The Vygotskian Approach: Natural Phenomenon Narrations by Adolescents with Mild Intellectual Disability

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ABSTRACT:
Story narration, often referred to as storytelling, is traditionally used by educators to effectively convey knowledge across various domains, including academic, social, and moral concepts. Rooted in Vygotsky's Zone of Proximal Development (ZPD), this qualitative study explored the impact of graduated prompting as a form of dynamic assessment within the framework of story narration on the understanding of natural phenomena in science by Kuwaiti students with mild intellectual disability (ID). Findings revealed that the application of the Vygotskian approach enhanced the comprehension of weather-related concepts among Kuwaiti students with mild ID. Following instruction, participants could narrate the story about the weather and link these scientific concepts to changes in the local climate. Recommendations and implications for future research and practice are provided.

Keywords: Zone of proximal development (ZPD), story narration, intellectual disability

INTRODUCTION

In the United States, the passing of the Individuals with Disabilities Education Act (2004) and the No Child Left Behind Act (2001) mandated that students with disabilities gain as much access to learning opportunities and the general education curriculum as possible (Spooner et al., 2008). These laws led educators to explore more effective instructional techniques and appropriate scaffolding for students with disabilities (Clarke et al., 2016). The Kuwaiti National Legislation took similar steps for students in Kuwait with the passage of Individuals with Disabilities Affairs of 2010, Law No. 8 (2010). This law emphasizes that all students, including those with special needs, should have access to the general education learning environment. Every student has the right to access scientific knowledge and to acquire the needed discovery skills inherent to the scientific process (Knight et al., 2020). In addition to being inclusive, opportunities for science learning should be culturally relevant (Moldavan & Gupta, 2024).

The Next Generation Science Standards (2013) provide guidelines for creating, supporting, and sustaining equitable science education for all learners, including those with special needs, with the aim of accelerating science learning opportunities for all students. The Ministry of Education National

Standards (2025) provide science standards for elementary students that focus on teaching students the skills of investigation. These standards also encourage students to observe the environment around them, including living creatures (both plants and animals), natural phenomena, and technology connected to their learning. Jasim (2002) highlighted that science standards concentrate on helping students improve their scientific practices, mental and functional skills, and understanding of natural phenomena. To meet the requirements of these national and international standards, it is essential to equip students with effective tools that enable them to "organize and respect scientific contributions" throughout their daily life (Moldavan & Gupta, 2024, p. 70). This objective can be achieved through innovative instructional strategies that help students cultivate their identities as scientists and empower them to apply their acquired knowledge in future endeavors (Cross et al., 2020).

One effective method for preparing students to engage with the scientific process is the integration of storytelling. The incorporation of narratives as a pedagogical approach in science education has gained traction in recent decades (Hu et al., 2021). According to Wilcox et al. (2015), effective science instruction is achieved by promoting a deep conceptual understanding of science concepts. By using stories to communicate scientific information, educators can inspire solutions to scientific challenges and encourage students to participate more actively in their learning activities (Gursoy, 2021). Furthermore, stories help learners elaborate on their scientific observations and experiences, facilitating connections between what they learn and the natural phenomena in their surroundings (Eun, 2018).

Educators have used storytelling effectively to convey knowledge across academic, social, and moral domains. Existing literature defines narration as the act of telling a story in a sequential and consecutive order of ideas, incidents, and themes. Such narration includes relevant macrostructure, vocabulary, and syntax (Altman et al., 2022; Labov, 2013; Westby & Culatta, 2016). Barnes and Baron-Cohen (2012) assert that an individual's ability to grasp events, moral values, and factual information from stories is related to their ability to understand information and social cues. Hadzigeorgious (2016) and others specifically note the efficacy of narrating scientific information through stories. Story narration facilitates science education (Moldavan & Gupta, 2024) by improving students' understanding of scientific concepts (Engel et al., 2018) and fostering positive attitudes toward science practices (Ayra & Maul, 2012). Avraamidou and Osborne (2009) emphasize that storytelling links both logical and emotional aspects of an individual's thinking, thereby enabling a more holistic approach to science education. Hu et al. (2021) explain that through story-based science education, children acquire knowledge that extends beyond basic understandings such as "the shape of the Sun" or "the day/night cycle" (p. 9). Through engaging with stories, children have the opportunity to develop a deeper comprehension and appreciation of the natural world that is intricately connected to their experiences (Eun, 2018).

Story narration teaches science concepts by using students' previous experiences as a scaffold for building additional knowledge (Pang et al., 2021). Yet, learning scientific concepts can be challenging for individuals with intellectual disability (ID) due to their deficits in information processing and cognitive development (Lifshitz, 2020). Children with ID may also experience difficulties in reasoning, abstract thinking, and problem-solving (American Psychiatric Association, 2013). Thus, students with ID need a high level of support and scaffolding in academics (Emerson et al., 2016; Fletcher et al., 2018). These supports should help students with ID make connections between various topics they have learned, improve upon learned skills to gain new ones, and generalize skills to other environments (Jacob et al., 2024).

In addition to helping students with ID learn academic material, story narration may be a useful tool for gaining adaptive skills. Adaptive skills are known to be an area of difficulty for individuals with ID (Buntinx, 2016). Accordingly, individuals with ID often benefit from additional time, effort, repetition, and personalized instruction to learn appropriate reactions. Individualized Education

Programs (IEPs) and similar documents outline educational goals, modifications, and strategies that tailor instruction to specific students according to their needs (Bryant et al., 2020; Timothy & Agbenyega, 2018). Story narration might be an effective strategy to include on an IEP for a child with ID.

Story narration has emerged as an effective and personalized instructional technique for teaching educational content to children with disabilities, especially those with ID (i.e., Brug et al., 2012, 2015, 2016; Mpofu, 2021; Penne et al., 2012). According to Alonso-Campuzano et al. (2023), story narration allows children to construct knowledge through a complex socio-cognitive function that encompasses language and event representation. Storytelling requires children to recruit basic skills of communication, language, and memory. As children develop these skills, they are better able to explain information, form accurate judgments, interact with others, and share their memories, beliefs, ideas, fantasies, and thoughts (Jacob et al., 2021).

Vygotsky's sociocultural theory helps explain how the construction of knowledge is connected to child development; Gauvain (2020) describes Vygotsky's sociocultural theory as "the study of mind" (p. 446). In a sociocultural approach, the focus is on the mediation between the child and the environment, people, and items around them. The tools of a culture, such as language and communication, are used to facilitate and guide the child's thinking, contributing to their cognitive development. In addition to supporting the child's thinking, these tools also regulate their interaction with themselves as well as with peers, adults, and the world around them. In this sociocultural model, socialization is viewed as foundational to a child's development (Gauvain, 2020).

One of the key concepts of Vygotsky's social cultural theory is that of the Zone of Proximal Development (ZPD), defined as "an overarching concept that integrates the main tenets of Vygotsky's theory of human development" (Eun, 2018, p. 19). The ZPD represents the space between what a child can do independently and what they can do with the guidance of an adult or more capable peer (Gauvain, 2020). Eun (2018) demonstrated how scientific concepts involving animals, plants, and weather intertwine with adaptive tasks such as self-care, personal hygiene, and eating habits through the lens of Vygotsky's ZPD. Scientific themes are typically learned through formal instruction facilitated by a more knowledgeable individual (e.g., a teacher or more capable peer) within a structured, systematic, social setting, such as an inclusive classroom (Hu et al., 2021). Conversely, daily concepts are often assimilated through informal interactions with others and their surroundings, without the need for systematic instruction. One such example is a child learning from their mother how to clean up following a meal.

Eun (2018) highlighted that according to the ZPD model, these two categories of concepts are interdependent in a child's developmental trajectory, requiring the involvement of capable individuals to support the child's learning process. Daniels (2007) further asserted that everyday concepts serve as a foundation for the acquisition of scientific concepts. These everyday concepts help children, especially those with ID, to better comprehend both concrete and abstract ideas relating to their daily life, thereby facilitating generalization (Robbins, 2009). Vygotsky's emphasis on structured instructional programs is crucial for enhancing children's understanding of scientific concepts beyond their daily routines (Hu et al., 2021). This principle will be reflected in the story narration method utilized in the current study.

Vygotsky (1978) posited that children learn through active social interactions with their peers and adults. He added that such social interaction plays a key role in the process of cognitive development. Through these interactions, young learners develop their awareness of their environment. Teaching facilitates the learners' incipient mental functions to better understand the concepts they encounter (Vygotsky, 1934). Vygotsky explained the ZPD as a recursive process, with different developmental levels. The child's cognitive functioning co-occurs with two levels of development: their circle and the circle of the more knowledgeable individual. The child's circle is their actual developmental level, in which the child can

independently perform the skill. Then, there is the potential developmental level, in which the child can complete tasks with the help of more knowledgeable individuals. Chaiklin (2003) stated that Vygotsky adopted the connotations of proximal development from others, giving it new life in his learning theory. In the classroom environment, a child's ZPD can be assessed through worksheets, group work activities, quizzes, and projects. Chaiklin (2003) emphasized that when a child interacts with the teacher or a more capable peer, the child will improve their ability.

In story narration, Vygotsky's ZPD is applicable as a child improves their ability in the skills discussed throughout the story by the teacher. The child absorbs concepts and major themes, especially if the narrator is enthusiastic, uses more facial expressions, and represents themes with more visual and audio aids (Altman et al., 2022). Vygotsky categorizes these supports as scaffolding. This more competent individual acts as a mediator between the learner and the knowledge or skill the student needs. Examples of possible scaffolds include explanation, interpretation, modeling, visuals, aids, hands-on assistance, graphics, and cooperative learning strategies (Ovando et al., 2003). The expert leads the novice to successive zones using scaffolds (Sarmiento-Campos et al., 2022). Thus, scaffolding is one of the underpinnings of the ZPD.

Vygotsky used the term "defektologia" to describe individuals with special needs (Smagorinsky, 2012, p. 1). This term encompasses all extranormative human characteristics that affect learning development, including learning disabilities, abnormal psychological traits, sensory difficulties, motor impairments, and low cognitive functioning (Smagorinsky, 2012). Kotik-Friedgut and Friedgut (2008) explained how Vygotsky's prior childhood experiences of anti-Semitism and the Jewish genocide created deep, lifelong feelings of exclusion, motivating him to pursue the study of defectology and the inclusion of all learners. According to Smagorinsky (2012), "Vygotsky situated variations from the evolutionary norm in the context of his broader emphasis on human development, rather than taking the customary approach of attempting to amplify the underdeveloped or absent capacity toward the norm" (p. 10). Vygotsky viewed children with impairments as simply impeded by a defect (deficit), developing differently than their peers without disabilities (Vygotsky, 1993). Thus, he posited that such children could be educated with the help of social mediators (Vygotsky, 1987).

In summary, Vygotsky's (1978) work centered on understanding and maximizing children's potential abilities, as well as on how these abilities develop through their interactions with the world around them. As noted by Rutland and Campbell (1996), "Indeed, Vygotsky himself was very concerned with applying his theory of the ZPD in the context of children with intellectual disabilities" (p. 151). Vygotsky emphasized that children's active engagement in social and cultural interactions—with peers and adults—serves as a foundation for their learning and developmental processes (Bonti, 2022). Children develop concepts through a process of "internalization", whereby learning is transferred from the social-interactional level to the individual-interaction level; mediators, such as teachers, guide this development.

Lantolf and Poehner (2010) discuss the importance of assessing a child's ZPD, as opposed to evaluating only their static ability when left to themselves. A Vygotskian approach to this kind of assessment involves the use of graduated prompting and is often referred to as dynamic assessment (DA). Bekka (2010) highlights that through DA, interaction between educators and students can foster the emergence of each child's ZPD, ultimately revealing their potential. In this context, graduated prompting creates an interplay between instruction and assessment, enabling educators to ascertain students' capabilities and enhance students' functioning at the individual-interaction level (Daneshfar & Moharami, 2018).

In essence, DA is a structured approach to aiding children in completing tasks after receiving prompts or hints (Marhani et al., 2023). Gauvain (2020) asserts that DA, as a measure of the ZPD, involves monitoring the number of prompts necessary for a child to accomplish a task. Coogle et al. (2019) elaborate that a consistent sequence of

prompts can motivate children to perform to their fullest potential. DA provides valuable instructional supports and scaffolds that predict a child's capability (Poehner, 2008). Daneshfar and Moharami (2018) underscore the vital role of DA procedures for both teachers and students, positing that they provide deep insights into learners' capabilities, revealing areas of weakness while offering a specific method of support.

Research Purpose and Question

This study examined the role of the ZPD within story narration in helping Kuwaiti students with mild ID understand scientific concepts related to local weather conditions. To achieve this objective, the following research question was formulated: In what ways does story narration, presented within the ZPD, facilitate the ability to narrate Kuwaiti weather conditions and relate these conditions to everyday life among students with mild ID?

METHODOLOGY

Design

This study employed a qualitative research paradigm, specifically using a case study approach to explore the role of the ZPD in story narration and its impact on the comprehension of scientific concepts among four Kuwaiti students with mild ID. As noted by Creswell (2009), case studies are characterized by their intensive focus on particular instances situated within their relevant contexts, environments, or fields. Furthermore, Glesne (2011) highlights that, "Qualitative studies are best at contributing to a greater understanding of perceptions, attitudes and processes" (p. 39).

Ethical Approval

Four students with mild ID were purposefully selected. Ethical approval for the study was first secured from the College of Education at Kuwait University. Following this approval, formal consent was obtained from the Special Education Administration District under the Ministry of Education. Once the necessary administrative approvals were in place, the primary researcher, in collaboration with the grade-level coordinator and assistant principal at the selected school, identified potential participants. Written consent forms were obtained from the participants' legal guardians before research activities began.

Participants/Sample

The school selected for this study is a part of a special education school center located in Hawalli, Kuwait. The complex houses nine schools for boys, eight for girls, and one kindergarten, with each institution dedicated to a specific category of disability. The school selected for this study serves girls between the ages of 10 and 20 years with mild, moderate, and severe ID.

Four middle school students with mild ID attending this school participated in the current study. After the ethical approval process was completed, the grade-level coordinator and assistant principal consulted student records and the classroom teacher to choose appropriate participants for this study. It was a sample of convenience. All research activities were conducted in the participants' classroom within the self-contained special education school.

Eligibility criteria for participant selection included: (a) middle school students between the ages of 14 and 16 years; (b) an official diagnosis of ID from the Public Authority of Disabled Affairs in Kuwait; (c) a full-scale intelligence quotient (IQ) between 68 and 70, as determined through assessments administered by psychologists or psychometric examiners licensed through the Public Authority of Disabled Affairs in Kuwait; (d) native Arabic speakers; (e) at least one science-related goal on their IEP and teacher's daily classroom objectives; (f) ability to understand modified or simplified classroom directions; (g) capability to comprehend step-by-step, explicit academic instruction with modified content; (h) ability to remain seated and maintain attention to adult instruction for 20 to 25 minutes; (i) absence of observable behavioral disruptions.

To ensure confidentiality throughout instruction, data collection, and data analysis, pseudonyms were assigned to all participants. Table 1 presents the demographic information of all participants.

Table 1

Participants' Demographic Information

Participant	Chronological Age	Ethnicity	IQ [a] Score	Disability Category [b]	Disability Severity Level	Primary Language	Rehabilitation/ Grade Level [c]
Raghad	14	Caucasian	70	ID	Mild	Arabic	6th
Rawan	15	Caucasian	70	ID	Mild	Arabic	6th
Retaj	16	Caucasian	69	ID	Mild	Arabic	6th
Reham	14	Caucasian	68	ID	Mild	Arabic	6th

Note. [a] Intelligence quotient test: Arabized Stanford-Binet, IV; [b] intellectual disability; [c] school levels are called rehabilitation and/or grade levels. These levels concentrate on training in behavioral, functional, social, and life skills along with simple academics of science, math, Arabic language arts, social studies and religion.

Materials

iBook Story Transcript

Science content in the Grade 6 textbook included the following topics: Unit 1 - Humans and Water, Unit 2 - Natural Phenomena and Seasons of the Year, and Unit 3 - Environment and Pollution. The weather conditions lesson found within "Unit 2 - Natural Phenomena" was chosen as a good lesson to teach through storytelling. Main ideas presented in this lesson included: (a) higher temperatures are experienced in the summer; (b) Kuwait summers bring hot air, sunny days, and sandstorms, while Kuwait winters are typically dry and cold with some windy and rainy days; (c) Fall and spring in Kuwait are agricultural seasons.

After reviewing the core concepts of the lesson, the second author translated and modified the story, *What Will the Weather Be Like Today?* by Paul Rodgers (1989), to accommodate the participants' learning levels and include the main science content (i.e., Kuwaiti climate) from the Grade 6 textbook. This adopted transcript was named *What Will the Weather Be Like in Kuwait Today?* and converted into a digital format using the Pages application on a MacBook Pro 13. The digital version of *What Will the Weather Be Like in Kuwait Today?* was created according to the main principles of Universal Design for Learning (CAST, 2025), in which the content was reinforced with multiple media forms: written text, audio narrations of the text, images, and audio of relevant terms such as storms, rain, and tweeting birds. *What Will the Weather Be Like in Kuwait Today?* was presented to students via an iPad mini using the iBook application.

Multisensory Components

Multisensory components were also integrated into the story narration process. Allowing students to use multiple senses in their learning solidifies their understanding of themes presented in stories (Al-Jafar & Buzzelli, 2004). In the context of this study, multisensory components related to various weather conditions. While students participated in the story narration, they interacted with pinwheels and an electronic fan that represented the effect of wind on wheels, dripped water on papers that represented precipitation, and touched cold packs and heat packs that represented cold and hot climates.

Instruments

Data Collection

Both researchers recorded anecdotal data in observation logs. Data was recorded for each participant during and after instruction. Specifically, data was collected while the participants performed hands-on activities, uttered sentences from the story, and explained their understanding of changes in Kuwaiti climate with graduated prompt scaffolding (i.e., DA). In her observational log, the first researcher created an observational card to assess the sentences narrated by participants along with the tasks performed by the participants during hands-on activities. She correlated the story's sentences of weather conditions with each hands-on activity. Data were collected on the card after each of the first researcher's prompts according to the most-to-least graduated prompts outlined in Table 2. Table 3 shows each story sentence with the accompanying activity.

Table 3

Story Sentences and Activity

Sentence Uttered	Activity Performed
1. Weather in Kuwait is hot in summer; we need air conditioning.	Students turn on an electronic fan.
2. In summer, it will be sunny, and sometimes we have sandstorms.	Students touch and wave the sand in the sandbox provided by the first researcher.
3. In Kuwait, the weather in fall will be cool and sometimes rainy.	Students spray papers with water to replicate the sensation of rain.
4. In winter, the weather in Kuwait will be cold, sometimes rainy, and windy. We drink hot drinks like hot chocolate, milk, and tea (we call it karak chai).	Students spray papers with water and turn on electronic fans. They sip hot chocolate and/or karak provided by the researcher.
5. In Spring, the weather is cool, and we play outdoors to see flowers and trees.	The participants point to pictures of flowers, trees, and gardens provided by the first researcher on the iPad.

Procedures

Research Sessions

Participants attended two research sessions per week for eight weeks, resulting in a total of 16 sessions. Each research session lasted 30 minutes. The first researcher conducted these research sessions with all of the participants at the same time. The second researcher observed the participants and collected notes on participants' repetitions of scientific concepts as well as their interactions with peers and the first researcher.

The first researcher began each session by introducing herself to the participants and saying, "Today, we are going to learn about the weather in Kuwait." She then asked participants to repeat after her by prompting them, "What are we going to learn?" Participants replied, "Weather in Kuwait." During this introduction, the first researcher showed the participants pictures of Kuwait Towers, a flag, and a sunny day in a garden on an iPad mini.

The first researcher then said, "We will learn about the weather in Kuwait by reading the story, *What Will the Weather Be Like in Kuwait Today?"* The first researcher would then proceed to read the story to the participants by reading each line, playing audio of each weather condition, and prompting students to repeat the sentences after her. After several repetitions, each student was asked to repeat the conditions corresponding to each season in Kuwait. In addition, students were shown several prompts embedded in the iBook story. They also interacted with multisensory components (e.g., pinwheels representing wind). Participants were again asked to repeat the conditions that correspond to each of the Kuwaiti seasons with graduated prompts from gestural to verbal to physical. At the end of each lesson, students were shown relevant images and audio clips and encouraged to summarize the story's main ideas by answering wrap-up questions. These questions included: What is the weather like in summer? Are temperatures high or low during summer in Kuwait? Do you go to indoor or outdoor places during the summer? Why? What is the weather like in winter? What do low degrees mean when discussing the weather? Where can people go in Kuwait during the winter?

After finishing the story narration, the first researcher said, "Let's go out to the garden and see what the weather is like today." She accompanied the participants to the school garden so they could observe the weather conditions every research session. Notably, the study was purposefully designed to start at the beginning of November and continue until the beginning of January. At the beginning of November, Kuwait is generally warm. By the end of the month, it is generally cool. December often brings rainy days and cold breezes. Thus, in these two months, students experienced a

seasonal transition and discussed the functional impact of seasons on Kuwait's agriculture. Each time the participants were taken to the school, they observed plants, felt the weather, and talked about their observations in the context of the story. The first researcher asked questions that prompted participants to describe what they saw and relate it to what they learned from the story. These questions included: How is the weather today? What can you see (while pointing to flowers)? What can we grow when the weather is cool? On rainy days, the students were not taken to the garden. Instead, they stayed in the classroom and were directed to observe the rain through the classroom window. The first researcher asked questions such as: What is rain? What does rain do to the plant?

The first researcher continued research sessions for story narration and trips to the school garden until the participants demonstrated understanding of the connection between temperatures and weather. Participants demonstrated understanding of this connection by narrating the story, stating scientific concepts, and describing weather conditions with graduated prompts (i.e., DA).

Participants were also given opportunities to practice hands-on activities such as spraying water on paper to make it crinkle as an analogy for rain. They were also prompted to feel air blowing from a battery fan and use the air to make pinwheels spin and touch heat packs to sense the heat. The first researcher used questions such as "How is the weather in Kuwait during summer?" to connect these multisensory activities to scientific concepts. A DA system was employed while completing these activities along with the story of weather conditions. Graduated prompts were set in an established hierarchy, allowing the first researcher to move from one level to the other, acting as a mediator in the participants' ZPD as they narrated the story of weather conditions. The first researcher would initially narrate sentence by sentence in the story, accompanying each sentence with an audio-visual demonstration from the iBook. After reading each sentence, the first researcher asked each participant to repeat the narration. If the participant did not respond, the first researcher used the prompt hierarchy. The hierarchical order was from most-to-least to ensure that students were given an opportunity to respond before intervention from the first researcher. Most-to-least graduated prompting system was highly recommended in prior literature for students with ID because it involves the control of prompt fading, involving errorless type of learning for students with ID (Spooner et al., 2019) along with incorporating Vygotsky's notion of mediation through dynamic assessment (Gauvain, 2020). Students were given 30 seconds to respond. If the participant did not respond in that timeframe, the first researcher would give the student the next level of prompt. Meanwhile, the second researcher would note that the student did not respond in the observation log. Johnson and Parker (2019) indicate that a 15-second wait time is sufficient for students with developmental disabilities. This wait time was doubled because the participants in the current study had ID and in many cases needed more supportive prompts to narrate the story. Table 2 displays the hierarchy of prompts provided for participants to narrate the story. This hierarchy was based on established recommendations for arranging the presentation of graduated prompting systems (Cannella-Malone & Schaefer, 2017; Spooner et al., 2019).

Table 2

Graduated Prompts Used with Participants

Graduated Prompts (Most-to-Least)	Example of Action Taken
1. Providing full assistance	Story: Narrating the sentence without waiting for the participant to attempt. Hands-on activity: Doing the steps with the participant's hands i.e., blowing the windwheel, splashing water on the paper.
2. Providing partial assistance	Story: Tapping the participant's shoulder or elbow to utter. Hands-on activity: Positioning their hand(s) to perform the task during the hands-on activity.
3. Modeling	Story: While narrating a sentence from the story, pointing to the researcher's lips while looking at the participants' eyes, then asking the student to repeat after her. Hands-on activity: modeling the next step, then asking the participant to perform.
4. Verbal prompt	Story: Saying the sentence of the story and waiting until the participant repeats. Hands-on activity: Giving the participant a verbal prompt to perform the step.
5. Gestural prompt	Story: Pointing to the sentence that the participant should narrate. Hands-on activity: Pointing to the needed item (i.e., windwheel).
6. Independent, no prompt at all	Story: Opening the iPad to the story and waiting for the participant to read. Hands-on activity: Waiting for the participant to perform the next step.

Data Analysis

After collecting data from all 16 research sessions, the researchers analyzed the observational logs. As articulated by Glesne (2011), the observational field log serves as an essential recording device for qualitative researchers because it encompasses descriptions of people, places, events, activities, and conversations. Additionally, observation logs also include the researcher's insights, reflections, initial impressions, and emerging patterns within the contextual framework of the study. This log enables readers to engage with the researcher's personal reactions. The recording of detailed field notes can be done through various means, including writing them in full or writing in shorthand and later transcribing the complete notes. Field notes can also be recorded on loose-leaf notebooks or through computer files; ultimately, the form does not matter as long as the notes are saved (Glesne, 2011).

To analyze the collected data, the first researcher used two methods: first, she counted the number of sentences uttered and activities performed as recorded on the observational card. Since this was qualitative research, she deduced the major thematic results from the frequency of the sentences and activities repeated. She analyzed whether participants were capable of uttering the sentences and performing the activities with and

without the graduated prompts provided as she acted as the mediator in the students' ZPDs.

Second, the first researcher used the method of analytic field noting proposed by Glesne (2011). This process involved writing reflections on the initial field notes, encompassing aspects such as emotions, impressions, thoughts, problem-solving ideas, clarifying interpretations, speculative insights, and notes to remember. Glesne (2011) elaborates that analytic noting is "a type of data analysis conducted throughout the research process; its contributions range from problem identification, to question development, to understanding the patterns and themes in your work" (p. 76). This means that for coding and analyzing these field notes, the first researcher wrote deep, thorough reflections, reflecting on various points: what the participants gleaned, how her scaffolds with the use of graduated most-to-least prompts helped them, how they became more capable than before, how she acted as a mediator, how the multi-sensory items along with the story narration approached the meaning of weather conditions to participants with mild ID.

Once reflections and interpretations were jotted down, the first researcher decoded the repetitions and frequent patterns uttered and performed by the participants. Specifically, she identified noteworthy patterns and frequently expressed themes expressed by participants. In alignment with guidance given by Peshkin (1993) regarding the management of collected data, the researcher categorized the main themes and ideas into distinct classifications—namely, places, themes, relationships, and situations. The first researcher then used the participants' utterances and actions to support interpretations. She identified the weather sentence that was uttered correctly most frequently, the most frequent hands-on activity, the most beneficial level of graduated prompt for gaining a direct response from the participants, and what Kuwait locations the participants named as ideal for witnessing specific weather conditions (i.e., gardens in springs, seashores in summer, desert and camping in winter). Identifying these patterns helped the researcher recognize how participants associated the narrated story ideas with their real-life contexts.

Additionally, the first researcher analyzed field data by employing techniques outlined by Spradley (1980). This approach involved examining the nuances of each description provided in the analyzed field notes to extract meaningful inferences and findings. To mitigate bias, each research question was carefully aligned with the analyzed data, focusing on knowledge derived from recorded observations rather than solely relying on explicit statements. In accordance with the method endorsed by Spradley (1980), the authors prioritized learning from the participants' culture to inform their inferences. The first researcher examined the similarities and differences among frequently observed codes and classified concepts related to places, relationships, and situations. Then, she connected the participants' cultural backgrounds to their actions in the classroom. This was especially important when considering the equipment used to provide tactile experience relevant to the natural phenomena of the Kuwaiti climate, including cold, hot, rainy, windy, and sandstorm conditions. This investigation also examined how DA within the ZPD facilitated the participants' engagement by noting the most repeated and correctly uttered narrative sentence(s) as well as most frequently performed activities.

RESULTS

The current study aimed to explore the influence of story narration and DA within the ZPD on the comprehension of scientific concepts by Kuwaiti students with mild ID. Using the analytic noting technique to analyze the anecdotal data, major themes emerged that represent the core findings of this research. These findings are displayed in terms of main ideas:

Scientific Concepts in Story Narration

Findings indicated that participants successfully grasped the scientific concepts of rising and lowering temperatures, as well as their impact on weather conditions (i.e., hot, cold, cool, rainy), when instruction was delivered through story narration as well as graduated prompting (i.e., DA).

The results demonstrated that concepts related to varying climates were learned effectively through the mediation of a more knowledgeable person (i.e., the first researcher) employing storytelling, which subsequently increased participants' engagement, academics, and social interactions. Apparently, the mediator's use of DA (graduated prompting system, most-to-least prompts) within the ZPD scaffolded participants' learning of weather conditions, characteristics of each climate, and Kuwaiti locations relevant to each weather pattern. The patterns identified in the first researcher's reflections demonstrated that DA mediated the scientific content to participants. The participants became more competent and knew how to narrate the story.

Participants were also able to relate the story's ideas to their real-life contexts. It was noted that participants talked about their own experiences during hands-on activities, including going to deserts, camping, resorts, and playing with seashore sands and water. This aligns with Bakhurst's (2007) assertion that learning can occur through communicative interactions between educators and students without relying on formal instruction. This also supports Vygotsky's ZPD theory in which more capable individuals mediate learning of students with "defectology" because the current study involved participants with mild ID who learn differently than their typically developing peers.

Furthermore, these findings underscore the effectiveness of story narration, echoing the central theme of the ZPD theory, as participants connected weather concepts to their daily experiences, such as observing weather conditions and responding to comprehension questions about the weather. Additionally, the use of graduated prompting in story narration and performing hands-on activities relevant to each story's idea facilitated learning and helped participants acquire self-regulation skills. For example, when discussing summer, the participants turned on the electronic fans and brought them to their faces. Raghad consistently smiled and said, "Cool air. We need it. It's very hot in summer." After multiple repetitions of the story narration, participants could complete each step of the hands-on activity associated with the weather condition they narrated during the story. In some sessions, they could move to the hands-on activity's items and perform it immediately (e.g., holding the sprayers and spraying water on the paper to wrinkle it, then touching the wet wrinkle) after seeing the picture of the weather condition or hearing an associated audio clip (e.g., the sound of rain) and immediately narrate the associated story sentence (e.g., "In winter, there is rain in Kuwait"). This specific example was performed by Rawan and Retaj.

Science Concepts and Daily Experiences in the Context of Learning Development

Findings indicate that the science concepts related to temperature changes and weather variations were learned through the mediation of an adult (i.e., the first researcher) within the students' ZPDs. The first researcher effectively helped students narrate a story and perform hands-on activities by providing graduated prompts. Each line from the story had an associated hands-on activity as well as a corresponding sound on iBook (e.g., wind, rain, sounds of birds in spring). Participants were also able to communicate their knowledge of real-world weather phenomena by observing the weather conditions in the school garden. In addition, participants could use cultural tools, particularly language, to repeat the narration of *What Will the Weather Be Like in Kuwait Today*? and relevant information, such as weather changes and seasonal features, and to connect their learning to everyday themes.

As previously mentioned, participants could relate the weather conditions to seasonal activities popular in Kuwait. The first researcher asked participants about their favorite seasons and weather conditions in Kuwait and relevant activities. Participants indicated that they enjoy summer because they go to beaches, swim, and play with sand and shells. They communicated that they love winter because they go camping in the desert, visit seasonal amusement parks (e.g., Kuwait's Winterland), go on walks, and eat in old Kuwait's Market (Almubarkiya Souq). In spring, they stated they could visit Kuwait's zoo, gardens (e.g., Yarmouk Public Garden), and Alwafra farms. It was noted that Raghad and Rawan provided the most

detailed descriptions. Raghad indicated that she loves visiting Alwafra farms in spring because she sees flowers, picks strawberries and carrots, and feeds goats and sheep. Rawan, though, said that she loves summer more because she stays in a seashore chalet in the Khairan Resort complex and plays with sand, putting her legs in the seawater.

These findings correspond with previous literature that states that DA embedded in the ZPD expands students' learning opportunities and motivates them to learn from more capable individuals by imitating them (Solovieva & Quintanar, 2016). Findings also supported the heart of Vygotsky's ZPD concept by engaging students of so-called "defectology", or students with mild ID, in the learning process. These students applied the ideas discussed in a story narration to their own culture and daily life situations; they were capable of discussing these concepts. Such results align with Eun's (2018) assertion that, from Vygotsky's dialectical perspective, science concepts and daily experiences are inherently interlinked, especially when ZPD is implemented through DA for students with special needs; one cannot exist without the other. Science concepts reinforce the understanding of the daily experiences, while the latter provides the scaffolding necessary for the absorption and acquisition of the former. Hence, scientific concepts and daily experiences are interdependent conceptual processes within the ZPD, playing pivotal roles in a child's development (Gauvain, 2022).

Cultural Tools and Behavioral Performance

The ability of participants to narrate the story when given appropriate prompts has implications regarding the transformation of cultural tools into behaviors. Participants used the cultural tool of language, including sentences, expressions, and descriptions, to repeat the narrated story with support from a mediator (i.e., the first researcher). This process served as a social activity, namely storytelling and conveying concepts related to weather conditions. Participants engaged with the cultural devices of words, short sentences, and descriptions to interpret verbal direction into behavioral performance. For instance, they followed directions to spin pinwheels using battery-operated fans and crinkle paper using water. This transformation of cultural elements into behavioral expressions contributes to the development of a recursive, critical repertoire of knowledge among individuals (Clark & Chalmers, 2016). In the context of the current study, participants with mild ID experienced this transformation and were able to spontaneously articulate words and descriptions related to climate as they saw, felt, and sensed various weather phenomena.

DISCUSSION

The purpose of this research paper was to explore the role of graduated prompting (i.e., DA) within the framework of story narration on students with mild ID's ability to learn about weather conditions. Findings indicated that when story narration was scaffolded through a DA system using most-to-least graduated prompting, delivered via an iPad with audiovisual supplements, accompanied by hands-on activities related to each weather condition, and supported by observations of real-life weather changes, participants could describe weather conditions and their characteristics. With the guidance of an adult mediator (i.e., the primary researcher), using most-to-least prompting, participants successfully engaged in hands-on activities that allowed them to represent different scientific concepts. Moreover, they demonstrated the ability to connect the learned science concepts to everyday life experiences. The current study aligns with existing literature which underscores the positive influence of storytelling, the ZPD, and DA on the educational outcomes of individuals with ID (Jacob et al., 2024). The application of graduated prompting (i.e., DA) within story narration facilitated the demonstration of potential scientific and communicative development among students with ID. These results suggest that individuals with ID can relate the simplified scientific concepts of weather conditions to their natural environment.

It is noteworthy that learning needs for the participants were met through the use of DA to narrate the story and eventually learn differences between each climate, seasonal traits, and activities associated with specific weather conditions. Prior

literature indicated that most-to-least prompting systems are effective, systematic, and direct instructional strategies that help in errorless learning endeavours for students with developmental disabilities such as ID (Brock et al., 2021). This resolution was represented in the current study's findings. Participants' deficits in reasoning, critical thinking and adaptive behaviors within their social and cultural environment affect their learning of different subject areas, including science. Yet, the use of DA embedded within ZPD helped them overcome these difficulties, learning weather changes and connecting them to their lives.

Participants also demonstrated improved emotional affects using story narration. Thy had several happy moments and showed motivated engagement when encouraged by the mediator (primary researcher). Story narration, delivered using principles of Vygotsky's ZPD and graduated prompting, resulted in participants' interactive responses during study sessions and allowed them to learn science using more engaging techniques than usually used in science classes. Many students with ID experience challenges in expressive language and adaptive behaviors (Purugganan, 2018). Yet, this study found that a DA approach within a story narration framework empowered participants to express their ideas regarding weather changes. They were able to describe varying conditions with basic language, elucidate the connection of these conditions to the seasons, and illustrate how these concepts are reflected in the Kuwaiti natural environment. This finding is consistent with Brug et al. (2015), who emphasized that story narration is not only enjoyable for individuals with ID, but also motivates them to participate in activities and social interactions through conversations and explanations. The findings of the current study highlight the effectiveness of story narration through DA and hands-on activities in improving the acquisition of science concepts. These results align with the conclusions of So et al. (2022), who found that scientific applications broaden students' learning experiences and real-life applications.

Limitations and Future Directions

This study did have some limitations that merit discussion. First, participants were middle school students with ID, which limits the generalizability of results to students of other ages, such as elementary students. Second, this study utilized convenience sampling, limiting the demographic representation of the study and further limiting the generalizability of the results. Future research should consider exploring ZPD, story narration, and students with ID in different grade levels and fields of study (e.g., social studies, language arts). Third, the current study focused on how graduated prompting/DA within each student's ZPD accelerated the engagement levels of students with ID. Students demonstrated increased participation in narrating their stories, hands-on activities, and sharing personal experiences related to the discussed weather conditions. However, this study was conducted in a single season with cool, sunny, and rainy weather. Although instruction did include story narration and hands-on activities of other weather conditions that are frequently experienced in Kuwait, such as sandstorms, participants did not have the opportunity to witness off-season weather with the first researcher. Future practitioners should consider teaching about sandstorms when students can see them first-hand and discussing real-life implications of sandstorms, such as staying at home to avoid respiratory disease and avoiding driving due to reduced visibility on roads. Future research should consider other influences on the learning of students with ID through story narration and the ZPD. Such considerations might include motivation, decision-making, and distractibility while narrating stories. Additionally, practitioners in the field should consider the use of story narration and providing graduated prompts when instructing students with ID in various subject areas, including science. Practitioners could also consider using technology to support narrative discourse. Technology enriched the learning experience for these individuals, primarily because it increased participant engagement.

CONCLUSION

In conclusion, this study explored the role of storytelling and graduated prompting (i.e., DA) grounded in Vygoskian theory and the concepts of the ZPD, in relation to teaching Kuwaiti students with mild ID scientific concepts. