density? Explain your thinking.
Yes, it will. If the volume is the same, then if an object is heavier, it will always have a greater density.

Part D

Directions: Do the following assignments individually in class or as homework, and then check your answers with partner or table group.

1. Calculate the densities on this data table. If the decimal repeats, round to the nearest hundredth.

Item Name	Mass (g)	Volume (mL or cm^3)	Density (g/mL or g/cm^3)
Water	100 g	100 mL	1.0 g/mL
Ice	4.6 g	5.0 cm^3	
Glass	230 g	100 cm^3	
Alcohol	9.6 g	12.0 mL	
Mercury	189.7g	14mL	
Plastic	5g	5.85 cm^3	
Wood (Oak)	25g	35.2 cm^3	
Cork	1100g	5000 cm^3	

The density of each item is included in the following data table.

Item Name	Mass (g)	Volume (mL or cm^3)	Density (g/mL or g/cm^3)
Water	100 g	100 mL	1.0 g/mL
Ice	4.6 g	5.0 cm^3	*.92 g/cm^3*
Glass	230 g	100 cm^3	*2.3 g/cm^3*
Alcohol	9.6 g	12.0 mL	*.8 g/mL*
Mercury	189.7g	14mL	*13.55 g/mL*
Plastic	5g	5.85 cm^3	*0.85 g/cm^3*
Wood (Oak)	25g	35.2 cm^3	*0.71 g/cm^3*
Cork	1100g	5000 cm^3	*.22 g/cm^3*

2. Does the object with the heaviest mass have the greatest density? Explain.
No. Although cork has the greatest mass, mercury has the greatest density.
3. Does the object that has the greatest volume have the greatest density? Explain.
No. Although cork has the greatest volume, mercury has the greatest density.
4. Can you determine if an object has a high density, if you only know the mass or if you only know the volume?
It is not possible to determine an object's high density if we don't know the mass or the volume of the object.

Part E

Directions: Do the following assignments individually in class or as homework, and then check your answers with partner or table group.

1. Rank the materials on the table above in order of most to least dense.

Materials	Density	Most dense
Water	1.0 g/mL	
		Least dense

The materials are shown on the table above in order of most to least dense.

Material	Density	Most dense
Mercury	13.55g/mL	
Glass	2.3 g/cm3	
Water	1.0 g/Ml	
Ice	.92 g/cm3	
Plastic	0.85 g/cm3	
Alcohol	.80 g/mL	
Wood (Oak)	.71 g/cm3	
Cork	.22 g/cm3	Least dense

2. Which of the above objects would float in water?
The following objects will float in the water as they have smaller densities: cork, wood, alcohol, plastic, and ice.
3. If the plastic object above were put into the alcohol, would it float or sink? Explain.
The plastic would sink in the alcohol because it has a higher density than alcohol.
4. If the cork were put in the alcohol, would it float or sink? Explain.
The cork would float in the alcohol because it has a smaller density than alcohol.

Calculating Density Homework

Introduction

Water has a density of exactly 1 g/mL. This means that one milliliter (or one cubic centimeter) of water weighs exactly one gram. Any substance that has a density *less* than 1 g/mL will float on water. Any substance that has a density *greater* than 1 g/mL will sink in the water.

Use the density table below to answer the questions.

Solids	Density	Metals	Density	Liquids	Density
Bone	2.0	Aluminum	2.7	Water	1.0
Brick	1.8	Copper	8.9	Seawater	1.3
Cork	0.2	Gold	19.3	Alcohol	0.8
Marble	2.7	Iron	7.83	Glycerine	1.25
Paraffin	0.9	Lead	11.3	Turpentine	0.9
Rubber	1.2	Silver	10.5	Mercury	13.55
Bamboo	0.3			Gasoline	0.7
Ice	0.92				

1. Name 5 substances from the table above that will float on water.
Any 5 of these: Cork, Paraffin, Bamboo, Ice, Alcohol, Turpentine, Gasoline
2. Name 5 substances from the table above that will sink in water:
Any 5 of these: Bone, Brick, Marble, Rubber, any of the metals, Seawater, Glycerine, Mercury
3. What is the least dense substance in the table?
Cork
4. What is the densest substance in the table?
Gold
5. Mercury is a liquid with a density of 13.55 g/mL. Which metal on the table would sink in mercury?
Gold
6. You find a substance that looks like gold. Based on what we have learned about matter and density, how could you determine if it is really gold?
Find its mass and volume then calculate its density. If the density is 19.3 g/cm^3, then it is gold.
7. What is the density of 400 g of a substance if it occupies 80 cm^3 of volume?
5 g/cm^3
8. Will the ice sink or float in seawater?
It will float because it has a smaller density than seawater.
9. Challenge: If a substance has a density of 2.5 g/mL, and it occupies 200mL of volume, what is its mass?
The work can be shown using the following formula:

It has a mass of 500g.

$$\frac{2.5g}{mL} = \frac{x}{200mL}$$

$$500g = x$$

Appendix B

Density Assessment

Dear Student,

Completing this test should take about 20 minutes of your time. You will not be graded based on this test. Please notice that this is a multiple-choice test. Pay close attention as you record your responses on the Scantron answer sheets using your best knowledge about density. All answers you provide on Scantron answer sheets will remain strictly confidential.

Please follow the directions in order to complete correctly the background information on your answer sheet. Only use a pencil to complete the survey.

NAME: Neatly print each letter of your last and first name in the spaces provided. Completely fill in each bubble that corresponds to each letter in your name.

SEX: Completely fill in the appropriate bubble, M = Male and F = Female.

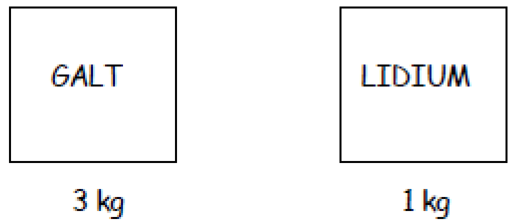
GRADE: Completely fill in the bubble that corresponds to the grade that you are in this school year.

BIRTHDATE: Completely fill in the month of your birthday. Neatly write the day and year in the spaces provided. Completely fill in the bubble that corresponds to each number in your birthdate.

IDENTIFICATION NUMBER: Fill in this area.

Carefully read each of the statements on the following pages. To respond, please completely fill in the bubble that best describes the degree to which you disagree or agree with the statement. Please fill in only one bubble per statement. If you make a mistake, or change your mind, please erase the incorrect answer completely before selecting a new answer.

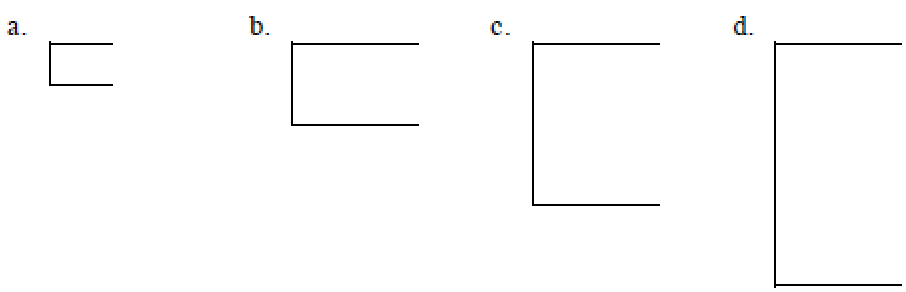
_____ 1. Here are two solid objects made of different materials. One is made of GALT and the other is made of LIDIUM. Both are the same size but weigh different amounts. Which object is made of a denser material?



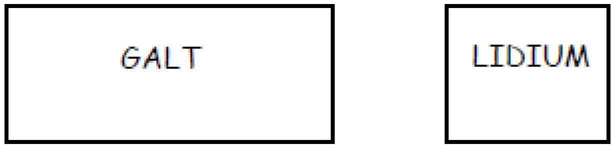
a. GALT
b. LIDIUM
c. They have the same density
d. Not enough information given

_____ 2. Here is another object made of GALT

Imagine an object made out of LIDIUM that weighs the same as the object made of GALT. Which of the following objects made out of LIDIUM would weigh the same as the GALT object above?

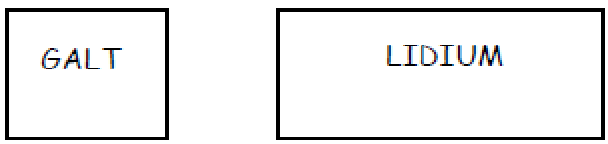


____3. Here are some additional pairs of objects made of GALT and LIDIUM. Decide if the objects in each pair weigh the same or if one of them is heavier. The object made of GALT is 2 times the size of the object made of LIDIUM.



