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Teachers' Perceptions Of Applying Universal Design For Learning Principles To Enable Students With Disabilities Access School Curricula: A Qualitative Research Study

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Abstract

The study aims to investigate general education teachers' application of the principles of the universal design for learning (UDL) and to reveal their effect on enabling students with learning disabilities (LDs) to access school curricula. The researchers used a qualitative approach to achieve the purpose of the study. Researchers used three data collection tools including classroom observations, school document analysis, and semi-structured interviews. The sample consisted of five general education teachers in a school with an LD program in Jeddah. The results indicated that the teachers applied the three main principles of UDL: providing several ways for participation, presenting information, and expressing comprehension and performance. The results also highlighted the effect of applying these principles in meeting the needs of students with LDs in both academic and social aspects by improving their school achievement and enhancing their participation opportunities throughout the learning process. Regarding the social aspect, the application of the UDL principles contributed to empowering those with LDs to interact positively with their peers in collaborative learning groups.

KEYWORDS access to school curricula, general education teachers, learning disabilities, inclusive education, universal design for learning.

Introduction

All fields of education are undergoing incredible scientific progress that has exceeded all expectations and limits. However, there is still a special focus on improving the quality of learning(Arslan& Karameşe,2018; Selvi,2022) to meet the goal of empowering students—the focus of the educational process—to acquire knowledge and instruction that will benefit them in their future lives and enable them to move from one study station to another (Benkohila, Elhoweris& Efthymiou,2020; Issa 2018; Kayaalp,Meral& Başcı,2021).

Inclusive education is considered as one of the main mechanisms to achieve diversity (Bartnikowska& Antoszewska,2017; Eissa & Borowska-Beszta,2019; Özaydın et al.,2021).This is supported by the fact that one of the pillars in which the inclusive education is based on having accessible curricula that consider the diversity of students in the classrooms(Aktepe,Temur&Yazıcıoğlu,2021; Demirdag, 2016; Fuentes et al.,2016).

Due to the diversity of learners and the individual differences between them(Ateş& Ünal,2021) , teachers are faced with tremendous challenges that impede achieving the wishes of learners with learning disabilities (LDs) to access the school curriculum. LDs are characterized by heterogeneity in the characteristics, abilities, and needs specific to learning (Abunayan 2021), which calls for teachers to exert their utmost efforts and

be familiar with the academic needs (Orhan-Karsak& Özenç,2022), potentials, and abilities of these learners (Kahramanoğlu& Dursun,2022). This effort also requires diversity in the presentation of the material to allow learners of different needs and categories to access the curriculum and benefit from all its content (Kennette and Wilson 2019).

Accordingly, Al-Sufyani (2021) highlighted the urgent need to overcome any obstacles to the universal design for learning (UDL), which aims to develop staff and educational institutions, turning them into a universal environment for all. Applying UDL principles can achieve a balance between the amount of information provided and the ability to absorb it, since the application of UDL principles contributes to bridging the gap in the access of learners with LDs to the school curriculum. However, achieving this goal requires concerted efforts and constructive cooperation between special education and general education (Karimah and Al-Zahraa 2018).

Based on the above and in response to the recommendations of the UDL Conference at Qatar University (2021), there is a pressing desire to examine the current state of general education teachers' application of UDL principles and their impact on enabling learners with LDs to access the general curriculum, which is considered a logical consequence of the progress we have reached in education. The access of learners with LDs to the general curriculum and the consequent success and progress will increase their motivation toward learning and help them enjoy psychological adjustment and independence in self-learning (Cross 2019).

Objectives

The main objective of this study was to examine the current state of general education teachers' application of the UDL principles, and the educational mechanisms they employ in applying these principles within the classroom while assessing the effect of applying the UDL principles on enabling learners with LDs to access the general curriculum. The study addresses the following questions:

1- What is the current state of general education teachers' application of UDL principles to empower learners with LDs to access the school curriculum?
2- What is the potential impact of general education teachers' application of UDL principles on empowering people with LDs to access the curriculum?

