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If Science Teachers Are Positively Inclined Toward Inclusive Education, Why Is It So Difficult?

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Abstract

This paper describes the unique challenges that students with learning disabilities (LD) experience in science studies, and addresses the question of the extent to which science teachers are willing and prepared to teach in inclusive classrooms. We employed the Theory of Planned Behavior (TPB), according to which behavioral intentions are a function of individuals' attitudes toward the behavior, their subjective norms and their perceived control – i.e., their perception of the simplicity and benefits of performing the behavior. The study comprised 215 Junior High School science teachers, who answered a TPB-based quantitative questionnaire. Semi-structured interviews were conducted to support and enrich the findings and conclusions. We found that teachers held positive attitudes and were willing to adapt their teaching methods (perceived control), which correlated and contributed to their behavioral intention. In terms of subjective norms, however, they felt a lack of support and ongoing guidance in providing the appropriate pedagogy to meet the needs of students with LD. We therefore recommend that educational policy makers and school management devote attention and resources to providing professional training and appropriate instructional materials, and to establishing frameworks for meaningful cooperation between the science teachers and special education staff. This could ensure the efficient cooperation and coordination of all the involved parties, and send a positive message of support to the science teachers who are the actual implementers of change.

Keywords:

Science education; Inclusion; Learning disabilities; Teachers' perceptions; Theory of Planned Behavior

Introduction

In the past two decades, a broad agreement has prevailed among educators that every student has the obligation and the right to acquire scientific education as part of their education (e.g., Common Core State Standards, CCSS, 2010; Hazelkorn et al., 2015; Science Council Declaration, 2014). This agreement has coincided with the call to include students with special needs in mainstream educational frameworks (ACECQA, 2011; El-Dor, 2014; ESSA, 2015; IDEA, 1997, 2004), an approach based on the understanding that all students are different in any number of ways (not limited to disability), and that schools need to adapt and change their practices to meet these diverse learning needs (Cologon, 2015; Kinsella & Senior, 2008). Although this approach was adopted by many countries, its execution as a reality of full inclusion for students with special needs in mainstream classrooms is complicated.

It is accepted that students with learning disabilities (LD) are the largest group of students with special needs (Cortiella, & Horowitz, 2014; McGinnis & Khan, 2014), and that most of them attend mainstream educational frameworks (McGinnis & Stefanich, 2007). This means that the majority of students with LD learn science in inclusive science classes (Ehren, Lenz, & Deshler, 2004) and are expected to perform to the same standard as peers without LD (ESSA, 2015; NCLB, 2002). This expectation can be challenging for students with LD because of the complex demands it places on their cognitive performance (Brigham, Scruggs, & Mastropieri, 2011), but with the appropriate teaching methods and instructional support, these students can be helped to meet that challenge.

Providing such help requires science teachers to make changes in their regular teaching practice to help them accommodate LD students’ particular needs. Teachers' training, experience and perceptions constitute a 'filter' through which the proposed change will be processed and occur in class (Anderson & Mitchener, 1994), so any attempt to achieve significant and durable change in science teachers' teaching methods or behavior toward students with LD must be based on an examination of their existing attitudes and intentions. This paper will therefore describe the unique challenges students with LD experience in science studies, and address the question of the extent to which science teachers are willing and prepared to teach science in inclusive classrooms, as well as their willingness to support the students with LD. Understanding science teachers' perceptions and the elements that impact their willingness to teach in inclusive classrooms will help teacher training frameworks and supervisors support science teachers more effectively in making the changes they need to make in order to teach in inclusive science classes.

Theoretical Framework

Science literacy for all

The fields of science, technology, engineering, and math (STEM) make substantial contributions to our modern life and play an important role in an array of issues from health care to the environment (Nagle, Marder, & Schiller, 2009). This makes scientific literacy an essential part of preparing all future citizens for life in modern society (AAA, 1993; Brown, Reveles, & Kelly, 2005; Fensham, 2004; Hand, Yore, Jagger, & Prain, 2010; NRC, 1996; OECD, 2003; Roth & Lee, 2004). In any academic discipline, *literacy* is defined as the listening, speaking, reading, and writing skills and strategies needed by students to learn within that field (Norris & Phillips, 2003; Shanahan & Shanahan, 2012). As DeBoer (2000) pointed out, however, merely being able to read and write about science is a rather broad definition, and is not necessarily the same as being scientifically literate. This means that just being able to memorize vocabulary does not make a person scientifically literate (Norris & Phillips, 2003). Thus, *scientific literacy* encompasses more than listening, speaking, reading, and writing skills and strategies needed to learn science (Ehren, Lenz, & Deshler, 2004).

There is no single accepted definition of scientific literacy. Instead, many characterizations of scientific literacy are discussed in the literature, and they include a variety of competencies in science enquiry, content knowledge, and attitudes toward science (Fives, Huebner, Birnbaum, & Nicolich, 2014). Scientific literacy implies a broad and functional understanding of science for general education purposes. Scientific literacy defines what the public should know about science in order to live more effectively with respect to the natural world (DeBoer, 2000). According to the PISA 2015 framework (OECD, 2016), scientific literacy includes 3 main competencies: scientific explanation of phenomena, evaluation and design of scientific enquiry, and scientific interpretation of data and evidence. According to this document (OECD, 2016), scientific literacy is defined as the ability to: a) engage with science-related issues and ideas as a reflective citizen; b) take part in reasoned discourse about science and technology; c) recognize, offer and evaluate explanations for a range of natural and technological phenomena; d) evaluate and design scientific enquiry; e) describe and appraise scientific investigations and propose ways of addressing questions scientifically, and f) interpret data and evidence scientifically (i.e., to analyze and evaluate data, claims and arguments in a variety of representations and draw appropriate scientific conclusions) (p.17-20). Allchin (2014) broadened the definition of scientific literacy to include additional aspects like familiarity with the history and philosophy of science, the applied philosophy of science and the nature of science, understanding the cultural context, and being knowledgeable about socioscientific issues. He also noted that these additional aspects are often neglected by science teachers, who are typically burdened with teaching an excessive scope of content.

In order to facilitate access to scientific literacy for all students, national education standards in many countries emphasize the necessary support and accommodations that should be provided to students with LD, including an individualized education program (Common Core State Standards, 2010) and appropriately trained teachers and specialized support personnel (Scruggs, Brigham, & Mastropieri, 2013). But the question remains: what do *science teachers* think about these decisions and do they feel trained and qualified to support students with LD?

Science is considered a valuable subject for students with disabilities to learn (Mastropieri, et al. 2006; Patton & Andre, 1989; Scruggs, Brigham, & Mastropieri, 2013) and some studies have reported that teachers identified science as the subject most suited for mainstreaming special needs students (Atwood & Oldham, 1985), as will be elaborated later in this paper. However, few science education teachers have had training pertaining to teaching students with disabilities, and few special education teachers have had training in science teaching (Norman, Caseu, & Stefanich, 1998; Scruggs, Brigham, & Mastropieri, 2013). Moreover, Kahn and Lewis (2013) found in their survey of 855 U.S. science teachers that nearly one third of them had received no training in teaching science to students with disabilities. Those who reported that they did have training most frequently cite their “on-the-job training,” which means that they did not receive any properly organized and structured professional training.

The challenge of inclusion in the science classroom

Learning disabilities are complicated to define, and this general term covers a heterogeneous group of disorders that manifest as significant difficulties in the acquisition and use of listening, speaking, reading, writing, reasoning, or mathematical abilities (Kenneth, Spaulding & Beam, 2009; NJCLD, 1994). Regardless of the variety in definitions, it is generally accepted that students with LD have normal IQs (Margalit, 2000), but have difficulty implementing academic skills and complex functions (Israel Ministry of Education, 2007), like the inductive and deductive thinking associated with scientific reasoning (Mastropieri, Scruggs, Boon & Carter, 2001) and meta-cognitive thinking (Swanson, 2001). These difficulties with such basic and complex learning functions create discrepancies between the students' abilities and their achievements. These gaps, as well as the accumulated experience of failure, lead to the development of low self-efficacy (Israel Ministry of Education, 2007).

The inclusion of students with LD in regular classes presents a complex situation, which requires great effort and flexibility on the teachers' part (Sharma, Loreman, & Forlin, 2012). Inclusion in regular science classes must contend with a twofold difficulty, which stems from the nature of scientific content. First, content in the subject area of science is expanding at an ever-growing pace (Schibeci & Lee, 2003) and is perceived as difficult and complex to learn (Hendley, Stables, & Stables, 1996; Lyons 2006; Osborne, Simon, & Collins, 2003). If this perception is common among students who do not have LD, it is even stronger among students who do (Moon, Todd, Morton, & Ivey 2012; Stanovich, 1986), which may cause the achievements of students with LD to be comparatively very low (Boyle, 2010). The second difficulty faced by inclusion in science education is that learning disabilities are the manifestations of a heterogeneous group of disorders, and it is impossible to develop a uniform curriculum adapted to address them all (Swanson & Deshler, 2003). Traditionally, teaching in a regular classroom is directed at a large group of students and based on a uniform learning curriculum (Wertheim & Leyser 2002). This is particularly true in science education, which uses the new Common Core State Standards (2010) as a standard base. This base holds all of the students to a rigorous standard, and its expectations may have serious implications for students with LD (Scruggs, Brigham, & Mastropieri, 2013). Allocating resources to provide specifically designed instruction for students is increasingly challenging as more students participate in the general education curriculum (Lancaster, Schumaker, & Deshler, 2002). Scruggs, Brigham, & Mastropieri (2013) addressed this concern, stating that applying the standards of the CCSS to students with disabilities necessarily requires additional support, and that accommodations should be made to facilitate these students’ access to the curriculum.

Many traditional efforts to include students with disabilities in inclusive classes focus on addressing the limitations and difficulties of the individual with a disability, and on how accommodations can be made to fit this individual into an established environment. In contrast, the *social model* of disability (DePoy & Gibson, 2008) considers variations in abilities—just like gender or race/ethnicity—to be a natural part of the human experience, and therefore makes an effort to design products and environments that are welcoming and accessible to all potential users (Gabel & Peters, 2010; Loewen & Pollard, 2010). Regardless of the approach taken to inclusion of students with LD, the main questions still remain: Are science teachers able to meet the needs of students with a wide range of abilities, learning styles, and preferences in the inclusive science classroom? Are they willing and prepared to teach in an inclusive setting, and what are their perceptions about inclusion itself?

As McGinnis and Stefanich (2007) have shown, science teachers and science teachers-in-training believe that they lack the appropriate training for teaching in inclusive classes. Since the late 1990s, the inclusion policy has become more and more established, although teachers were not part of the decision-making process (Jitendra, Edwards, Choutka & Treadway, 2002). This lack of involvement may cause low motivation amongst teachers to implement this policy (Greer & Greer, 1995), which is troubling since many studies have shown that teachers' perceptions about inclusion are central components to its success (DeBoer, Pijl & Minnaert, 2010). Research that focuses specifically on the attitudes, willingness and capabilities of science teachers regarding inclusion in their lessons is scarce, and this focus is the objective of this study.

Challenges faced by students with LD when learning science

Science classes can cause difficulties for many students, since they pose challenges such as understanding complex visuals, handling measuring tools, mathematical and statistical calculation, etc. Students with LD must cope with a set of additional difficulties raised by various aspects of learning science, such as:

Reading scientific texts: Students with LD have at least one low basic academic skill (reading, writing, or mathematics), which may interfere with their science learning (McNamara, 2007), and for most of them it is primary or secondary reading difficulties (Lyon et al., 2001). Bryant (2003) argued that students with LD in reading often fail to learn scientific concepts due to learning inefficiencies that limit their ability to profit from traditional instruction (see also Mastropieri, Scruggs, & Graetz, 2003). Mastropieri, Scruggs, and Graetz (2005) claim that school science textbooks are often written on a level substantially higher (about two grade levels) than the grade level to which they are targeted. Mastery of complex vocabulary, higher-level text analysis, comprehension skills and scientific writing are all areas of relative weakness for many students. These areas are particularly problematic for students with learning disabilities (Lerner & Johns, 2012; Scruggs, Brigham, & Mastropieri, 2013).

Higher-order thinking skills: Higher-order thinking was operationally defined by Resnick (1987) as: effortful, nonalgorithmic, complex thinking that often yields multiple solutions. It involves nuanced judgement and interpretation, the application of multiple criteria, uncertainty, and self-regulation of the thinking process, imposing meaning and finding structure in apparent disorder.

Higher-order thinking is manifested in any problem-solving process that requires critical thinking, creative thinking and reasoning (Hwang, Chen, Dung, & Yang, 2007). Helping LD students use higher-order thinking skills when solving problems is one of the challenges for teachers in general and in science education in particular. Studying science as an enquiry process requires the implementation of higher-order thinking skills, such as drawing conclusions and formulating hypotheses (Mastropieri, Scruggs, Boon & Carter, 2001). It requires creative thinking, data analysis, and the integration of information and knowledge (Anderson & Rainie, 2010), as well as the ability to pose questions, provide scientifically grounded arguments, express opinions, make decisions, and employ system thinking (Dori, Tal, & Tsaushu, 2003). Higher-order thinking skills are a source of difficulty for most students with LD (Swanson & Deshler, 2003), but studies show that acquiring higher-order skills may contribute to and enhance the studying abilities of students with LD (Krawec, Huang, Montague, Kressler, & De Alba, 2013; Scruggs, Brigham, & Mastropieri, 2013).

Social and behavioral difficulties: Students with LD also tend to experience social difficulties, such as higher levels of isolation, increased peer pressure, interpersonal difficulties and loneliness (Hogan, McLellan, & Bauman, 2000). If such deficits indeed exist, it could explain why peers and teachers report that students with LD have lower social skills, are less cooperative, and often experience more social rejection from their peers than students not identified as such (McDougal, DeWit, King, Miller, & Killip, 2004). Science lessons require a great deal of interaction, both among students, and between the students and the teacher (Cawley, Hayden, Cade & Baker-Krooczynski, 2002). For students with LD, working in small groups, interacting with peers and participating in open discussions may cause behavioral and emotional difficulties (Cawley, Foley, & Miller, 2003).

Positive opportunities for students with LD when learning science

Despite all of the above, science studies can, with certain adjustments, provide positive learning opportunities for students with LD. In the following section we will highlight some of these opportunities reported in the research literature:

Relevance: Science studies consist of social and practical elements that make it possible to address topics that are relevant to the students' lives. This relevance may constitute an important advantage for students with LD, because it has been found to be a significant factor that promotes motivation for learning (Shechtman & Leichtentritt, 2004). In addition, learning science (which is perceived as a difficult and complex subject) may contribute to the self-confidence and self-efficacy of the students with LD (Moller & Wahl, 2000).

Meta-cognition: Although students with LD find meta-cognitive thinking difficult (Swanson, 2001; Geary, 2004), they may benefit greatly from meta-cognitive *training* (Pennequin, Sorel, Nanty, & Fontaine 2010). Thus, metacognition is recommended by researchers for integration into mainstream science classes (Thomas, 2011).

Enquiry based learning: The process of scientific investigation is structured and clear on the one hand (observations, data analysis and work orders) and creative on the other (raising hypotheses, integration of data, drawing implications). This means that the enquiry process has the potential to answer the needs of diverse learning styles and abilities (Galyam & Grange, 2003). The integration of enquiry into the science classroom provides an alternative approach for students with disabilities to acquire scientific knowledge and skills. Such an integration could contribute to the creation of an inclusive classroom in which all students are valued, respected, and given the opportunity to fully participate in class (Trundle, 2007).

The enquiry process provides an opportunity for hands-on learning (Ma & Nickerson, 2006), independent learning, experience with the work habits of scientists, interaction with other students and exploration of scientific phenomena. This form of learning may be particularly suitable for students with LD who find it difficult to read, write, listen, and perform other skills that are required in traditional learning. Instead, students with LD can learn through senso-motoric experiences and through social interactions with peers (Brigham, Scruggs, & Mastropieri, 2011).

Since the 1980s science education researchers have also emphasized the mental and cognitive processes enacted during hands-on activities. Hofstein and Lunetta (1982) stated that a *minds-on* science activity should include the use of higher-order thinking, such as problem solving. Therefore, students should be both physically and mentally engaged in activities that encourage learners to question and devise temporarily satisfactory answers to their questions (Victor & Kellough, 1997). Science education reforms worldwide have described minds-on processes as an essential part of enquiry based learning and scientific literacy (Kapanadze, &

Eilks, 2014; OECD, 2015). Although these pose unique challenges for science teachers helping students with LD, studies show the contribution of hands-on, minds-on scientific activities to these students (Cortiella & Horowitz, 2014; Trundle, 2007).

Teamwork: Small-group discussions have been strongly advocated as an important approach to teaching science for a number of years (Atwood & Oldham, 1985; Windschitl, Thompson, Braaten, & Stroupe, 2012). This recommendation stems from a more general movement toward student-centered learning, and a more constructivist approach. Teamwork provides students with an opportunity to articulate and reflect on their own ideas about scientific phenomena (Bennett, 2007). Despite the potential difficulty students with LD have with working in small groups, the literature indicates that such teamwork can also offer significant advantages (Brigham, Scruggs, & Mastropieri, 2011; Moon, et al., 2012). Working in small groups can improve self-esteem, provide a safe learning environment, and lead to greater success rates in classroom tasks and/or better products (Jenkins, Antil, Wayne, & Vadasy, 2003; Kuhn, 2015).

The above challenges and opportunities emphasize the potential contribution of science studies for students with LD. However, science studies demand a variety of high-order skills and abilities (enquiry skills, learning and thinking skills, problem-solving skills, social skills, etc.). Thus, teaching and learning science constitutes a complex challenge for students and teachers. To what extent are science teachers prepared for this task?

Perceptions about teaching science in an inclusive classroom

Research has shown that teachers' perceptions and attitudes are important factors in the implementation of new instructional strategies and methods (Wigle & Wilcox, 1996). Other studies that investigated science teachers show indications that when teachers gain greater confidence and self-efficacy and a more positive attitude through continuing education efforts, they subsequently teach science better, and are able to improve the attitudes of their students in this area (Osborne & Dillon, 2008; Osborne, Simon, & Collins, 2003; van Aalderen-Smeets, van der Molen, & Asma, 2011). Science teachers with less positive attitudes have lower confidence and self-efficacy beliefs about teaching science (Tosun, 2000), and are less able to stimulate the attitudes of their students (Jarvis & Pell, 2004; Osborne, Simon, & Collins, 2003; Weinburgh, 2007). Only when teachers believe that science is relevant and important, when they have positive feelings toward these subjects, and when they perceive themselves as capable of teaching them without being dependent on too many systemic, professional or emotional factors will teachers change and improve in their teaching of these topics (van Aalderen-Smeets, van der Molen, & Asma, 2011).

Teachers' perceptions and attitudes are also important factors in successfully including students with LD (Avramidis & Norwich 2002; Smith & Smith 2000). Studies have shown a connection between teachers' perception and their actions in inclusive classrooms (Brady & Woolfson, 2008; Wang, Moore, Roehrig, & Park, 2011).

The relationship between attitudes and actions is addressed by socio-psychological theories (Zint, 2002). One of the more prominent theories in this field is the Theory of Reasoned Action (TRA) (Fishbein & Ajzan, 1975). According to this theory, change of action occurs through a change in the intention to act, which is affected by attitudes. A later theory, which is based on the TRA theory, also addresses the relationship between the intent to act and the action itself. This theory is called Theory of Planned Behavior (TPB) (Ajzen, 1985, 1991, in Zint, 2002). The theory of planned behavior (Ajzen, 1991) provides a useful framework for addressing the relationship between attitude and behavior.

According to the TPB, an individual's behavior is driven by behavioral intentions–the willingness to carry out the given behavior. These intentions are a function of that individual's attitude toward the behavior, their subjective norms (i.e., their perception of how significant others will approve of their behavior), and their perceived behavioral control (their perception of how easy/difficult it will be for them to perform the behavior). Perceived behavioral control (PBC) is an important element in this theory's explanation of behavioral intention. The relationship between PBC and behavioral intentions predicts the individual's belief and the individual's actual control over his/her actions.

According to Zint (2002), TPB provides a more accurate prediction of the relationship between attitudes and actions than the TRA. According to Ajzen, behavior is determined by an individual's *intention* to perform it, and intention is a function of that person's *attitude toward the behavior* and his or her *subjective norm* (Ajzen & Fishbein, 1980). While *attitude toward behavior* refers to the amount of pleasure a person derives from performing a behavior, *subjective norm* is defined as the extent to which an individual is motivated to comply with the views others hold about that behavior.

--------- Insert Figure 1 about here -------

The TPB has been employed in a variety of contexts, including studies that investigated teachers' behaviors or behavioral intentions to adopt a certain method or teaching environment (Lee, Correto & Lee, 2010; Teo, 2015; van Aalderen-Smeets, van Der Molen & Asma, 2011). However, there is a gap in the literature with respect to the application of TPB to teachers' attitudes and behavior toward children with special needs in inclusive settings (MacFarlane & Woolfson, 2013). This gap is even wider since, as far as we have seen, few studies have investigated science teachers' perceptions and intentions toward teaching science in an inclusive classroom. Our aim was to fill this void, and to examine the relations between junior high school science teachers' attitudes, subjective norms, perceived control and intentions to act (Ajzen, 1985, 1991; Figure 1). Shedding light on science teachers' perceptions will help to design training and professional development programs that prepare and support science teachers who work in inclusive classrooms.

The study described here is part of an extended study. In this paper, we present our findings regarding the first part of the TPB, which addresses the relations between attitudes, subjective norms, perceived behavioral control and behavioral intention (Ajzen, 1985, 1991; Figure 1). Findings regarding behavior in practice – the actual instruction of the teachers in inclusive science classrooms – will be presented in future publications.

Research goals

The primary goal of this study was to characterize junior high school science teachers' perceptions and intentions on the topic of teaching students with LD in their inclusive science classrooms. Specifically, we sought to examine the relations between the four main variables in Ajzen's Theory of Planned Behavior (TPB): their attitudes, subjective norms, perceived control and behavioral intentions (Ajzen, 1985, 1991; Figure 1). Our examination of these relationships was based on the following hypotheses:

H1: Teachers' attitudes toward inclusion of students with learning disabilities in science classes will positively and significantly influence the teachers' behavioral intentions.
H2: Teachers' perceived subjective norms and perceived control regarding inclusion of students with learning disabilities in science classes will positively and significantly influence the teachers' behavioral intentions.

H3: Teachers' attitudes, perceived subjective norms, and perceived control toward inclusion of students with learning disabilities in science classes, will positively and significantly relate to each other.

H4: The teachers’ professional background (e.g., seniority, teaching experience) will predict their behavioral intentions to work with students with LD.

In order to gain a thorough understanding of the above variables and their relations, we collected qualitative data in addition to the quantitative analysis, using interviews with science teachers to support and enrich the findings and conclusions.

Methodology

This study applied a mixed methods approach (using different approaches—qualitative and quantitative—to answer the same questions) (Bryman, 2006). This form of research poses various challenges for the inquirer, among them the need for extensive data collection, the time-intensive nature of analyzing both text and numeric data, and the need for the researcher to be familiar with both quantitative and qualitative forms of research (Creswell, 2009, p. 205). However, since our goal was to attain a depth of understanding and multiple points of view (Creswell & Clark, 2011; Johnson & Onwuegbuzie, 2004) regarding science teachers' perceptions toward inclusion, our data sources in this study included a questionnaire and an in-depth interview. Moreover, the qualitative tool in this study (the interview) was used to better understand, explain, and build on the results from the quantitative tool—the questionnaire (Creswell, 2009).

Participants

The study comprised 215 middle school science teachers. They were gathered from amongst the participants in the Science & Technology in-service professional development (PD) courses taught by one of the authors. The PD courses took place in special professional development centers throughout the country as part of the Ministry of Education's policy of improving Science & Technology instruction. The issue of teaching in inclusive classrooms and addressing the needs of students with LD was not part of the PD course curriculum. All 215 of the participating science teachers agreed to answer the questionnaire, and seven teachers agreed to be interviewed.

A further interview was conducted with the Israeli National Supervisor of Science Teaching in middle school.

The participants' cohort was characterized by the following:

Academic profile: 68.2% of the teachers had an undergraduate degree, 31.8% had an M.A. (masters' degrees are not compulsory for middle school science teachers in Israel).

Seniority: 11% of the participants had been teaching for less than four years and 89% for over four years. The average seniority was 15.21 years (SD=8.90), with a distribution of 1-40 years.

Professional development: All participants had participated in various advanced in-service science teaching courses during their career.

Experience in teaching students with LD: 94% of the teachers declared that they had experience in teaching science to students with LD in inclusive classes. The official estimated percentage of students with LD in Israeli classrooms is approximately 10%, similar to the estimation worldwide (El-Dor, 2014). Teachers were asked to indicate whether they participated in in-school or/and out of school PD courses dealing with the instruction of students with LD. In answer, 58.6% declared that they had participated in in-school PD activity, 47% declared that they had participated in an out of school course, and 27.8% declared that they had never participated in such a course. It is important to note that most of the PD courses—in or out of school—were not exclusively dedicated to the topic of teaching students with LD. Usually, one of the lectures in the course or a special discussion were focused on this issue. Moreover, none of these PD courses dealt specifically with teaching science to students with LD.

Research tools

As described above, teachers' perceptions were examined according to the TPB - Theory of Planned Behavior (Ajzen, 1985, in Zint, 2002). According to this theory, three variables (attitudes toward the behavior, subjective norms, and perceived behavioral control) contribute to the formation of a fourth variable—teachers' behavioral intentions. We examined those variables through the *Teaching Science in Inclusive Classroom* Questionnaire, supporting the quantitative data it provided with additional qualitative data in the form of semi-structured interviews with teachers and with the Israeli National Supervisor of Science Teaching in middle school.

The Teaching Science in an Inclusive Classroom Questionnaire:

The questionnaire collected data regarding teachers' perceptions and their instructional methods in the inclusive science classroom. The questionnaire was constructed as a 4-level Likert type questionnaire (responses ranged between 1= "Do not agree" to 4 = "Fully agree"). It included 34 statements gathered from three different questionnaires: the Attitude toward Inclusion Questionnaire (Lifshitz & Naor, 2001), from which we modified some questions concerning general attitudes regarding inclusion of students with LD; the Attitudes toward Teaching Science Questionnaire (Norman, Caseau, & Stefanich, 1998), from which we gathered questions specifically regarding inclusion in science classes; and the Examining the Relation between Attitudes and Action Questionnaire (Zint, 2002), from which we chose questions aimed to verify teachers' intentions and willingness to make a change and to adapt their teaching.

Validity and reliability of the questionnaire: The questionnaire's contents were validated by 10 science education experts. They were asked to note whether or not each statement reflects the variable that the statement was designed to reflect, and to express their opinion regarding the statement's wording. The experts reached an agreement of 85%, after which some of the statements were rephrased according to their comments, and several statements were added according to their suggestions. The statements that were changed or added were reexamined by the same 10 experts, until full agreement was reached regarding their wording.

In another stage of validation, the revised questionnaire was tested in a pilot, and administered to 40 middle school science teachers. Following the completion of the questionnaire, these teachers were interviewed and asked to describe what they understood about the meaning of each statement of the questionnaire, and to explain their reasons for responding as they did to the questionnaire's different sections. After this stage, the questionnaire’s phrasing was finalized and it was administered to this study's 215 participants.

The questionnaire underwent a Confirmatory Factor Analysis procedure, and the different variables are presented in Table 1.

Table 1: The Teaching Science in an Inclusive Classroom Questionnaire: Description of the variables, content, examples of statements and reliability. N=215.

Variables	Items	Content	Example of statement	Cronbach's Alpha - α
Attitudes	1, 2, 8, 11	Teachers' attitudes about the idea of inclusion	*"Students with LD should learn science in mainstream classes."*	0.65
Subjective norms: Perceived feedback from work environment	4, 9, 10, 12	Teachers' perceptions about the norms and feedback they receive from their colleagues, principal, and supervisors.	*"The school principal thinks I do good work with students with LD."*	0.63
Perceived control: Methods and abilities	3, 7, 13, 15, 19, 22, 24, 26, 28, 34	Teachers' sense of self efficacy, ability and availability of methods for instruction in the inclusive classroom.	*"I know specific teaching methods appropriate for students with LD."*	0.77
Behavioral intentions	16, 20, 21, 23, 25, 27, 29, 30, 31	Teachers' perceptions about their willingness to teach in inclusive classes, to take training courses, to change teaching strategies.	*"I'll be open to changing my teaching strategies and the learning environment in order to address the needs of students with LD."*	0.77

Table 1 illustrates four variables that were found as compatible with the variables that were defined in this research. Seven statements that were found to be unrelated to any of the variables were removed from the questionnaire, and were not included in the statistical analyses, a step which also statistically strengthened the reliability. The total variance that was explained by the four variables was 42.3%. In order to examine the characteristics of the relationships between the variables, we conducted an ANOVA regression analysis (Table 7).

Interviews

The purpose of the interviews was to expand and enrich our body of information regarding the teachers' perceptions and teaching methods beyond the findings that emerged from the questionnaire. Seven teachers agreed to an in-depth interview. Their ages ranged between 30 to 50 years (average age – 40.4 years). The average seniority was 16.8 years (ranged between 7 to 29 years). These seven teachers represented various sectors (e.g., urban, rural, geographic periphery) from all over the country. Their survey responses mirror the patterns observed in the larger group from which they were recruited.

Most of the interviews were conducted in the interviewees' homes, and the interviews were recorded and transcribed. The interviews lasted about 45 minutes. They were semi-structured and included questions in accordance with the TPB theory. For example:

- Attitudes: *What do you think about the inclusion of students with LD in inclusive science classrooms?*
- Perceived subjective norms: *Did you ever get any guidelines from the school management or supervisor regarding ways to meet the needs of students with LD in your classroom? Please describe those guidelines.*
- Perceived behavioral control: *In what ways did you acquire pedagogical tools or knowledge of how to support students with LD? What obstacles do you meet regarding teaching science in inclusive classrooms?*
- Behavioral intention: *Can you recall an incident in which you acted in a certain way relating to a student with LD and you feel you would like to respond in a different way next time? Would you like to know more about the specific difficulties of your students? To what extent do you feel it is necessary for you to attend a professional development course designed to equip you with strategies for teaching science in an inclusive classroom?*
- Behavior: *What kind of learning activities do you plan for your students? How do you adapt those activities to meet the needs of the students with LD and other difficulties? How often do you employ teamwork and student collaboration during the lessons?*

Qualitative analysis and validity: The transcribing process was as follows (Shkedi, 2004): First, all of the interviews were transcribed verbatim. The second stage consisted of coding and categorizing the transcribed text—dividing it into episodes and content units. Each unit or episode was characterized according to its content. Next, the text was read again and the categories were reexamined and redefined. At the last stage, the categories and sub-categories were organized and rephrased to form a final structure of new main categories. The main categories that emerged were similar to the four variables revealed from the quantitative data. The main categories and sub-categories were: **attitudes regarding inclusion** (in general and in the teachers' own science classroom), **perceived subjective norms** (the principal, supervisor, and other teachers), **perceived control**—the available methods and abilities (experience, teaching strategies, instructional adaptations, training), and **behavioral**

intentions (collaboration with special education staff, time and attention efforts, continuous PD, applying appropriate instruction).

In order to validate the analysis, two referees—a science-teaching academic expert who studies inclusion in the science classroom, and an experienced science teacher—simultaneously judged the analysis of two interviews. The level of agreement between the four analyses was examined, and compatibility was found for 95% of the statements.

The interview with the National Supervisor of Science Teaching in middle school took place in her office. The semi-structured interview lasted 90 minutes. Its goal was to enrich our data regarding the subjective norms, in other words, to shed light on the Ministry of Education's policy regarding the inclusion of students with LD in mainstream science classes. The interview focused mainly on questions that were related to teacher training, such as: Is there a mandatory teacher training course that focuses on teaching science to students with LD? Does the Ministry of Education see a need for such training? Do programs of professional development for science teachers consider the difficulties teachers meet in the inclusive classroom?

Results

Science teachers' perceptions regarding teaching Students with LD

In order to understand the nature of the variables emerged from the Teaching Science in an Inclusive Classroom Questionnaire, we calculated the mean value (scale 1-4) and standard deviations for all variables. The teachers' behavioral intentions and their attitudes, mean value 3.26 (SD 0.41) and 2.94 (SD 0.67) respectively, were positive, and higher than their perceived control—i.e., their perceptions of the methods and abilities that were available to them (2.49, SD 0.42), and of the subjective norms—i.e., their feedback from the work environment (1.48, SD 0.96, scale 0-4). In other words, the teachers presented positive intentions to act and positive attitudes toward the inclusion of students with LD in their classes, but most of them believed that they do not have the appropriate training or knowledge of methods for teaching science to students with LD. Their perceived subjective norms returned the lowest score, indicating that teachers believe that they do not receive support and assistance, and perceive little or no interest from their supervisors and decision makers on the issue of teaching students with LD, managing an inclusive classroom, and adopting new teaching methods.

In the next sections, we will elaborate on each of these composite variables by presenting the mean values of each statement that comprises the variable and related qualitative data.

Science teachers' perceptions of their own attitudes

As mentioned above, teachers' attitudes regarding the inclusion of students with LD in mainstream classrooms and in their own science classrooms were positive (Table 2).

