# The Perceptions of Science Teachers in Improving and Developing Science Learning of Students with Learning Difficulties in the Middle Stage of Private Schools in Dubai

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**Abstract. Purpose-** This research investigates science teachers' perceptions and practices in enhancing the science learning of students with learning disabilities (LD), guided by social cognitive theory and Fox's Personal Learning Theories.
**Methodology-** The study utilized a questionnaire responded to by 156 science teachers from various private schools in Dubai.
**Findings-** Findings indicate a positive perception among teachers towards developing science learning for students with LD, employing well-established strategies.
**Implications-** the study emphasizes the need for guidance and coordination among stakeholders to maximize the impact of these positive perceptions.
**Originality/value-** providing essential information for enhancing science teacher performance and creating an optimal classroom environment.

## 1 Introduction

### 1.1 Overview

Learning scientific best practices yields real-life benefits for all students, including those with learning difficulties. Acquiring these skills enables students to apply them in various contexts (NRC 2012). Furthermore, in the field of science, prioritizing an accessible and meaningful learning experience for all remains an ongoing educational goal (NRC 1996).

### 1.2 Statement of Problem

Teachers with high self-efficacy levels contribute to a positive experience for all students, including those with LD, fostering kindness and reducing the fear of future failure (Villanueva, Mary Grace Taylor et al. 2012). However, studies indicate that general education instructors may not be adequately prepared to support this student group in mainstream classes. Teachers' attitudes significantly shape their understanding of students, emphasizing the importance of familiarity with science fundamentals and the ability to motivate learners. Nevertheless, lacking experience in teaching students with LD may hinder the effective use of teaching techniques (Mastropieri, Scruggs & Magnusen 1999; Bencze,


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Bowen & Alsop 2006; Kim 2013; Park, Lee & Heo 2015). Limited research exists on science teachers' attitudes and readiness to instruct students with LD (Kang & Martin 2018).

### 1.3 The Purpose and Research Questions

The intent of this research study is to investigate science teachers' perceptions and practices in developing the science learning of students with LD and to answer the research question below:

What are science teachers' perceptions regarding developing science learning among students with LD in Dubai middle schools?

### 1.4 Rationale for the Study

Teachers' beliefs about learners' abilities significantly influence learning outcomes, as evidenced by various studies (Darling-Hammond 2000; Stronge et al. 2007). Earlier research indicates that a shortage of highly qualified teachers for students with learning disabilities hampers the progress of this student group (Allinder 1995; Scruggs & Mastropieri 1996; Orynbassarova 2017). Moreover, this shortage limits opportunities for students with LD to pursue science or mathematics in their academic and career paths (Sharma & Chunawala 2013; Burgstahler & Chang 2014).

### 1.5 Significance of the Study

There has recently grown a global trend that aims to improve Science, Technology, Engineering and Math (STEM) education to produce a new generation that holds the professional skills to gain work in the STEM field (Therrien, Hughes & Hand 2011; Green 2014). Since STEM education relies on problem - solving skills related to real life experiences that the students will face in their work experience later on, students in general, (Chen 2013) and students with LD in particular, find it difficult to develop these kind of skills (Street et al. 2012).

## 2 Literature Review

### 2.1 Overview

The intent of this research study is: to investigate science teachers' perceptions regarding developing science learning among students with LD in middle stage of private schools in Dubai; to examine the practices that science teachers use to enhance students with LD in science learning; and to investigate the effect of demographic differences on science teachers' perceptions regarding developing science learning for this group of students in the middle stage of private schools in Dubai.

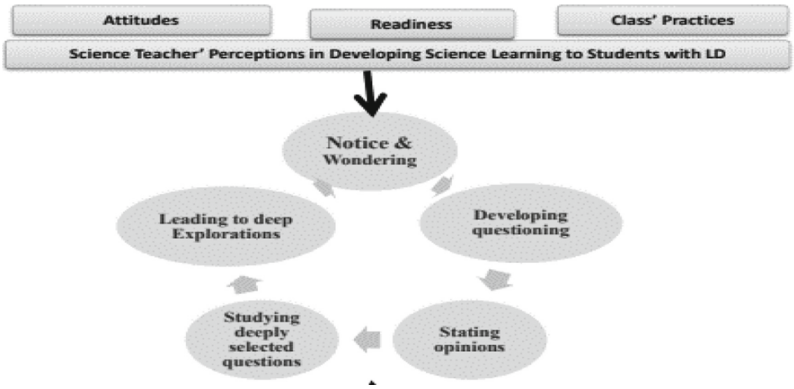


**Fig. 1.** The Conceptual Framework of the Study

## 2.2 The Conceptual Framework

With regards to this study, the conceptual framework establishes a link between the science teachers' perceptions, including their attitudes, readiness, and the best practices followed to develop the science learning of students with LD, as shown in Fig. 1 below:

## 2.3 Theoretical Framework

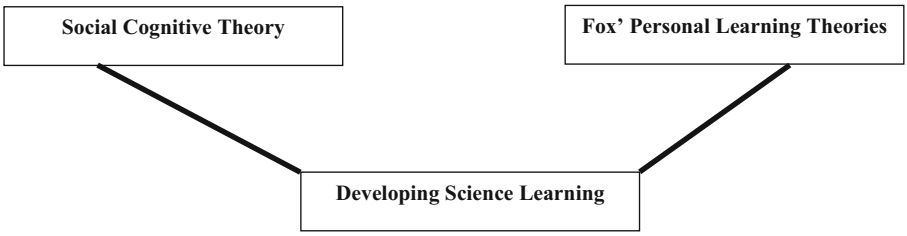


**Fig. 2.** The Theoretical Framework of The Study

The relevant theories that support this study are shown in the Fig. 2 below: Social Cognitive Theory and Fox Personal Learning Theories.

## 2.4 Literature Review

The main aspects in this literature review are developing science learning, and learning difficulties through the perceptions of science teachers. In this section, the researcher describes the main concepts in this research study including science learning as the main concept of the study. The other aspects of this study are science teachers' attitudes and readiness, and class practices used to enhance students with LD in developing science learning.

### 2.4.1 Science Learning

Education faces the challenging task of cultivating future generations capable of shaping the world effectively (Suryanti & Lede 2018). Learners need higher thinking abilities to become effective leaders in the learning economy (UAE Ministry of Education 2015). An essential education function is introducing children to the culture of science, encompassing reasoning patterns, observation skills, and standards of proof, driven by a growing appreciation of children's thinking and learning (NRC 2007). Recognizing students' greater learning potential emphasizes the need for richer and more challenging learning environments led by skilled teachers, with a particular focus on science in early education (Worth 2010). To create a healthy learning environment, Flook (2021) proposes four strategies for schools: fostering positive relationships, developing students' self-management skills through engaging teaching strategies, cultivating social, emotional, and intellectual competency, and establishing comprehensive school support systems, including after-school activities and community collaborations.

### 2.4.2 Science Teachers; Preparation, Attitudes and Readiness to Teach Students with LD

Science teachers and those in training often feel unqualified to teach in inclusive classroom settings, despite the policy being in place since the late 1990s (McNamara 2007). Lack of teacher involvement in decision-making may lead to low motivation to implement inclusive policies (Greer, B. & Greer 1995; Jitendra et al. 2002). Instructors' attitudes toward inclusion are crucial for success (De Boer, Pijl & Minnaert 2011; Spektor-Levy & Yifrach 2019; Teo 2021). Teo (2021) categorizes science teachers into those supporting inclusion for students with LD and those opposing it. Some teachers express reluctance or preference for teaching students without LD, while others are willing to teach students with LD, providing necessary adjustments and adaptations (Dev & Kumar 2015). Adaptations and modified approaches are vital for inclusive science classrooms (PACER 2018).

### 2.4.3 Recommended Strategies and Practices in Science Classes for Students with LD

In this regard, investigations that have been conducted. Watt et al. (2013) demonstrate that the goals of Individualized Education Programs (IEPs) must be established by modifying the content of general education programs, and those instructional activities must be carried out using differentiated instructions within the scope of science learning to students with LD. Curriculum modification, according to Hall, Vue, Koga & Silva (2004) is making adjustments to curriculum components like content, teaching methods, and acquisitions to meet the needs of students. For example, whereas the purpose of a science and technology course is to explain the meanings of ideas, this goal might be changed for students with intellectual disabilities to "demonstrate the named concept" or "match concepts and meanings" if the students have reading and writing skills difficulties (King-Sears 2001). For students who lack reading and writing skills, textbook-based instruction and verbal lectures pose significant barriers Mastropieri, Scruggs, Norland, et al. (2006).

## 3 Methodology

In this study, data were collected from science teachers in various private schools in Dubai using a questionnaire designed specifically for this research. The questionnaire comprises three sections: a demographic section, three clusters exploring science teachers' perceptions of inclusive education, teaching strategies, and learning barriers for students with LD. The final section includes a qualitative question. The questionnaire underwent revision by an educational expert and was pilot-tested to address the research question: "What are science teachers' perceptions regarding developing science learning among students with LD in Dubai private middle schools?" Confidentiality standards of the British University in Dubai (BUiD) were adhered to, and participants were provided with a detailed description of research protocols, confidentiality measures, the study's primary goal, and its objectives before granting informed consent. This approach ensures research accessibility and comprehensive security (Creswell 2014).

## 4 Data Analysis and Results

The main results of analyzing the data from science teachers' questionnaires revealed that most science teachers are prepared for and have attitudes towards inclusive education, use effective teaching strategies to help students with LD be included, and agree on the academic barriers that constrain this group of students. The total number of science teachers from various private schools in Dubai who agreed to participate in the questionnaire was 156.

**Science Teachers' Questionnaire Validity Test**

As it is shown in Table 1, an important step involved weighting the overall significance of the correlation matrix through Bartlett's Test of Sphericity, which provides a measure of statistical probability that the correlation matrix has significant correlations among some of the components. The results were significant: $x^2$ ($n = 156$) = 2995.721 ($p < 0.001$), which indicates its suitability for factor analysis.

The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (MSA), which indicates the appropriateness of the data for factor analysis, was 0.931. In this regard, data with MSA values above 0.8 are considered appropriate for factor analysis.

**Table 1.** Results of Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of the Science Teacher' Questionnaire

| KMO and Bartlett's Test | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy | | . 931 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 2995.721 |
| | df | 378 |
| | Sig. | .000 |

The exploratory factor analysis (EFA) employed principal component analysis and varimax rotation, setting a minimum factor loading criterion of 0.50. Communalities, indicating variance explanation, were evaluated, with all exceeding 0.50, except for item 5 in cluster B, leading to its removal. The EFA initially yielded three factors, explaining 59.785% of the variance. However, three items failed to load significantly, prompting their removal: item #5 and item #2 in cluster B, and item 6 in cluster D.

Subsequent EFA, excluding these items, affirmed the theoretically defined three-dimensional structure. The Kaiser–Meyer–Olkin MSA was 0.929, and the dimensions explained 58.902% of the variance. The Bartlett's Test of Sphericity was significant, and all communalities exceeded 0.500. Factor loadings, detailed in Table 3, aligned with the research's theoretical framework. Item revision and statement rephrasing were undertaken to enhance alignment with each questionnaire cluster (Table 2).

**Table 2.** KMO and Bartlett's Test after EFA

| KMO and Bartlett's Test | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy | | . 929 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 2890.854 |
| | df | 351 |
| | Sig. | .000 |

**Science Teachers' Questionnaire Reliability Test**

The reliability of the science teachers' questionnaire was assessed using Cronbach's Alpha coefficient, with specific focus on clusters B, C, and D. For cluster B, which comprises 16 items related to learning strategies, the alpha value was 0.933, indicating high internal consistency. The item statistics, including mean and standard deviation, further supported the reliability of individual items within this cluster.

Similarly, cluster C, examining teachers' perceptions toward inclusive education with five items, demonstrated high internal consistency, with an alpha value of 0.901. The item statistics, encompassing mean and standard deviation, reinforced the reliability of each item within this cluster.

Cluster D, investigating barriers affecting students with LD in learning science with six items, exhibited an alpha value of 0.847, indicating strong internal consistency. The item statistics, including mean and standard deviation, along with the inter-item correlation matrix, affirmed the reliability of individual items within this cluster. Overall, these results highlight the questionnaire's reliability in assessing different aspects of science teachers' perspectives and practices.

**Table 3.** Reliability Statistics of Science Teachers' Questionnaire Clusters

| Cluster | Cronbach Alpha | Cronbach Alpha Based on Standardized Items | N of Items |
|---|---|---|---|
| B: Teacher' Strategies used with Students with LD | .932 | .933 | 16 |
| C: Teacher Perception towards Inclusive Education | .901 | .902 | 5 |
| D: The Barriers that Affect students with LD Learning of Science | .849 | .847 | 6 |

**Descriptive Statistics Analysis of Science Teachers' Questionnaire**

The analysis of 156 science teachers' responses focused on cluster B, examining teaching strategies for students with learning disabilities. While most scores were similar, item #15, suggesting greater success for such students in inclusive classes, received the highest score ($M = 4.333$, $SD = 1.0181$). In contrast, item #16, assessing positive attitudes toward inclusive education based on teaching experience, scored the lowest ($M = 3.865$, $SD = 0.9843$). This implies that teaching experience may not significantly contribute to positive attitudes about inclusive education among science teachers (Table 4).

**Table 4.** The Descriptive Analysis of Cluster B s related to the Teaching Strategies used by Science Teachers

| Cluster B: Teaching Strategies used by Science Teachers | N | Mean | Std. Deviation |
|---|---|---|---|
| 1. Coordination between science teachers and support teachers can enrich inclusive education policy application | 156 | 4.147 | .9890 |
| 2. Reading scientific texts constrains students with LD to learn science | 156 | 4.231 | .9076 |
| 3. Scientific terminology constrains students with LD to learn science | 156 | 4.096 | .9557 |
| 4. I prefer to have a support teacher during science lessons | 156 | 4.103 | 1.0787 |

(*continued*)

**Table 4.** (*continued*)

| Cluster B: Teaching Strategies used by Science Teachers | N | Mean | Std. Deviation |
|---|---|---|---|
| 5. I integrate technology to facilitate learning for students with LD | 156 | 4.429 | .9511 |
| 6. The class size affects the quality of inclusive education provided | 156 | 4.282 | 1.0522 |
| 7. I use Enquiry -based learning strategy in most science lessons | 156 | 4.237 | .8733 |
| 8. Use of higher- order thinking skills | 156 | 4.122 | .9252 |
| 9. I use Guided Science Inquiry instruction with students with LD | 156 | 4.083 | .9295 |
| 10. Inclusive education builds better people for a better society | 156 | 4.218 | .9456 |
| 11. I use differentiated work to meet the needs of students with LD | 156 | 4.224 | .9268 |
| 12. I am open to changing my teaching strategies and the learning environment in order to address the needs of students with LD | 156 | 4.128 | 1.0014 |
| 13. I use note-taking techniques to improve student's science learning | 156 | 4.256 | .9630 |
| 14. I follow small group strategy (4–5 students) in planning the lesson activities and running them in class | 156 | 4.026 | .9964 |
| 15. Students with learning difficulties will be more successful in inclusive classes | 156 | 4.333 | 1.0181 |
| 16. An experienced teacher has a positive attitude towards inclusive education | 156 | 3.865 | .9843 |

In Cluster C, focusing on science teachers' views on inclusive education, mean scores range from 4.231 to 3.718. The highest mean ($M = 4.231$, $SD = 0.9005$) is associated with item #21, gauging teachers' readiness to adjust teaching practices for students with LD. Conversely, the lowest mean ($M = 3.718$, $SD = 1.0210$) is found in item #17, assessing teachers' knowledge of specific teaching methods for students with LD (Table 5).

**Table 5.** The Descriptive Analysis of Cluster C examining Science Teachers' Perceptions towards Inclusive Education

| Cluster C: Science Teachers' Perceptions towards Inclusive Education | Mean | Std. Deviation |
|---|---|---|
| 17. I have adequate knowledge of specific teaching methods appropriate for students with LD | 3.718 | 1.0210 |
| 18. I have adequate experience to teach students with LD | 3.942 | .8962 |
| 19. My subject coordinator's feedback is that I do very good work with students with LD | 3.942 | .8962 |
| 20. I use appropriate teaching methods and instructional support with students with LD to help them meet the expectation level of each lesson | 4.115 | .9085 |
| 21. I make changes in regular teaching practices to accommodate the needs of students with LD | 4.231 | .9005 |
| 22. Language barrier | 4.115 | .9085 |

In Cluster D, addressing learning barriers for students with LD in science, the 156 science teachers highlight item #23 as the most significant barrier (M = 4.231, SD = 0.9005), focusing on missing previous knowledge and experience. Conversely, item #27, addressing social and behavioral difficulties, is considered the least significant barrier (M = 3.846, SD = 1.605) (Table 6).

**Table 6.** The Descriptive Analysis of Cluster D that is related to the Learning Barriers that reduce Science Learning

| Cluster D: Learning Barriers that reduce Science Learning | Mean | Std. Deviation |
|---|---|---|
| 23. Missing previous knowledge and experience | 4.231 | .9005 |
| 24. Lack of concentration | 4.006 | 1.0984 |
| 25. Low skills level in mathematics and reasoning | 3.981 | .9933 |
| 26. Scientific terminology | 3.891 | 1.0196 |
| 27. Social and behavioral difficulties | 3.846 | 1.0605 |

- **Analyzing the Open-Ended Question of the Science Teacher's Questionnaire**

In Cluster E, focusing on the need for courses or professional development to teach students with LD, the majority of science teachers (144) express a preference for such educational opportunities. This inclination indicates the teachers' readiness to enhance their skills in working with students with LD (Table 7).

Science teachers stress the importance of a degree course or professional development for addressing learning difficulties. They substantiate this need by highlighting the

**Table 7.** The Frequency of Science Teachers' Responses of Cluster E: Course Degree or Professional Development related to Special Education Needs

| Type of Response | Yes | No |
|---|---|---|
| # of Response | 144 | 10 |

significance of understanding coping strategies, implementing effective methodologies, improving student performance, and facilitating accommodations. Conversely, those who responded negatively attribute their stance to their existing experience, academic qualifications, or, in some cases, choose not to provide further comments.

## 5 Discussion

This section analyzes the research results in the context of the theoretical framework and relevant studies from the literature review. The study aimed to explore science teachers' perceptions and practices in enhancing science learning for students with LD in private schools in Dubai. Both quantitative and qualitative data were collected to address the research question:

What are science teachers' perceptions regarding developing science learning among students with LD in Dubai private schools?

The data indicates that science teachers generally hold positive perceptions about including students with LD in their science classes, as seen in their responses to item #5 in Cluster C and item #2 of the questionnaire. However, a significant number of teachers lack the necessary training and resources to translate these positive perceptions into practice, especially evident in their responses to item #2 and the qualitative question in section E, emphasizing the need for professional development or a diploma related to learning difficulties in education. This underscores a lack of adequate training for science teachers in handling this student group.

Breault (2006) states that teachers must be held accountable, have a variety of methods available, work together with parents, teachers of special education, and other support staff, view every learner as a potential resource for improving instruction, and have patience and flexibility. Research has shown that only a limited number of science teachers have obtained training in teaching students with LD, and Fox theories have been developed to address the relationship between a teacher's personal teaching theory, learning theory, and instructional approaches. This study investigates the science teachers' perceptions of developing the science learning of students with LD. The transfer theory, shaping theory, traveling theory, and growing theory are all well-suited to this research study. Social cognitive theory (SCT) is another theoretical framework that connects to the science teachers' perceptions of developing science learning of students with LD.

SCT involves the interchange of actions or behaviors between an individual and environmental factor, encompassing elements like behavior ability and observational learning. A science teacher with positive perceptions and the ability to convey scientific knowledge becomes a model for students. The data indicates positive perceptions among

science teachers regarding science learning development, although variations exist in certain questionnaire items. For instance, item #6, addressing the impact of class size on inclusive education quality, aligns with studies suggesting benefits for students with severe learning requirements in smaller classes. However, there is disagreement on the optimal student-to-teacher ratio for various age groups.

Item # 16, related to the experienced teacher and their positive attitude towards inclusive education, showed the same results as Mouchritsa et al. (2022). However, the positive attitude of teachers is not related to the experience, it is linked to the teacher' belief and readiness. The acceptance of diversity and the elimination of exclusion at all levels, adaptation of curriculum and teaching methods, teacher cooperation, and support from the school unit's principal are necessary for inclusion practices to function properly. An item in the science teacher' questionnaire that shows a notable difference is item # 19, linked to the teacher' qualification to educate students with LD. This indicates either the feedback was not efficient and helpful, or the coordinator does not have sufficient knowledge to guide the science teacher to teach students with LD.

Whitworth et al. (2017) found that science coordinators need more effective professional development to be able to work more effectively with students with LD. Garcia (2021) suggested four essential practices to help science teachers in their inclusive setting: individualizing instructions, reorganizing assignments, simplifying information, and providing options in assessments. Teachers' attitudes and opinions play a significant role in the adoption of new instructional strategies and methodologies.

**Implications**

This research study, which investigates the perceptions of science teachers in developing the science learning of students with LD can provide the stakeholders in the education sector with needed information to improve the science teachers' performance and support them in creating a better classroom setting.

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