Theoretical Framework

Learning disabilities

LDs are defined as disorders in one of the psychological processes whose causes are not due to any other disabilities, learning conditions, or family problems (2018, 2018; Filiz,& Güneş,2022). LDs manifest in students who show a discrepancy between the level of their mental abilities and that of their academic achievement. This discrepancy is more evident after subjecting them to diagnostic tests in language, mathematics, or both, and as a result, they become qualified to receive special education services in the resource room within a period not exceeding half the school day (Hoogendoorn, 2021; Yousry and Al-Badr 2020).

There are four foundations on which the concept of LDs is based(Eissa,2015, 2017; Gomaa, 2014; Nassar, 2019) : i) diversity that makes LDs vary from one student to another; ii) differentiation arising from the difference between students' expected performance and their actual performance due to their deficiencies; iii) exclusion, which is explained by the fact that the disability is not due to learning conditions, family problems, or any other disability, whether visual, auditory, developmental,

intellectual, or kinetic; and iv) student-centered teaching (Abunayan, 2020).

Miciak and Fletcher (2020) indicated that LDs seem to be perplexing to many education practitioners, as many of them wonder how students possess mental abilities that enable them to learn, listen, and see in a quite natural way but show a considerable defect in learning compared to their peers. Thus, it may be beneficial to identify factors that contribute to the occurrence of LDs and their indicators, which play a great role in teachers' understanding of their students, identifying the challenges they face, and providing services and educational methods appropriate to their needs (Frohlich et al. 2020).

It should be noted that several LD-related factors contribute to the emergence of these disabilities, and relate to the etiology of LDs, which is brain dysfunction (Kader& Eissa,2015). These factors negatively affect students when exacerbated; however, they may leave a positive impact if their severity is reduced and properly oriented.

Therefore, these contributing factors are not a cause of LDs (Al-Hawamdeh 2019). Zaidan and Al-Sartawi (2020) classified the factors contributing to LD into four categories: i) physical factors, which are evident in visual and auditory difficulties; ii) emotional and psychological factors; iii) socio-economic factors, such as parenting methods and the economic level of the family; and iv) educational factors, which are reflected in the problems that hinder effective education.

Academic characteristics of learning disabilities

Dyscalculia is reflected in LD individuals' lack of awareness of the meanings of numbers and the distinction between similar ones, and the difficulty of differentiating between the mathematical symbols indicating the type of arithmetic operations (addition, subtraction, multiplication, division) (Koç& Korkmaz,2020; ElAdl,2020). This deficiency extends to knowledge of the place value, which in turn affects the ability to read and write numbers correctly, in addition to the difficulty of differentiating between ordinary fractions and decimals, ratio, and proportion, and completing the related operations. It may also extend to defects in geometry, which prevents learners with LDs from recognizing geometric shapes with all their differences (Alptekin& Sönmez,2022; ElAdl, & Eissa ,2019;Hajj 2019; Rotem and Henik 2020).

According to Ibrahim et al. (2021) and Al-Salami and Al-Zahrani (2021), dyslexia includes slow and difficult recognition of written symbols, as well as an inability to match letters to their corresponding sounds, which results in a failure to read the whole words or read them fragmented. This deficiency also appears in the form of deleting or adding some letters to the target words or replacing their letters with other letters. Dyslexia includes a failure to comprehend reading and derive meanings from reading texts (Elhoweris,2017; Tepetaş , Şule & Erol,2021), which consequently leads to a decrease in the academic achievement of those with LDs(Eissa, 2014).

Spelling difficulties are reflected in the failure of learners with LDs to write commonly used words and the difficulty of distinguishing between similar sounds, and consequently produce spelling errors that are attributed to a discrepancy between what is spoken and what is written. In particular, the spelling errors of learners with LDs are characterized by continuity and repetition (Abunayan 2020).

By contrast, dysgraphia involves the inability of learners with LDs to convert their knowledge and intellectual language into written material with coherent meanings, and the difficulty of generating multiple sentences about one of the target

ideas (Al-Shiha 2020). Learners with LDs also lack sufficient vocabulary to construct correct sentences that include the integrity of grammatical rules, which negatively affects the quality of what they write.

Handwriting disabilities are reflected in the failure of students with LDs to draw letters in the correct shape and size so that they fit with the rest of the letters within the written word or text. They also involve the difficulty of placing the words and letters on the line, as they may go up or down, which is attributed to their failure to hold the pen in the correct way (Zaidan 2021).

Access of learners with LDs to the general education curriculum

Students with LDs who spend most of their time in mainstream classrooms encounter behavioral, social, and educational challenges that negatively affect their performance in the classroom. Among the most prominent challenges they face are the restrictions imposed by the school curriculum, which deny them the right to be equal with their peers in receiving information from educational sources. Furthermore, the curriculum is not designed in a way that meets their needs or takes into account their requirements, which consequently leads to the emergence of an evident disparity between students with LDs and their regular peers in acquiring and retaining academic skills (McGrath and Hughes 2018; Alqarni and Al-Salem 2019).

Thus, it is essential for education systems to design curricula that take into account the diversity of learners, including those with LDs (Basham et al. 2020). The educational institution staff needs to be empowered to create a supportive environment for students with LDs by applying the appropriate methods to communicate with them and teaching them principles and strategies that will enable them to increase their levels of interest in the content presented. Such efforts will facilitate their access to and allow them to benefit from the curriculum, consequently contributing to their academic achievement. (Johnson and King-Sears 2020).

Universal design for learning

The UDL philosophy emerged from a system of architecture called the universal access system, which focuses on making the environment available for use by all individuals. In the education domain, the concept of UDL is based on neuroscience and the study of brain function and performance through the provision of an integrated study environment that meets the distinct needs of students in the classroom (Green 2017).

According to Hamilton (2020), the UDL concept is an educational method that enables teachers to plan well for teaching by removing obstacles and barriers (intellectual, cognitive, and physical) that prevent students from learning effectively while taking into account content preservation and the curriculum requirements as much as possible. It is a way to enable regular students and those with LDs to achieve educational goals within a single-classroom environment.

The concept has multiple connotations. The word "universal" clearly refers to inclusiveness, which is concerned with providing diverse learning opportunities for all students with different educational abilities so that they are given enough space to use their previous experiences and strengths to benefit from what is offered to them. "Learning," however, requires students to be motivated so that there is harmony between the three brain networks (what, how, and why to learn). In other words, motivation requires the individualization of education and the involvement of everyone in the educational process with equal opportunities, and this is achieved through "design," which is reflected in the flexible planning of the

presentation of study materials, and support for students' access to the information and knowledge included in the curriculum (IDA 2021).

UDL principles

The Center for Applied Special Technology (CAST 2018) took the lead in adopting UDL principles since they emerged from the US state of Massachusetts in 1984. CAST created a conceptual framework that highlighted the importance of the principles and identified the foundations on which they are based, the environmental requirements, and the educational adaptations necessary to apply them. The framework also enables students with LDs to benefit from and generalize the skills and knowledge they receive in their school day.

Hence, the UDL principles can be defined as guiding foundations for teachers to create a supportive educational environment that provides fair opportunities and takes into account the diverse types of learners within the classroom to achieve effective learning and optimal access to all curricula. This is achieved through simultaneous work between brain networks (cognitive, strategic, and affective) and the three principles of UDL (Ikebuchi 2019), which, according to CAST (2018), are to:

1) Provide multiple means of participation and interaction centered around the emotional network in the brain, which seeks to increase the motivation to learn by raising the question of why to learn. It also aims to enable learners to enjoy independence in learning and to reduce the fears and external influences that hinder their interactions with the content presented to them. This principle is reflected in encouraging work within learning groups or learning with peers, in addition to providing feedback and stimulating reinforcements to the spirit of competition, taking into account the preservation of the entity of each learner and the opportunity for everyone to interact and participate according to what suits their abilities.
2) Provide multiple means of presenting and displaying information based on strengthening the cognitive network in the brain by stimulating the cognitive and creative efficiency of learners (what to learn). This is reflected in presenting the content using a variety of visual and audio methods and tools or educational alternatives that lead them to discover the content according to their preferred learning styles. It is essential to build the lesson on these aspects as well as focus on the tools that are limited to the auditory aspects.
3) Provide multiple means of performance and expression based on stimulating the strategic network in the brain, which allows learners to meet their goals, implement the strategies assigned to them, and show what knowledge they have acquired. This is executed by asking about what they learn, an inquiry that enables them to employ educational methods that develop their self-monitoring of progress, and the acquired study skills in the form of illustrated videos, mind maps, or representative stories, according to their inclinations, desires, and abilities.

Applying UDL principles

Applying UDL principles requires teachers to be mindful while planning lessons and includes activities and methods that enable all learners to reach the target skills. A sample mechanism for applying the UDL principles in the classroom presented by Johnstone et al. (2018) involves several steps.

First, the title of the lesson is determined (identifying the main areas in the state and pinpointing their locations on the map).

Second, the material is presented by displaying an explanatory video or illustrative card showing the names of the main areas in the state and showing their locations on the map, making sure to characterize each region by a different color during its representation on the map (the principle of providing multiple means for presenting and displaying information). Third, a blank map of the state is displayed, and the learners are asked to name or write one of the main areas and indicate its location verbally or in writing (the principle of providing multiple means to express understanding).

Lastly, the learners are given the opportunity to participate by telling personal or fictional stories of their visits to one of those areas, and cooperating with each other in implementing their experiences in the form of an article, illustration, or a representative scene (the principle of providing diverse ways of participation and interaction).

Al-Jabri and Al-Husseini (2020) conducted a study aimed at identifying the extent to which teachers apply UDL principles to students with intellectual disabilities. The authors found that most teachers applied the UDL principles by organizing the classroom environment according to the educational needs of their students, in addition to employing the strategies in cooperative learning groups or on an individual scale. Students were also assigned tasks of graded difficulty, considering individual differences and extra-curricular activities that enabled them to socialize with their peers in the mainstream classroom.

Alquraini and Rao (2020) evaluated the knowledge and willingness of teachers to apply UDL principles in the classroom. They confirmed that 61% of the respondents showed insufficient knowledge of UDL, which is due to receiving no training during educational preparation, in addition to inadequate professional development. Further, 75% did not apply UDL in their classrooms, which may be because the field of education lacks guidelines that introduce UDL and the mechanism of its applications in the classroom.

However, Boxtel and Sugita (2019) argued that teachers use most of the UDL principles by planning their lessons and defining the mechanisms and objectives of implementing educational activities and tasks assigned to learners, such as conducting discussions with peers and assigning educational photo clips and concept maps as educational assignments. This has an impact on the interaction of learners with the academic skills offered to them, and their keenness to personalize their assigned assignments, in addition to supporting the constructive communication of students with LDs with their peers in the classroom.

In Chavaria et al.'s (2019) study, which aimed at assessing the extent to which teachers know and include UDL principles, the results showed that teachers' knowledge of UDL principles is limited and does not go beyond the knowledge of the nomenclature of these principles (requirements and mechanisms of applications in the field of education), which, no doubt, curbs their effective use. The results also suggest that teachers need to be trained in ways to apply these principles in conjunction with educational strategies so that they can include their students with LDs in their classrooms.

In an investigation of the impact of using the UDL principles with learners with LDs, Alquraini (2022) argued that there is a scarcity in using these principles with learners with LDs and that activating these principles enables those learners to face their challenges, namely, the difficulties associated with insufficient knowledge and incomplete schoolwork. Moreover, it also contributes to their access to and benefits from the school curriculum.

Johnson and King-Sears (2020) also found a positive impact of teaching chemistry using the main UDL principles on students with LDs or those at risk. The study concluded that applying the three main UDL principles through the use of motivational applications, digital timers, displaying educational content in the form of scientific experiments, and activating the role of the Padlet application increased the motivation of learners with LDs toward learning chemistry and led to their improved participation and interaction with the educational process, in addition to their academic achievement.

The use of educational games in science education to teach learners with LDs according to the UDL principles proved to have positive benefits, as the researchers confirmed that the performance of learners with LDs who were taught using video games improved, and their participation in the educational process increased, due to the fact that video games contain various exercises that allow the user to repeat the training, and correct errors automatically (Marino et al. 2014).

Al-Awamra (2019) examined the impact of UDL by teaching a geometry unit based on UDL. The author confirmed that the application of the UDL principles contributed to reducing educational obstacles by providing equal opportunities for learners to receive educational content by diversifying the use of educational alternatives—pictures, films, and exercises—and enabling students to interact with them and give them the opportunity to express what they have learned according to their understanding, in addition to developing their geometry-based thinking. Further, Saliba (2019) stressed the need to train teachers on how to use UDL principles and assess their impact on the academic achievement of regular students and those with LDs to enable them to access and benefit from general education curricula.

We believe that this study is the first Arabic study to examine the application of the UDL principles to a sample of general education teachers working in schools with LD programs and to reveal the impact of applying these principles on individuals with disabilities using a qualitative approach that included interviews, class observations, and analysis of school documents to address the research questions.

Methodology

Study Design

In light of the nature of the current study and in response to its objectives and questions, the qualitative approach, whose features and designs reached the point of maturity in the late nineteenth century, was used. The qualitative approach is concerned with identifying the meanings and implications adopted by the participants to produce and present a clear picture of the studied problem by reviewing the participants' viewpoints in an organized and coherent manner (Al-Qahtani 2019). Phenomenology was employed as the research design in this study(Avcı,2022; Türker& Silman,2020). Abdul Karim (2020) argued that relying on a qualitative approach to extrapolating educational phenomena fills a deep gap in the knowledge background of schools and learners and leads to a deeper understanding by becoming familiar with the interaction between the elements of the educational process within the classroom environment. This is evidenced by experiencing educational situations and discovering the mechanisms of learners' interactions with what is presented to them. Regarding the questions of the current study, the case study was employed, as it is one type of qualitative approach and includes a detailed and accurate examination of a specific situation to reach a deeper understanding of the problem

studied within its context for a group of individuals or a particular classroom in a school (Al-Rashidi and Faraj 2019).

Study sample

Al-Saeed (2020) stated that quantitative methods require that sample sizes be large enough to meet the requirements of statistical tests, whereas qualitative methods' sample should consist of a small number of participants (5-10) to create an in-depth understanding that leads to achieving the objectives of the study, and answering its questions (Poles 2020). Al-Qahtani (2019) added that the sample in the case study should range from four to five people. Thus, the number of participants in the current study was five general primary education teachers in the upper grades (fourth, fifth, and sixth) in a school in Jeddah that implements an LD program (3 males and 2 females). The sample was intentionally chosen, and the selection criteria included having knowledge of UDL principles, teaching upper primary grades with LD programs in the city of Jeddah, and having worked in schools with LD programs for no less than 5 years.

Data collection

In accordance with the requirements of this study and the nature of the data to be collected and the approach followed, interviews, and class observations were used, and school documents were reviewed.

Interviews

The study adopted a semi-structured interview with general education teachers in the upper grades affiliated with schools that apply an LD program. An interview is an ideal way of collecting the largest amount of detailed information about the actual application of UDL principles, in addition to its impact on enabling learners with LDs to access the curricula. An interview is an organized personal communication and direct verbal interaction carried out by an individual with another individual or group of individuals, aiming to elicit certain types of information and data for use in scientific research in order to analyze a particular phenomenon and diagnose the difficulties it faces and describe how it can be dealt with (Obaidat et al. 2020).

We conducted a pilot study to test the instrument (interview protocol) with three participants who had the same characteristics as the study participants, and the interview protocol was improved to meet the purpose of the study. Face-to-face and online interviews (30–40 minutes) were then conducted, recorded, and transcribed.

Observation

This is the most well-known method in qualitative research for collecting information and is of great importance in the field of education, as educational experiences need to be observed by the researcher in their actual environment. Observation requires the researcher to write a detailed description of all events or dialogues observed or heard within the study site (Abdul Karim 2020). Six observations were conducted in several subject areas: one for each teacher of four teachers and two for the fifth teacher.

School documents

The documents were written, illustrative, or handmade materials that enabled us to extract information about the studied problem. The importance of these documents lies in revealing what was not said in the interviews or seen through observation. The documents were complementary to the interviews and observations, as they deepened and informed the qualitative analysis (Abdul Karim, 2020). Several documents were analyzed, including electronic sources,

lesson planning, grade books, worksheets, and online assignments.

Data analysis

Data analysis helps in the organization and examination of the collected data, which allows the researcher to see patterns, identify topics and reveal relationships and links between them (Abdul Karim 2020). We used objective analysis of the data, since it contributes to flexibility in the analysis of qualitative data. It is an ideal way to identify, analyze, and report on topics within the data (Pearse 2019).

The data analysis procedure involved several phases. The first phase was organization and familiarity, which aimed to organize the data collected from the participants by making a backup copy of the observations and interviews to avoid any potential damage. The contents of what was copied were then reviewed for a deeper understanding, followed by its transformation into a text written using Microsoft Word. To ensure the validity of what was written, it was revised against the original text. This was followed by the transfer of the Word document to the NVivo program, which helped us perform a set of tasks easily.

The second phase was encoding and reduction, in which the researcher wrote down some independent notes from the data that were recorded to link them later with the theoretical framework. This was demonstrated by reading the content of the data and dividing it into several paragraphs, assigning codes for each paragraph, and then giving it an appropriate title. It may be pointed out that at this stage, the researchers revised the topics and determined the final ones that would be the basis for the interpretation of the study problem.

The third stage was the interpretation and representation phase. This step refers to the interpretation of the data by examining the relationships between the participants' viewpoints, and the similarities and differences between them, in addition to linking this interpretation to the previously identified topics.

Results and Discussion

Results of the first question

To answer the first study question, "What is the current state of general education teachers' application of the UDL principles?", the study identified two major themes: general education teachers' knowledge of the UDL principles and their application mechanism of applying these principles.

Findings supporting the first major theme were class observation and interview data, which indicated that the teachers had a knowledge background of UDL and how to employ it in the educational process, and this was confirmed by all participants. Participants (1) and (2) said, "I am interested in the latest developments of UDL and will do my best to employ it to help my learners," while Participant (4) stated, "I discovered that what I used to do in my classroom is an application of these principles," adding that, "At first, my "knowledge of UDL was superficial".

These findings are consistent with the study by Al-Jabri and Al-Husseini (2020), which revealed that teachers have a knowledge background of UDL principles. However, the results contradicted those reported by Alquraini and Rao (2020) and Chavaria et al. (2019), who found that teachers' had limited knowledge about the applications of UDL principles in different learning environments.

Regarding the second major theme, the study identified three sub-themes related to the UDL principles that are applied in the classroom: providing multiple means of participation and interaction, displaying information, and understanding and expressing performance.

Providing multiple means of participation and interaction

Class observations showed that multiple means of participation and interaction were used according to subject area and stage. According to the participants, activating cooperative learning groups, creating a classroom environment, and diversifying activities and tasks according to the inclinations and needs of learners were some of the most prominent ways.

This principle was applied by providing options to attract the learners' attention and urging them to exert their effort and be perseverant. Its application contributed to discussions between peers and the acceptance of reactions and positive interaction, which enabled the learners to be in harmony with each other and engage in carrying out their tasks. This was evidenced through cooperative learning groups, whose roles were to provide opportunities for learners to choose their roles within the scope of this group, support each other, and maintain a spirit of challenge and fair competition with other groups according to the rules set by the class teacher.

Further, classroom activities were designed in a way that appealed to the interests and desires of the learners so that they could interact with the activities. The activities included various forms, such as audio, visual, or kinetic, and those that served all senses. Participant (4) agreed with this result by stating, "Regular students interact with students with LDs through integration in performing the tasks required for role-playing, and they support students with reading disabilities by "reading what has to be done." In the interview with Participant (5), she indicated that role-playing and exchanging knowledge "makes students with LDs discuss with their friends the distribution and selection of roles and suggest to them the method of representation."

Providing multiple means of presenting information

The study findings identified the multiple means of presenting information used with learners with LDs in the mainstream classroom according to the UDL principles, which included the use of various educational materials such as models, PowerPoint, and video presentations, graphs, learning tables and concept maps.

All participants agreed with the delivery of the lessons in a variety of ways that serve the needs of learners, consider their abilities, and enhance their benefit from the curriculum information. In the interview, Participant (3) claimed, "I use various methods to present my lessons and I follow this rule: you will be able to observe the results everywhere if the information is delivered in an appropriate manner for each student". Participant (1) confessed that their class was "all about chat and information related to the lives of my students."

These findings support those of Almumen (2020) and Salbia (2019), who argued that presenting information in a variety of ways, including educational videos, technical games, and graphics, enables regular learners and those with LDs to receive information more effectively and enhances their self-learning.

Thus, it is essential to determine the main requirements for applying UDL: goals, activities, expectations, etc., according to the needs of learners, to allow them to discover their latent abilities and apply them in the educational process. It is also necessary to include educational practices that support participation and interaction. Mackey (2019) argued that defining goals and expected outcomes creates personal connections to the learning content, which enables learners to interact with what is learned, since it is related to their tendencies and hobbies. Such connections should be enhanced by a partnership between regular and learners with LDs,

which will stimulate interaction and the exchange of experiences, as this interaction will reduce the difficulties related to the learning content.

We found that all participants managed to provide multiple means to present and display information using multiple educational strategies, such as peer education, multiple-sense strategy, practical activities, multiple intelligences, and cartoon characters. This result is related to one of the main foundations of UDL, that is, the accessibility of all learners, including learners with LDs, to learning contexts (CAST 2020; Iris 2020).

Based on the data presented above, the current study is consistent with the findings reported by Al-Jabri and Al-Husseini (2020), Al-Awamrah (2019), and Saliba (2019), who indicated that providing multiple means of presenting information refers to the diversification of strategies and educational activities that allow students to access the curriculum information with ease.

Providing multiple means of understanding and expression

Based on the interviews, all participants affirmed that they provided their learners with various options to allow them to express their understanding of the study skills, in addition to educational alternatives appropriate to their abilities. They also allowed their learners to monitor their self-learning progress.

We argue that providing participants with multiple means to enhance their performance and express their understanding allows them to solve the educational problems they may encounter using the specific tools available in the mainstream classroom.

Further, learning becomes more enjoyable and impactful when the outputs of understanding are based on discussions with peers. Participant (3) referred to the use of a variety of assessment tools that "provide learners with multiple opportunities to express their learning, including oral assessment, writing the math problems for students with learning difficulties in a bigger font size, and allow them to use a calculator".

Participants (2) and (5) added that they tried to give learners enough time to express their understanding of the content while giving them immediate feedback.

These observations are consistent with those of Boxtel and Sugita (2019), who claimed that UDL-based discussions with peers make learners interact with what they are learning, and support constructive peer communication that contributes to learning retention.

Notably, participants' diverse use of the three main principles of UDL—providing multiple means of participation and interaction, presenting information, and expressing understanding and performance within the mainstream classroom with students with LDs—was prominent evidence of the application of UDL, which aims to provide opportunities for learners to benefit from educational data in accordance with its principles (CAST 2020).

We found these findings consistent with the reports of Alquraini (2022), Almumen (2020), Boxtel and Sugita (2019), and Saliba (2019), who sought to apply the three main principles of UDL in different educational environments within various geographical scopes.

Results of the second question

The second study question is, **"What is the potential impact of general education teachers' application of the UDL principles on empowering people with LDs to access the school curriculum?"** In response to this question, the results of this study indicated, through classroom observation, that the application of UDL in classrooms with students with LDs helped

reduce the barriers and challenges that these learners faced during learning, through the activation of cooperative learning groups that enabled learners with LDs to cooperate and converse with their peers, build social relationships, and share tasks. According to Participant (1), these groups "have a distinct impact on learners with LDs by allowing them to interact and express their opinions and encouraging their peers to give them space to speak."

The usefulness of the UDL application was also demonstrated in providing the necessary flexibility to access knowledge by allowing learners to practice interactive games based on subject content. Participant (2) highlighted that "Students feel excited when their assignment takes the form of the games in the Wallet educational application; they learn more and they also ask for more games".

Similarly, the participants expressed their wish to implement UDL principles in all domains and stages of education. This is because this knowledge helps learners practically achieve their educational goals and meet their academic needs, regardless of whether or not they have disabilities. Participant (2) stated that based on her 17-year experience, "All teachers should be introduced to these principles due to their deep impact on both teachers and students". We believe that the application of the three main principles of UDL led to the enhanced interest of learners with LDs in the educational content and made them accept the learning process with passion. It also enabled them to access the curricula with ease, and retain their learning, and as a result, improved their academic achievement (Flis Jr. 2020). This result is consistent with the idea of CAST (2020), which stated that the application of UDL provides multiple opportunities for learners, which gives them access to and benefits from the curriculum, positively affects their self-efficacy, and motivates them to engage in educational tasks.

These findings align with those of Alquraini (2022) and Johnson and King-Sears (2020), whose findings highlighted the impact of applying UDL principles to allow learners with LDs to access and benefit from the curriculum. It also agreed with Al-Awamrah's (2019) and Marino et al.'s (2014) findings that applying UDL with learners with LDs increases their participation in the educational process and provides an opportunity to express what they have learned.

Conclusion

This study aimed to investigate the implementation of UDL by general education teachers in teaching schools' curricula. The study focused on teachers' experience of using UDL principles in inclusive education to enable students with LDs to access the general curriculum. Qualitative research has been used to achieve the purpose of the study. Through, observations, interviews, and document reviews data were collected. The study showed that teachers had knowledge of UDL principles which they implemented in their teaching practices. Furthermore, the implementation of UDL in general classrooms motivated students with LDs to learn and succeed. Thus, UDL implementation was beneficial for all students including students with disabilities. It created a supportive learning environment that meets all learners' needs.

Recommendations

The researchers recommend that the Saudi Ministry of Education urges its decision-makers to develop guidelines for educational practitioners in the two educational domains—general education and special education—that aim to define the UDL and the mechanism of its application in the educational field. Educational practitioners are also urged to computerize educational activities and assignments to support the application of

the UDL principles. Furthermore, creating an Arabic platform as a reference for UDL is essential.

Empirical or case-based studies are recommended to investigate the impact of UDL principles across subject areas. Moreover, we recommend conducting studies on the attitudes of teachers of students with LDs toward applying UDL principles and their application, in addition to university-wide research investigating the extent to which faculty members apply UDL principles. We suggest conducting a similar study on the scale of the various cities and governorates of the Kingdom of Saudi Arabia, and a proposed program for planning educational content in accordance with UDL principles may be carried out.

Compliance with Ethical Standards

Conflict of Interest

The authors declare no potential conflicts of interest with respect to the research, authorship, and publication of this article.

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