Table 2: Middle school science teachers' responses to statements related to the *attitudes* variable on a scale of 1-4 (1=Do not agree, 4=Fully agree), N=215

Statement	Mean	SD
Students with LD should learn science in mainstream classes.	2.80	0.8
I think including students with LD in science lessons is the right thing to do.	2.84	1 .04
I accept the necessity of teaching science to the students with LD in my classroom too.	3.02	1.14
I recognize the importance of integrating students with LD into regular classrooms.	3.09	0.79

The teachers indicated that inclusion is appropriate, and that students with LD should learn science in mainstream classes. They saw the need for inclusion and understood its importance. As one of the teachers (O) said: *"Students with LD can and should learn science like anybody else. Everyone can!"* Another teacher (B) said: *"I am trying to improve my communication with my students with LD. If I manage to stay and talk* [with a student] *after the lesson even just for 15 minutes, even just once a term – they trust me better afterwards. I feel success."*

The National Supervisor of Science Teaching in middle school elaborated and expressed her positive attitudes regarding inclusion in all subject areas, including science education. However, statements like the following suggested that she preferred offering general support to students with LD, and did not think that students with LD meet specific difficulties when learning science: *"Students with LD receive an individual program of support and assistance—in school lessons and in extra hours—according to their specific disabilities."* The interviewer asked: "When the student is called to leave the science lesson in order to get assistance, do you have any information about whether that student gets support in science learning, or is it support in other subjects like math, reading, etc.?" The supervisor answered: *"In general, the purpose is to enhance their basic skills. Assisting them to overcome their difficulties. To help them overcome obstacles in all subject areas. It does not provide specific support in specific subjects. When they* [the students] *return to class, they have to catch up on* *all the information and tasks that were taught during the lesson they missed. But if they know how to read better, they will adopt learning strategies that will assist them in all subject areas."*

Science teachers' perception of subjective norms—the feedback from their work environment

Table 3 presents the teachers' responses to the statements that comprise the category of Perceived subjective norms—feedback from their work environment.

Table 3: Middle school science teachers' responses to statements about the Perceived subjective norms—feedback from the work environment variable on a scale of 0-4 (0=He/she is not familiar with my work; 1=Do not agree; 4=Fully agree), N=215.

Statements	Mean	SD
My supervisors think that I do very good work with students with LD.	0.59	1.16
My subject coordinator thinks I do very good work with students with LD.	1.91	1.04
My school principal thinks I do very good work with students with LD.	1.77	1.57
There is an agreement among all science teachers who teach with me at school about the teaching methods that should be applied to students with LD.	1.92	1.10

Table 3 shows that the perceived feedback from the work environment was low, or, in most cases, did not really exist. 71% of the participants reported that the supervisor was unfamiliar with their work in the context of teaching science to students with LD, 36% claimed that the school principal was unfamiliar with their work, 32% claimed that the subject coordinator was unfamiliar with their work, and 19% reported that their fellow science teachers in school did not address this subject. These findings emphasize the lack of explicit or constructive norms regarding the inclusion of students with LD in science classrooms, namely, the subjective norms that existed were that it is neither an important issue nor an expectation. School principals, subject coordinators, and supervisors did not pay attention, nor did they expect science teachers to invest effort in addressing the needs of students with LD.

Qualitative inductive analysis of teachers' interviews revealed a more complicated picture of the situation. It allowed us to compare the teachers' perceptions to the national supervisor's policy and perceptions, and thus to gain a better understanding of the subjective norms science teachers experience in the Israeli educational system regarding the inclusion of students with LD in science classrooms.

As described before, *subjective norm* refers to how significant others feel about the individual's behavior, as perceived by that individual (Ajzen, 1985, 1991). One of the science teachers who participated in this study (R) demonstrated the absence of norms regarding the inclusion of students with LD in mainstream science classes: *"I felt frustration in the inclusive classroom. I needed guidance. I questioned everyone. I asked my supervisors for advice, and they told me: 'Do what feels comfortable to you, try to get the best you can.' They said: 'you're doing very important work, carry on…' I also find myself raising the issue in teachers' training courses. I am always alone..."*

R, who felt alone, was seeking guidance, but she felt that the supervisor was indifferent to her request, and at the same time felt incompetent in teaching students with LD ("try to try to get the best you can …"). N, another science teacher, said: *"You should understand, it's a small group* (i.e., the students with LD), *and I'm fighting for them, like Don Quixote, trying to make an effort, and then they (the principal, the subject coordinator and the other teachers on the science staff) say: Don't you understand that he can't learn? There's no chance that this student will improve… Why waste your time and energy?"* In other words, N, who perceived her own attitudes as positive and herself as someone who makes an effort on behalf of students with LD in her science class, felt that she was alone and noted that the system had no interest in these efforts. Furthermore, during the interview, in reply to a question about the teamwork of the science teachers in her school concerning teaching students with LD, she replied: *"Sure there's teamwork in the science department. But nobody ever talks about this subject. It's not interesting. The special education teachers are not interested, or they don't have time for us. There are always more urgent things. Who has the time? … I make an effort and no one sees it! There are always more important things, so although it is important to me, it's not enough."* N felt that although the science staff worked as a team, the staff did not address teaching students with LD as a goal, and neither did the supervisors or the principal. N believed she was receiving a message that devoting effort and teaching strategies to students with LD in class was one of the lowest priorities, and that other issues, other events in school, were more important.

When asked to address and relate to the issue of the ambiguous norms regarding teaching science in inclusive classrooms, the National Supervisor of Science Teaching in middle school said: *"In each school there is a special education staff that provides advice and instructional support in general to all teachers in school regarding how to treat students with LD. When there are many students with LD in a specific school, the teachers find ad hoc solutions… it depends on the teachers…if they talk a lot about this issue, they find a solution."* She further elaborated by adding that: *"In elementary schools there were training courses. In middle school it is sporadic. Local supervisors who felt the need initiated special lectures and workshops in professional development courses in order to help teachers in this area."* The supervisor's answer reflected the absence of clear policy and norms handed down from the national science and technology supervision office regarding how science teachers should cope with the challenge of inclusion in their classes.

Science teachers' perceptions of their perceived control—the available methods and abilities

The participating science teachers were asked about the amount of time they invested in supporting students with LD in their classrooms, about the instructional aids that were available to them, and about the actual skills and abilities at their disposal when teaching in the inclusive classroom. Table 4 presents the teachers' responses.

Table 4: Middle school science teachers' responses to statements addressing the perceived control—methods and abilities variable on a scale of 1-4 (1=Do not agree, 4=Fully agree), N=215

Statements	Mean	SD
Investing in children with LD does not take up the teacher's time.	1.90	0.71
I have sufficient tools with which to adapt the curriculum to students with LD.	1.91	0.73
I have teaching aids suitable for students with LD at my disposal.	2.08	0.78
I know how to use teaching strategies suitable for students with LD.	2.25	0.67
I have the proper knowledge and skills for handling the behavioral problems (if such exist) of students with LD.	2.43	0.72
Science and technology teachers can devote time to the special needs of students with LD.	2.80	0.83
If I received the proper training, I could teach students with LD.	2.82	0.72
Science and technology teachers should be expected to make		

extensive adaptations in order to meet the special needs of students with LD.	2.83	0.73
I can teach students with LD in my classroom.	2.93	0.67
It makes sense to expect me to teach science and technology to students with LD.	3.07	0.74

Teachers' responses about the instructional methods available to them and their abilities to cope were confusing, but generally positive for most of the statements. The participants conveyed positive levels of perceived control: they felt they were able to support students with LD if they could get professional guidance; they perceived themselves as capable of teaching in an inclusive science classroom. However, responses to statements that express the actual time and effort teachers must invest in order to address the needs of students with LD received low levels of agreement. This means that the teachers felt they currently did not know what teaching strategies are effective for students with LD, and they did not know how to adjust the curriculum and teaching materials to meet the needs of the students with LD in their classes. These findings reveal that the overall perception of most of the participants was that they have no support—in the form of instructional abilities and of teaching methods—to help them teach science in the inclusive classroom.

Analysis of teachers' interviews revealed the same frustration in the Perceived Control—the available methods and abilities category. Teacher (A) said: *"The gap between the students with LD and the students with no LD is so big, I don't know how to deal with it."* Teacher (W) said: *"In my science class there are 32 students. Half of them, or more accurately a third of them, are diagnosed as having LD. The difficulty is immense. There are excellent and talented students in my class as well. They also deserve special treatment. And me? Where am I? Sometimes I feel like a carousel. This student needs that, and this student needs this, and another student needs to be assessed by oral testing, so I have to stay with him…"* Teacher (F) said: *"I have no idea how to teach students with LD, I have no strategies, no methods. Even when somebody tells me 'do this' or 'do that', I really don't understand what to do."*

As part of the discussion in the interviews about Perceived Control and available methods, participants were asked to indicate whether or not they worked in collaboration with the special education staff at their school. Most of the teachers (68.7%) reported that they collaborated with the special education staff, though the interviews raised some doubt regarding the effectiveness of this collaboration. For instance, N spoke of her collaboration with the special education staff: *"They say: 'He has that, he needs such and such,'… but they* *are not precise about what I should do. They certainly don't explain."* S added: *"Collaboration? I don't know if I would call it that… Look, the school counselor makes the diagnosis, or receives the diagnosis from other experts. The counselor writes instructions to all teachers who teach the students with LD. All the teachers receive a document with instructions about each student: The specific type of LD, how the student's achievements should be assessed, in what ways the student should be taught. But the truth is that for us, the science teachers, it doesn't mean a lot… So he has dis-something-or-other…. what does it mean? What should I do with it? How does it hinder him in science lessons? I don't know."* Her words demonstrated that although she collaborated with the special education staff (as she also noted in the questionnaire), she did not perceive that collaboration as contributing to her teaching in the inclusive classroom.

The words of these two teachers indicate an inefficient collaboration, raising doubts regarding the whole issue of collaboration with the special education staff. Accordingly, the interview with the national supervisor indicates that there is no guidance regarding how to work with students with LD when teaching science: *"In some schools, the counselor, for instance, may provide instructions for the school staff in general, how to take care of these students. Usually, it happens when there is a significant number of students with LD in school. In most cases, there are ad hoc solutions 'invented' by the science teachers"*. In other words, the supervisor did not require the teachers to collaborate with the special education staff, and if such collaboration occurred it was initiated ad hoc by the school staff or by the teachers.

When the National Supervisor of Science Teaching in middle school was asked whether science teachers in middle school are trained to teach in inclusive science classrooms, she said: *"Science and technology teachers need to acquire the proper instructional methods…only few science teachers have the instructional abilities and the professional training to teach students with LD. In recent years, awareness of the difficulties faced by students with LD has grown, and science teachers absolutely need to acquire the proper teaching strategies and methods.*" The Supervisor could not specify what is being done in the Ministry of Education to resolve this lack of training and abilities among science teachers.

Science teachers' perceptions of their behavioral intentions

As described, teachers' perceptions of their behavioral intentions were positive. The teachers were asked about their willingness to be trained to teach in inclusive classrooms, about their willingness to work in cooperation with the special education staff, and about their willingness to change their teaching methods and adapt their teaching materials to address the needs of students with LD. Table 5 presents the teachers' responses.

Table 5: Middle school science teachers' responses to items of the category “behavioral intentions” on a scale of 1-4 (1=Do not agree, 4=Fully agree), N=215

Item	Mean	SD
I would choose to study in a course aimed to train me how to teach science to students with LD.	3.12	0.68
It should be obligatory for science teachers to attend a course aimed to train them how to teach science to students with LD.	3.19	0.66
In all science education conferences, there should be a session focused on teaching science to students with LD.	3.23	0.68
I would be open to making changes in my teaching methods and class management in order to address students with LD.	3.24	0.59
I need to study in a course aimed to train me how to teach science to students with LD.	3.26	0.73
Science teaching in the inclusive classroom setting should be an integral part of the training process of teachers.	3.28	0.65
Teachers need special training in order to be able to cope with difficulties in teaching science to students with LD.	3.31	0.67
Collaboration between science teachers and the special education staff can make teaching in the inclusive classroom rewarding.	3.31	0.65
I would be glad to have and use teaching & learning materials that are adapted for students with LD.	3.39	0.62

Table 5 indicates that the teachers' behavioral intentions were positive regarding gaining expertise on how to teach science to students with LD, working in collaboration with the special education staff, changing their teaching methods, and using adapted teaching materials. In other words, most of the science teachers who participated in the study 'agreed' or 'fully agreed' with statements that expressed a desire to obtain additional training and professionalization that is focused specifically on teaching science to students with LD.

The inductive analysis of the teachers' interviews also reflected this willingness. Teacher (C) said: *"I have been teaching for many years and I absolutely think that the idea of inclusion is very fitting and important. But, I must say, I don't see myself sitting for hours each day, before each lesson, to prepare and to adapt the right learning materials for each student that suit him/her….just imagine, in most classes that I teach, a third of the class was diagnosed as* *having LD, and each one has a different disability. I simply think it is imposable to address the needs of each student. Show me where to find the teachers who manage to do that."*

All the teachers who were interviewed expressed similar frustrations. They thought the idea of inclusion was appropriate, and they were willing to teach science in an inclusive classroom, but they were aware of the difficulties and the fact that they have received no support and no proper training. The National Supervisor of Science Teaching in middle school explained: *"When students are diagnosed as having LD with no further disabilities or limitations, they are integrated in mainstream classes and the teachers who are supposed to teach them, usually, are not trained and have no appropriate instructional strategies. Each one acts based on their individual options and abilities, looking on their own for more information and tips regarding learning disabilities and ways to support the student. Most of their work with these students has less to do with teaching than with assessment, where they give the student extra time and support."*

Relationships between the four variables of the teachers' perceptions

In order to examine the relations between the four variables in our questionnaire, we conducted a Pearson's correlation. Table 6 presents the Pearson's correlation between the four variables: attitudes, subjective norms (perceived feedback from the work environment), perceived control (methods and abilities), and behavioral intentions.

Table 6: Pearson's correlation between the four variables of teacher's perceptions (N=215).

	Behavioral intentions	Perceived control – methods and abilities	Attitudes	Subjective norms – in work environment
Behavioral intentions		**0.277*** **	**0.201** **	0.021
Perceived control – methods and abilities			**0.213** **	**0.180** **
Attitudes				-0.114

*P<0.05, **P<0.01, ***P<0.001

Table 6 indicates that significant but low correlations were found among all categories, except for Subjective Norms, which was found to have a low correlation with Perceived Control and no correlation with Attitudes and Behavioral Intentions. In order to examine the extent to which the variables Perceived Control, Attitudes, and Subjective Norms contributed to the variable Behavioral Intentions, we conducted an ANOVA Regression Analysis (Table 7).

Table 7: Standardized coefficients of hierarchical regression: Explained variation of Behavioral Intention (N=208).

Predictors	**Beta**
Attitudes	0.14*
Subjective norms— Perceived feedback from the work environment	0.01
Perceived control— methods and abilities	0.25***
R^2	0.10***

*p<0.05, ***p<0.001

As presented in Table 7, the findings show a significant correlation in which perceptions regarding Perceived Control contributed to the perceptions of the science teachers in this study regarding Behavioral Intention. We also found that the variable Subjective Norms was not correlated to the teachers' Behavioral Intention. The total contribution of Perceived Control and Attitudes to the teachers’ Behavioral Intention was significant.

Relationships between teachers' background variables and their perceptions

We conducted a T-Test analysis in order to compare teachers' perceptions based on variables such as seniority and experience in teaching students with LD. We found no difference between the perceptions of novice teachers and those of more experienced ones. We also found no difference between the perceptions of teachers with experience in teaching students with LD and teachers who lack such experience. On the other hand, we did find differences between the perceptions of teachers who had been given any type of training in teaching students with LD and those teachers who lacked such training (Table 8). We also found differences between teachers who worked in collaboration with the special education staff in school and those who did not. The differences were found mainly in regard to the categories of Perceived Control (tools and abilities) and Subjective Norms (feedback from the work environment). Teachers who received training reported greater feedback from their work environment regarding teaching students with LD. Regarding the Behavioral Intention and Attitudes variables, we found no difference between teachers who received special training or worked in collaboration with the special education staff, and those who did not.

Table 8: T-Test analysis to compare teachers' perceptions on a scale of 1-4 (1=Do not agree, 4=Fully agree), according to the four variables of the TPB theory and the independent variables: training and cooperation with special education (SE*) staff (N=215).

Variable			**N**	**Mean**	**SD**	**T (2-tailed)**
Attitudes	Out of school training	Not trained	114	2.91	0.70	-0.52
		Trained	101	2.96	0.62	
	In-school training	Not trained	89	2.89	0.71	-0.71
		Trained	126	2.96	0.63	
	Cooperation with SE* staff	Cooperation	64	2.83	0.64	-1.15
		No cooperation	135	2.95	0.68	
Subjective norms: Perceived feedback from work environment	Out of school training	Not trained	114	1.34	0.94	**-2.31***
		Trained	101	1.63	0.95	
	In-school training	Not trained	89	1.28	0.95	**-2.50***
		Trained	126	1.61	0.94	
	Cooperation with SE* staff	Cooperation	64	1.25	0.87	**-2.20***
		No cooperation	135	1.57	0.98	
Perceived control: Methods and abilities	Out of school training	Not trained	114	2.38	0.44	**-4.13*****
		Trained	101	2.60	0.36	
	In-school training	Not trained	89	2.41	0.39	**-2.60***
		Trained	126	2.54	0.43	
	Cooperation with SE* staff	Cooperation	64	2.37	0.35	**-2.40***
		No cooperation	135	2.52	0.43	
Behavioral intention	Out of school training	Not trained	114	3.26	0.43	0.41
		Trained	101	3.24	0.39	
	In-school training	Not trained	89	3.23	0.42	-0.79
		Trained	126	3.27	0.38	
	Cooperation with SE* staff	Cooperation	64	3.20	0.37	-0.97
		No cooperation	135	3.27	0.42	

Discussion

The primary goal of our study was to characterize mainstream middle school science teachers' perceptions and intentions toward teaching students with LD in their inclusive science classrooms. We applied the TPB theory and examined the relations between four main TPB variables: attitudes, subjective norms, perceived control and behavioral intentions (Ajzen, 1985, 1991; Figure 1). We approached our study with four hypotheses, which we tested against our results, as discussed in the following section.

H1: Teachers' attitudes toward inclusion of students with learning disabilities in science classes will positively and significantly influence the teachers' behavioral intentions.

First, it is important to note that our findings indicate that most of the science teachers who participated in the study (94%) have taught students with LD in practice. This figure is higher than the data found by Norman et al. (1998), who reported a percentage of about 88.9% of teachers almost two decades ago. This increased rate is compatible with Biddle (2006), and establishes an understanding that the inclusion idea is a reality in science classes today and efforts are made to effectively support all students, and students with special needs in particular (Jitendra et al., 2002; Villanueva & Hand, 2011).

Our study shows that teachers' attitudes did indeed contribute to their behavioral intentions. This supports the findings of other studies (Aizen, 1985; DeBoer, Pijl, & Minnaert, 2010; Zacharia, 2003). As mentioned before, there are various factors that contribute to teachers' perceptions about their behavioral intentions. Ballone and Czerniak (2001), who examined science teachers' perceptions in relation to accommodations for various learning styles in class, note that attitudes and perceived feedback and norms from the work environment are factors that influence teachers' behavioral intentions. They showed that attitudes were the most influential factor regarding teachers' intentions to act, and suggested that in order to cope with teaching that is adapted to various learning styles, teachers are required to be open to the use of diverse teaching methods. Accordingly, we propose that teachers' attitudes were found to contribute to their intention to act because supporting students with LD in inclusive classrooms requires the teachers to perceive inclusion as desirable, important and possible; i.e., to have positive attitudes.

Our study found that science teachers' attitudes toward the inclusion of students with LD in science classes were positive. In other words, teachers perceived the actual inclusion as desirable and worthwhile. Similar perceptions were found by previous studies (e.g., Cohen & Lazer, 2004; Cook, Cameron, & Tankersley, 2007; Scruggs & Mastropieri, 1996), but most of these studies explored the perceptions of teachers who were not science teachers. Ballone and Czerniak (2001) studied science teachers, but focused on their ability to respond to their students' various learning styles, not on the issue of inclusion and inclusive classrooms. Biddle (2006) examined the attitudes of secondary school science teachers toward accommodating students with LD in the science classroom, but did not examine their intentions to act. Thus, the context of our findings is unique and the findings revealed not only the positive attitudes of secondary science teachers toward inclusion in their classroom, but the relationship between these attitudes and other variables of the TPB theory.

The science teachers in our study are willing to teach science in inclusive classrooms, but they state a condition—that they should receive training and guidance in applying teaching methods and appropriate pedagogy to meet the needs of students with LD. This need for further training to meet the challenge is reflected in the findings of other studies that examined teachers' attitudes toward inclusive education, which have suggested that teachers' attitudes are strongly influenced by the nature of the learners' disabilities. These studies indicate that teachers are more positive about including those learners whose disability characteristics do not require extra instructional or management skills on the part of the teacher (Avramidis, Bayliss, & Burden, 2000; Cagran & Schmidt, 2011; Cohen & Lazer, 2004).

H2: Teachers' perceived subjective norms and perceived control regarding inclusion of students with learning disabilities in science classes will positively and significantly influence the teachers' behavioral intentions.

Our findings revealed that the perceived behavioral control of the teachers in our study (i.e., their perception of their abilities and the instructional methods that are available to them) contributed to their behavioral intentions, but that the perceived subjective norms were not correlated and did not contribute to them. This finding is in accordance with the tendency noted by Armitage and Conner (2001) in their meta-analysis of the efficacy of the TPB. They showed that subjective norms are often either a weak predictor of behavioral intention or have no predictive power at all.

Teachers' perceptions of their abilities and the instructional methods that are available to them were low. They perceived themselves as possessing a poor ability to teach students with LD in mainstream classes. These findings are compatible with the findings of other studies in general education (e.g., Cohen & Lazer, 2004). Scruggs, Brigham, and Mastropieri (2013) contend that results from observational studies and attitude surveys concerning the ability or willingness of general education teachers to implement specialized or differentiated instruction are not entirely positive. They elaborate that survey studies of teacher attitudes toward inclusion report that although the majority of teachers in those studies supported inclusive practices, only a small minority agreed that they had sufficient time, training, or support to implement inclusion effectively. This reality emphasizes the need for professional development and training courses that promote the acquisition of instructional methods and abilities that should be at the teachers' disposal. In addition, a systemic change is required to provide teachers with the support that they need from their work environment.

In schools, the professionals who are trained to work with students with LD and help integrate them in inclusive classes are the special education staff. It is therefore important to examine the nature and quality of the cooperation that exists between the science teachers and this staff. Our research indicates that the Israeli Ministry of Education has no detailed plan or vision of how to enforce such cooperation, and therefore does not provide the schools with guidelines on this subject. Each school plans its teaching methods according to its needs and perceptions. It also appears that even though most of the teachers declared that they do work in cooperation with the school's special education staff, the extent and manner of this cooperation are not significant. The framework for cooperation recommended in the literature includes a wide range of recommendations for collaboration: science teachers and special education teachers can work together on lesson plans, special teaching adaptations, and preparing individual work programs according to the students' diagnoses (Scruggs & Mastropieri, 1994). The literature even suggests co-teaching (Scruggs, Mastropieri & McDuffie, 2007), according to a model in which the science teacher and the special education teacher teach jointly in class, with the special education teacher providing the students with LD with the in-class support that they need (Steele, 2005).

Interestingly, data from the Teaching Science in an Inclusive Classroom Questionnaire revealed that most teachers reported collaborating with the special education staff. However, this collaboration is not supervised by the national supervisor, and is mainly the result of local initiatives in schools. In addition, the collaborations are manifested mainly in reports issued by the school counselor to the teachers about students' diagnoses and a "list of accommodations " that the students are entitled to receive. In other words, it appears that there is no collaboration in the sense of working together, but rather in the sense of exchanging information, with no further discussion about what teaching methods might be useful or what accommodations might support this or that student with LD.

One of the most dominant findings in our study is that subjective norms—i.e., the teachers' perceived feedback from the work environment—were low, or, in most cases, did not really occur. Seventy-one percent of the participants reported that the supervisor was unfamiliar with their work in the context of teaching science to students with LD, 36% percent claimed that the school principal was unfamiliar with their work, 32% claimed that the subject coordinator is unfamiliar with their work, and 19% reported that the science teachers' staff did not address this subject. These findings emphasize the lack of explicit or constructive norms regarding the inclusion of students with LD in science classrooms. In other words, the subjective norms that are conveyed are that it is neither an important issue nor an expectation. School principals, subject coordinators, and supervisors in most middle schools (represented by the science teachers that participated in this study) do not pay attention to this issue, and do not expect science teachers to invest efforts in addressing the needs of students with LD.

H3: Teachers' attitudes, perceived subjective norms, and perceived control toward inclusion of students with learning disabilities in science classes, will positively and significantly relate to each other.

Our results show significant but low correlations between all categories, except for subjective norms, which was found to have a low correlation with Perceived Control and no correlation with other variables. ANOVA Regression Analysis further showed a significant correlation in which attitudes and perceptions regarding perceived control contribute significantly to science teachers' behavioral intention. However, the Subjective Norms variable did not correlate with the teachers' behavioral intention.

To summarize, the data analysis that addressed the nature of the relationship among the perception factors indicated that a significant but weak correlation exists among the following three variables: Attitudes, Perceived Control, and Behavioral Intention. The Subjective Norms variable was found to have a weak but significant correlation only with Perceived Control. We also found that the Behavioral Intention variable was influenced positively by Perceived Control and Attitudes. As mentioned before, similar results were found by MacFarlane and Woolfson (2013). Overall, teachers in general and science teachers in particular tend to adopt positive attitudes regarding inclusion. However, they express less confidence and less perceived control toward their ability to support students with LD (Avramidis & Norwich, 2002), but not to the extent that they refuse to act. Thus, the TPB variable that may hinder teachers' behavioral intensions is the Subjective Norms, as we shall discuss further below.

H4: Teachers' professional background (e.g., seniority, teaching experience) will predict their behavioral intentions to work with students with LD.

Our study looked into the background variables of the participating teachers. We found that teachers who experienced training and/or cooperation with the special education staff had more positive perceptions regarding the methods and abilities that are available to them and the feedback they receive from the work environment, in comparison to teachers who did not receive training. No difference was found between teachers who received training and teachers who did not receive training regarding their perception of their intention to act and their attitudes. This supports Ajzen's claim (Ajzen's, 1991) that there is no connection between background variables (e.g., training, seniority) and teachers' attitudes. Though there have been other studies (Cohen & Lazer, 2004; DeBoer, Pijl & Minnaret, 2010) that showed a statistical relationship between teachers' training and their attitudes, as well as their perception of their instructional tools and abilities, no such relationship was found in our study.

Interviews with middle school science teachers and the National Science and Technology Supervisor regarding the types of professional development programs offered to teachers revealed the following: In the large majority of training and professional development frameworks for Israeli teachers in the field of science teaching, there is no obligation or even option for teachers to study the issue of teaching students with LD, or teaching in inclusive classrooms. Furthermore, there are no plans to design any program for the future training of science teachers in these subjects. This absence stands in stark contrast to the fact that both the supervisors and the teachers appear to feel a need for significant training and professional development in this field, as was found by Cohen and Lazer (2004). Despite the lack of official frameworks or initiatives, we found that approximately two-thirds of the teachers in our study did manage to attend courses about teaching students with learning disabilities, mainly due to the efforts of their school's management to provide training in the form of in-school courses. This situation supports the findings of MacFarlane and Woolfson (2013), who emphasized that school principals have a central role in promoting the inclusion principle within their schools.

Another way to support science teachers in inclusive science classrooms is to collaborate with the special education staff in school. In a recent synthesis of all available qualitative research on co-teaching, Scruggs, Mastropieri, and McDuffie (2007) concluded that special education co-teachers served mostly in a supporting capacity, and rarely employed specialized instructional strategies to assist students with disabilities. These findings suggest that much work remains to be done to design and implement effective science instruction in inclusive environments (Scruggs, Brigham, & Mastropieri, 2013).

Meaningful cooperation with the special education staff requires the structured support of the school’s management. Our study showed that the teachers believe that their school management and other educational authorities are not interested in or inclined to provide such support. We recommend addressing the gap that arises from the findings of this research, between the need for meaningful cooperation that is anchored in managerial support, and the teachers' perceptions that their work environment is unsupportive and certainly not working to generate any efficient cooperation. Hallahan, Kauffman, and Pullen (2012) state that "truly effective special education requires both a general education teacher and a special education teacher trained to do two different things, not merely to work together with a common purpose" (p. 38).

Our results suggest that the support teachers need from their work environment should include two roles:

Administrative: a) To enable collaboration between teachers and special education staff by allocating hours for preparing lessons together, for shared staff meetings or for the presence of an inclusion or special education instructor in the classroom itself. b) To encourage teachers to use *non-traditional* teaching tools like computers (Becker, 2001), diverse multi-sensory teaching tools (Ballone & Czerniak, 2001), hands-on enquiry experiments, and working in small groups.

Perceptive: The literature shows close relations between teachers' perceptions of the feedback they receive from their work environment and their perceptions of their own behavioral intentions (Ajzen, 1985; Zacharia, 2003). Similar relationships were found to be significant regarding inclusion (Bender, Vail, & Scott 1995), and regarding teachers' attitudes toward adapting science teaching methods to the various learning styles of students (Ballone & Czerniak, 2001). Accordingly, an unsupportive work environment, like the one perceived by the teachers in this research, sends a negative message to the teachers and hinders their efforts to teach science in a manner that is appropriate to inclusive class settings.

Our research did not find statistical relationships between subjective norms and the teachers' behavioral intentions. One possibility is that teachers' perceptions in general have minimal effects on their behavioral intention, or in other words, that most of the factors that contribute to their intentions to act are different from those that were examined in this research. This would mean that decisions regarding inclusion policy are made at a systemic level, and do not actually involve the teachers who are charged with implementing it (Greer & Greer, 1995; Idol, 1997). If this is the case, then teachers are receiving a mixed message: in practice, the system expects inclusion; yet, the system does not demonstrate any interest in its implementation, and does not involve the teachers in decision-making about how it should be carried out. These contradicting messages seem to have led to a sense of frustration. The teachers feel obligated to include students with LD. They have positive intentions to act, despite the fact that they do not perceive their work environment as a factor that can provide support or help them solve their difficulties.

While the subjective norms did not seem to have an impact on the teachers' behavioral intentions, their perceived control (i.e., their sense that, given the proper tools and methods, they will be able to answer the needs of LD students) did have a significant connection to their intentions. Similar connections between perceived control and behavioral intentions were found in Ballone and Czerniak (2001).

This finding is thought-provoking in light of the definition of behavioral intention as a factor that predicts action. The behavioral intention determines the actual action, and—in the case of this study—the use of appropriate teaching methods. Norman et al. (1998) suggested that science teachers do not feel responsible for the inclusion, and that they expect 'others', such as the special education teachers, to provide solutions. The findings of this study show the opposite. The science teachers who participated in our research feel responsible and are ready to acquire the capabilities and knowledge needed to support students with LD.

This situation leads to a key recommendation of this research, which is that educational policy makers and the schools' management must rally to support the science teachers in teaching students with LD. The system should devote attention and resources to provide help in this field. It should establish frameworks for meaningful cooperation between the science teachers and the special education staff, and allow the teachers in class to do more meaningful work by solving problems that are preventing the teachers from adapting their teaching. This can be done, for example, by lengthening lessons or by reducing the number of students in class. Further research on this subject is needed.

Another recommendation pertaining to the change in the system's support is creating shared professional development frameworks: professional development courses or workshops for the school science teaching staff together with regional instructors, supervisors, and school management (Ballone & Czerniak, 2001; Biddle, 2006; Vaughn & Linan-Thompson, 2003). This shared education can help ensure the efficient cooperation and coordination of all the involved parties, and send a positive message of support to the science teachers who are the actual implementers of the change. Future research should examine the consequences of such a change in middle school inclusive science classrooms. Additional future research can examine affective dimensions, like motivation to support students with LD or empathy toward students with LD, which could potentially interact with teachers' attitudes, perceived control, behavioral intention and behavior.

Limitations of study

The study described in this paper addressed specific aspects of science teaching in the inclusive classroom, based on the TPB theory (Ajzen, 1985, 1991). The TPB model posits that behavioral intention is determined by attitudes, subjective norms and perceived behavioral control, and that it is a mediator for the actual behavior. The TPB has been used to a lesser extent in educational science settings and to an even lesser extent in inclusive science education settings. One limitation of the study described here was that findings were mainly based on participants' statements and reflections through the questionnaire and interviews. Future research should examine teachers' practical behavior through observations in class and through students' views of lessons and the science teachers' instruction. Self-report measures can increase the likelihood of social desirability bias (King & Bruner, 2000) in teacher responses about inclusive attitudes and professional practices.

Another concern is the fact that the participating teachers in this study did not take part in a special education PD course. Would participation in such a course skew the results? For example, it could potentially influence teachers' attitudes and their perception of their ability to teach students with LD. The implications of PD courses of this kind should be addressed in future studies.

To conclude, our findings can contribute to the development of training programs in special education for pre-service and in-service science teachers. They emphasize the need to develop an instructional model for the instruction of science in the inclusive classroom, as well as collaborative frameworks for science teachers and the special education staff in school. They also echo the necessity of developing intervention programs and introducing subjective norms aimed at improving the integration of students with LD in inclusive science classrooms.

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