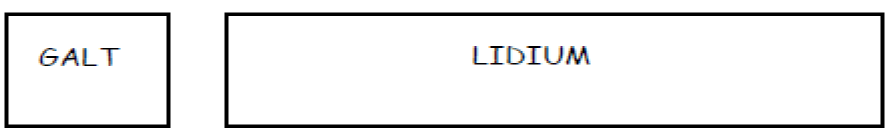
a. GALT is heavier
b. LIDIUM is heavier
c. Both objects weigh the same

____ 4. The object made of LIDIUM is 2 times the size of the object made of GALT.



a. GALT is heavier
b. LIDIUM is heavier
c. Both objects weigh the same

____ 5. The object made of LIDIUM is 4 times the size of the object made of GALT

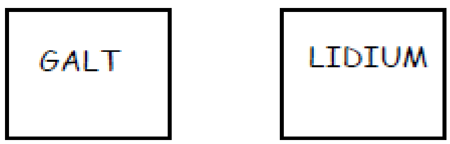


a. GALT is heavier
b. LIDIUM is heavier
c. Both objects weigh the same

____ 6. The object made of LIDIUM is 3 times the size of the object made of GALT

a. GALT is heavier
b. LIDIUM is heavier
c. Both objects weigh the same

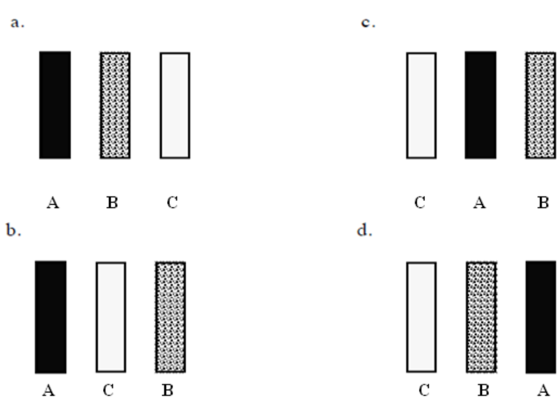
___ 7. These two objects of GALT and LIDIUM are both the same size.



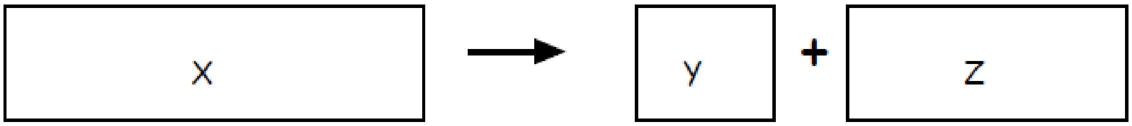
a. GALT is heavier
b. LIDIUM is heavier
c. Both objects weigh the same

____ 8. Consider the following three objects made of different materials: wood (A), aluminum (B), and steel (C). The objects are all the same size. The one made of steel is heavier than the one made of aluminum, and the one made of aluminum is heavier than the one made of wood.

Which of the following set of pictures best represents these three objects?



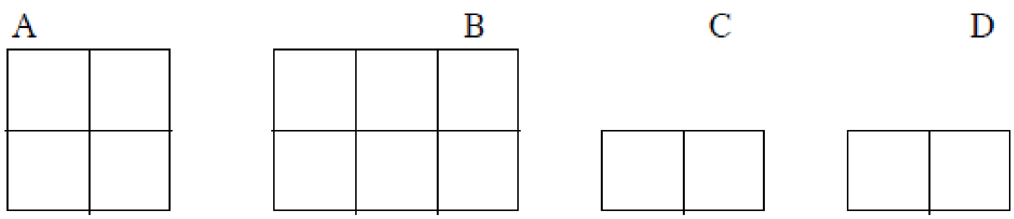
____ 9. Here is a block of wood (X) that is cut into two pieces (Y + Z).



Which of the following statements is true?

a. Block X has the greatest density
b. Block Z is denser than Block Y
c. Both a and b are correct
d. They all have the same density

____ 10. Here are four objects that have the following sizes and weights:
(hint: 1 cube unit = 1 cm^3)



	A	B	C	D
Size:	4 cube units	6 cube units	2 cube units	2 cube units
Weight:	12 grams	12 grams	6 grams	8 grams

Think about whether any of these objects could be made of the same material.

Which of the following is the correct statement?
a. Objects A and B could be made of the same material because they are the same weight.
b. Objects C and D could be made of the same material because they are the same size.
c. Objects A and C could be made of the same material because they have the same weight per unit size.
d. None of the above could be made of the same material.

____ 11. What is the density of the material in object A?

a. 12 g/cm^3
b. 3 g/cm^3
c. 8 g/cm^3
d. 1/3 g/cm^3

____ 12. What is the density of the material in object D?

a. 8 g/cm^3
b. 2 g/cm^3
c. 4 g/cm^3
d. 1/4 g/cm^3

____13. The density of gold is 19.3 g/cm^3, and the density of silver is 10.5 g/cm^3. If you had 10 cm^3 of each, which would weigh more?

a. Gold
b. Silver

____ 14. You have a table of densities that you are using to identify an unknown shiny metal. You know that the densities of barium= 3.51 g/cm^3, cobalt = 8.9 g/cm^3, and iron = 7.8 g/cm^3. You determine the mass to be 667 grams and the volume to be 74.9 cm^3. What kind of metal do you have?

a. Barium
b. Cobalt
c. Iron

____ 15. A cup of metal beads was measured to have a mass of 425 grams. By water displacement, the volume of the beads was calculated to be 48.0 cm^3. Given the following densities, identify the metal

Gold: 19.3 g/cm^3
Silver: 10.5 g/cm^3
Bronze: 9.87 g/cm^3
Copper: 8.85 g/cm^3

a. gold
b. silver
c. bronze
d. copper

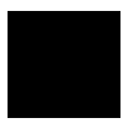
____ 16. What is the density of a board whose dimensions are 5.54 cm x 10.6 cm x 199 cm and whose mass is 28600 g?

a. 13.55 g/cm^3 c. 3.21 g/cm^3
b. 5.46 g/cm^3 d. 2.45 g/cm^3

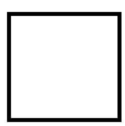
____ 17. What is the density of a metal whose dimensions are 2.35 cm x 6.2 cm x 122 cm and whose mass is 12200 g?

a. 13.72 g/cm^3 c. 6.86 g/cm^3
b. 2.29 g/cm^3 d. 3.43 g/cm^3

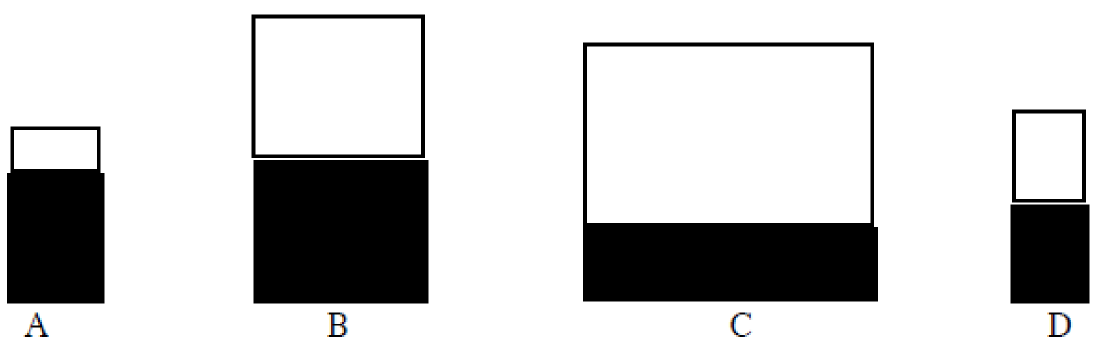
Here is a chunk of very dense solid material.



Here is a chunk of not so dense solid material.



The following objects were made by combining the two solid materials in different proportions as shown.



____ 18. In the above example, which object has the greatest average density?

a. A
b. B
c. C
d. D

____ 19. In the above example, which object has the least average density?

a. A
b. B
c. C
d. D

____ 20. You are trying to determine the density of an irregularly shaped object. The object displaces 55 mL of water and has a mass of 115.2 grams. What is its density?

a. 1.85 g/cm^3
b. 2.09 g/cm^3
c. 0.47 g/cm^3
d. 0.98 g/cm^3

ANSWER KEY

1. A
2. D
3. A
4. A
5. B
6. C
7. A
8. D
9. D
10. C
11. B
12. C
13. A
14. B
15. D
16. D
17. C
18. A
19. C
20. B

Inclusion Survey for Middle School Students (Pre-test)

Dear Student,

Inclusion means that students who have disabilities are included in some classes with students who are not disabled. Sometimes, that means in an elective class like Art, Music, or P.E. Sometimes, it means in other academic classes like Science or Social Studies. This survey is designed to find out your experiences as a middle school student with inclusion with students who are disabled.

Disability is a condition that can limit a person's activities, senses, and movements. A person with a disability will need some extra help from other people to be able to overcome limitations due to his/her senses and movements in his/her daily life.

This is not a test. There are no incorrect answers since these are your honest opinions. You will not be graded on your answers. Completing this survey should take about fifteen minutes of your time. Please notice that this is a multiple-choice survey. Pay close attention as you record your responses. It is important to us that you answer each of the questions as honestly as possible. **All information will remain strictly confidential.**

Please follow the directions in order to complete correctly the background information on your answer sheet. Only use a pencil to complete the survey.

NAME: Neatly print each letter of your last and first name in the spaces provided. Completely fill in each bubble that corresponds to each letter in your name.

SEX: Completely fill in the appropriate bubble, M = Male and F = Female.

GRADE: Completely fill in the bubble that corresponds to the grade that you are in this school year.

BIRTHDATE: Completely fill in the month of your birthday. Neatly write the day and year in the spaces provided. Completely fill in the bubble that corresponds to each number in your birth date.

IDENTIFICATION NUMBER: Fill in this area.

SPECIAL CODES:
K: Please select the correct number that corresponds to whether you have had students who are disabled in some of your classes and completely fill in that bubble in the column marked "K."

0 = Since I was in elementary school.
1 = Only since I have been in middle school (not in elementary school).
2 = I do not know.

L: Please select the correct number that corresponds to whether you have someone in your family who has a disability and completely fill in that bubble in the column marked "L."

0 = Yes 1 = No 2 = I do not know

Carefully read each of the statements on the following pages. To respond, please completely fill in the bubble that best describes the degree to which you disagree or agree with the statement. Please fill in only one bubble per statement. If you make a mistake, or change your mind, please erase the incorrect answer completely before selecting a new answer.

Tell us about your experience with inclusion:					
	Strongly Disagree	Disagree	Neither Disagree or Agree	Agree	Strongly Agree
1. I would have feelings like happy or comfortable when I learn that students with disabilities will be included in my class.	1	2	3	4	5
2. I would have feelings like scared or angry when I learn kids with disabilities will be included in my class.	1	2	3	4	5
3. I really would not know what to think about having students with disabilities in my class.	1	2	3	4	5
4. I would know something about some disabilities before inclusion began.	1	2	3	4	5
5. It would be important to know details about the disability that a particular student will have in my class.	1	2	3	4	5
6. It would be important to know what that student with a disability who will be in my class will be able to do or not to do.	1	2	3	4	5
7. As the school year would go on, I will think less about what a student with disability would do or would not do.	1	2	3	4	5
8. As the school year would go on, I will not think as much about the disability.	1	2	3	4	5
9. I would like having students who are disabled in my class.	1	2	3	4	5
10. It would distract me (take my attention away) to have a student with a disability in my class.	1	2	3	4	5
11. I would tell someone in another school that inclusion is a good experience.	1	2	3	4	5
12. I would tell someone in my family about my experiences with inclusion.	1	2	3	4	5
13. My thinking about people with disabilities would change by experiencing inclusion.	1	2	3	4	5
14. My thinking about people with disabilities would become more positive (such as not afraid, feel compassion for them) by experiencing inclusion.	1	2	3	4	5
15. I the future, I would hope to continue to have students with disabilities in my class.	1	2	3	4	5
16. I would be interested in learning more about disabilities.	1	2	3	4	5
17. I would think about having a career or a job in which I will help people who are disabled.	1	2	3	4	5

18. This year or next year, I will become a friend to a student who is disabled in my class.	1	2	3	4	5
If you would have a friendship with another student who is disabled, please tell us about it:					
	Strongly Disagree	Disagree	Neither Disagree or Agree	Agree	Strongly Agree
19. This friendship would be valuable to me.	1	2	3	4	5
20. I would give more to the friendship.	1	2	3	4	5
21. The student who is disabled, and who is my friend, would give more to the friendship.	1	2	3	4	5
22. I would think that I am really more of a helper than a friend.	1	2	3	4	5
23. I would think that I am more of a friend than a helper.	1	2	3	4	5
24. My teacher would encourage me to be a friend to someone who is disabled.	1	2	3	4	5
25. My parent would encourage me to be a friend to someone who is disabled.	1	2	3	4	5
26. A student in my class would encourage me to be a friend to someone who is disabled.	1	2	3	4	5

Thank you very much for participating!

Inclusion Survey for Middle School Students (Post-test)

Dear Student,

<u>**Inclusion**</u> means that students who have disabilities are included in some classes with students who are not disabled. Sometimes, that means in an elective class like Art, Music, or P.E. Sometimes, it means in other academic classes like Science or Social Studies. This survey is designed to find out your experiences as a middle school student with inclusion with students who are disabled.

Disability is a condition that can limit a person's activities, senses, and movements. A person with a disability will need some extra help from other people to be able to overcome limitations due to his/her senses and movements in his/her daily life.

<u>This is not a test.</u> There are no incorrect answers, since these are your honest opinions. <u>You will not be graded on your answers.</u> Completing this survey should take about fifteen minutes of your time. Please notice that this is a multiple-choice survey. Pay close attention as you record your responses. It is important to us that you answer each of the questions as honestly as possible. **All information will remain strictly confidential.**

Please follow the directions in order to complete correctly the background information on your answer sheet. Only use a pencil to complete the survey.

NAME: Neatly print each letter of your last and first name in the spaces provided. Completely fill in each bubble that corresponds to each letter in your name.

SEX: Completely fill in the appropriate bubble, M = Male and F = Female.

GRADE: Completely fill in the bubble that corresponds to the grade that you are in this school year.

BIRTHDATE: Completely fill in the month of your birthday. Neatly write the day and year in the spaces provided. Completely fill in the bubble that corresponds to each number in your birth date.

IDENTIFICATION NUMBER: Fill in this area.

SPECIAL CODES:
K: Please select the correct number that corresponds to whether you have had students who are disabled in some of your classes and completely fill in that bubble in the column marked "K."

0 = Since I was in elementary school.
1 = Only since I have been in middle school (not in elementary school).
2 = I do not know.

L: Please select the correct number that corresponds to whether you have someone in your family who has a disability and completely fill in that bubble in the column marked “L.”

0 = Yes 1 = No 2 = I do not know

Carefully read each of the statements on the following pages. To respond, please completely fill in the bubble that best describes the degree to which you disagree or agree with the statement. Please fill in only one bubble per statement. If you make a mistake, or change your mind, please erase the incorrect answer completely before selecting a new answer.

Tell us about your experience with inclusion:					
	Strongly Disagree	Disagree	Neither Disagree or Agree	Agree	Strongly Agree
1. I felt feelings like happy or comfortable when I learned that students with disabilities would be included in my class.	1	2	3	4	5
2. I felt feelings like scared or angry when I learned kids with disabilities would be included in my class.	1	2	3	4	5
3. I really do not know what to think about having students with disabilities in my class.	1	2	3	4	5
4. I knew something about some disabilities before inclusion began.	1	2	3	4	5
5. It was important to know details about the disability that a particular student had in my class.	1	2	3	4	5
6. It was important to know what that student with a disability who was in my class was able to do or not to do.	1	2	3	4	5
7. As the school year went on, I thought less about what a student with disability could do or could not do.	1	2	3	4	5
8. As the school year went on, I did not think as much about the disability as I did in the beginning.	1	2	3	4	5
9. I like having students who are disabled in my class.	1	2	3	4	5
10. It distracts me (takes my attention away) to have a student with a disability in my class.	1	2	3	4	5
11. I would tell someone in another school that inclusion is a good experience.	1	2	3	4	5
12. I have told someone in my family about my experiences with inclusion.	1	2	3	4	5
13. My thinking about people with disabilities has changed since experiencing inclusion.	1	2	3	4	5

14. My thinking about people with disabilities has become more positive (such as not afraid, feel compassion for them) since experiencing inclusion.	1	2	3	4	5
15. I the future, I hope to continue to have students with disabilities in my class.	1	2	3	4	5
16. I am interested in learning more about disabilities.	1	2	3	4	5
17. I have thought about having a career or a job in which I would help people who are disabled.	1	2	3	4	5
18. This year or another year, I became a friend to a student who was disabled in my class.	1	2	3	4	5
If you had a friendship with another student who was disabled, please tell us about it:					
	Strongly Disagree	Disagree	Neither Disagree or Agree	Agree	Strongly Agree
19. This friendship was valuable to me.	1	2	3	4	5
20. I gave more to the friendship.	1	2	3	4	5
21. The student who was disabled, and who was my friend, gave more to the friendship.	1	2	3	4	5
22. I think that I was really more of a helper than a friend.	1	2	3	4	5
23. I think that I was more of a friend than a helper.	1	2	3	4	5
24. A teacher encouraged me to be a friend to someone who was disabled.	1	2	3	4	5
25. A parent encouraged me to be a friend to someone who was disabled.	1	2	3	4	5
26. Another student in my class encouraged me to be a friend to someone who was disabled.	1	2	3	4	5

Thank you very much for participating!

Appendix C
University of Oklahoma
Institutional Review Board
Informed Consent to Participate in a Research Study

Project Title:	Charter Schools and Inclusive Science Education: The Conceptual Change and Attitudes of Students Without Disabilities
Principal Investigator:	Seyithan Demirdag, M.Ed.
Department:	Instructional Leadership and Academic Curriculum-Science

Your child is being asked to volunteer for a research study. Research is being conducted in your child's middle school science classroom. Your child was selected as a possible participant because he/she is a middle school student. Please read this form and ask any questions that you may have before agreeing to let your child take part in this study.

Purpose of the Research Study
The purpose of this study is to analyze the effects of inclusive science education on the general education population of charter middle school students' conceptual understandings, retention of the conceptual understandings, and attitudes of students without disabilities towards students with disabilities in inclusion. The researcher will provide an opportunity for students to be involved in hands-on science activities and learn whether the conceptual understandings of students without disabilities and their attitudes towards students with disabilities change in inclusive settings. The researcher will ask students questions that are designed to measure conceptual understandings, retention of the conceptual understandings, and attitudes of students without disabilities towards students with disabilities in inclusive charter middle school science classrooms.

Number of Participants
About a total of 120 students will take part in this study. The participants will be placed in non-inclusive (20 students without disabilities) and inclusive science classrooms (20 students without disabilities and two students with disabilities) from each grade level (6^{th}, 7^{th}, and 8^{th} grade).

Procedures
If you agree for your child to be in this study, your child will participate in two science lessons on density, a multiple choice *Density Assessment* and a multiple choice survey called the *Inclusion Survey for Middle School Students.* Your child's answers from these assessments will be collected and recorded during the class time. Your child will be asked to do the following: participate in density lessons and science activities, provide information related to scientific conceptual understanding on density through a density assessment, and provide information related to whether students without disabilities gain any positive or negative attitudes towards students with disabilities in the same science classroom through a survey. Your child's answers will allow the researcher to understand whether the inclusion of students with disabilities have an

effect on the scientific conceptual understanding and attitudes of students without disabilities.

Length of Participation

The study will be conducted during regular class time for three weeks and will include two science lessons on density, a density assessment, and a survey. The length of each science lesson will be about one week and each lesson will be implemented in each classroom 50 minutes every day. In addition, before and after science lessons, students will answer questions on a given density assessment and survey. The assessment will take about 20 minutes and the survey will take about 15 minutes to complete.

Risks of being in the study are

Because these activities are made up of the material normally taught in your child's classroom, there should be no added risks to your child due to his/her participation.

Benefits of being in the study are

Your child will benefit from the opportunity to experience hands-on science activities in a fun and exciting way. In return, the information your child provides will be used to help develop better ways to teach science.

Compensation

Your child will not be reimbursed for his/her time and participation in this study.

Confidentiality

In published reports, there will be no information included that will make it possible to identify your child without your permission. Research records will be stored securely and only approved researchers will have access to the records.

There are organizations that may inspect and/or copy your research records for quality assurance and data analysis. These organizations include Timothy A. Laubach (Academic Advisor) and the OU Institutional Review Board.

Voluntary Nature of the Study

Participation in the research portion of this study is voluntary. If you withdraw or decline your child’s participation, your child will not be penalized or lose benefits or services unrelated to the study. If you decide for your child to participate, your child may decline to answer any question and may choose to withdraw at any time. Even if your child does not participate in the research portion of the study, he/she will still be taught the same lessons as the rest of the class.

Waivers of Elements of Confidentiality:
Your child's name will not be linked with his/her responses unless you specifically agree for him/her to be identified. The data you provide will be retained in anonymous form unless you specifically agree for data retention or retention of contact information beyond the end of the study. Please check all of the options that you agree to:

I consent to having my child being quoted directly. ___ Yes ___ No

I consent to having my child's name reported with quoted material. ___Yes ___ No

I consent to having the information my child provided retained for potential use in future studies by this researcher. ___Yes ___ No

Request for record information
If you approve, your child's confidential records will be used as data for this study. The records that will be used include your child's answers from two science lessons, *Density Assessment* (pre-test, post-test, and post-post-test), and from the *Inclusion Survey for Middle School Students* (pre-test and post-test). These records will be used for the following purpose(s): The data will be used for the researcher's dissertation project to answer the following research questions:
1. How does inclusive science education affect the scientific conceptual understanding of general education students in a charter school?
2. How does inclusive science education affect the attitudes of general education students toward students with disabilities in a charter school?
3. What is the difference in retention of science concepts between students without disabilities in inclusive science classrooms and students in non-inclusive science classrooms after a-two-week inquiry science lesson?

_____ I agree for my child's records from two science lessons, *Density Assessment* (pre-test, post-test, and post-post-test), and from the *Inclusion Survey for Middle School Students* (pre-test and post-test) to be accessed and used for the purposes described above.

_____ I do not agree for my child's records from two science lessons, *Density Assessment* (pre-test, post-test, and post-post-test), and from the *Inclusion Survey for Middle School Students* (pre-test and post-test) to be accessed for use as research data.

Contacts and Questions
If you have concerns or complaints about the research, the researcher(s) conducting this study can be contacted at 405-227-1326 and sdemirdag@ou.edu or the researcher's advisor, Dr. Timothy A. Laubach at 405-325-1979 and laubach@ou.edu.

Contact the researcher(s) if you have questions, or if your child has experienced a research-related injury.

If you have any questions about your rights or your child's rights as a research participant, concerns, or complaints about the research and wish to talk to someone other than individuals on the research team or if you cannot reach the research team, you may contact the University of Oklahoma – Norman Campus Institutional Review Board (OU-NC IRB) at 405-325-8110 or irb@ou.edu.

You will be given a copy of this information to keep for your records. If you are not given a copy of this consent form, please request one.

Statement of Consent

I have read the above information. I have asked questions and have received satisfactory answers. I consent my child to participate in the study.

____

Participant Signature Print Name Date

____

Signature of Person Obtaining Consent Date

____

Print Name of Person Obtaining Consent

____

Signature of Witness (if applicable) Date

____

Print Name of Witness

University of Oklahoma
Institutional Review Board
Assent to Participate in a Research Study
(For children 7-12 years old)

Project Title:	Charter Schools and Inclusive Science Education: The Conceptual Change and Attitudes of Students Without Disabilities
Principal Investigator:	Seyithan Demirdag, M.Ed.
Department:	Instructional Leadership and Academic Curriculum-Science

Why are we meeting with you?

We want to tell you about a research study that we are doing. A research study is when researchers collect a lot of information to learn more about something. Researchers will ask you a lot of questions. After we tell you more about it, we will ask if you would like to be in this study or not. In the whole study, there will be about 120 middle school students who will take part in this study.

What will happen to you if you are in this study?

If you agree to be in this study, we are going to ask you to participate in a study to understand about the effects of inclusive science education on the general education population of charter middle school students' conceptual understandings, retention and attitudes. The study includes two science lessons on density, and answer questions on a *Density Assessment* and a survey called the *Inclusion Survey for Middle School Students.* The first lesson on density will be implemented in the first week of research and includes three hands-on science experiments. The second lesson will include mathematical calculations on density. In addition, *Density Assessment* will be conducted before the science lessons (pre-test), right after the science lessons (post-test), and one week after the science lessons (post-post-test). The survey will be conducted before the science lessons (pre-test) and after the science lessons (post-test).

How long will you be in the study?

You will be in the study for about three weeks. You will be asked to participate and answer questions in a study, which includes two science lessons, an assessment, and a survey before and after your experience with activities that the researcher teaches to you and your classmates. The length of each science lesson will be about one week and each lesson will be implemented in each classroom 50 minutes every day. As a result, you will spend five hours in the first week, five hours in the second week, and 20 minutes in the third week in all research activities in your school.

What bad things might happen to you if you are in the study?

No bad things will happen to you. The questions may take a few minutes to answer.

What good things might happen to you if you are in the study?

You will have fun working with your friends and engage in science experiments.

Do you have to be in this study?

No, you don't. No one will be mad at you if you don't want to do this. If you don't want to be in this study, just tell us. Or if you do want to be in the study, tell us that. And, remember, you can say yes now and change your mind later. It's up to you.

Your Parent or Guardian will also have to give permission for you to be in this study.

Do you have any questions?

You can ask questions any time. You can ask now. You can ask later. You can talk to me or you can talk to someone else.

If you sign this paper, it means that you have read this form and want to be in the study. If you don't want to be in the study, don't sign this paper. Being in the study is up to you, and no one will be upset if you don't sign this paper or if you change your mind later.

The person who talks to you will give you a copy of this form to keep.

____________________________________ ________________
Signature of Child Date

SIGNATURE OF PERSON CONDUCTING ASSENT DISCUSSION
I have explained the study to ______________________(*print name of child here*) in language he/she can understand, and the child has agreed to be in the study.

____ ________________
Signature of Person Conducting Assent Discussion Date

____
Name of Person Conducting Assent Discussion (*print*)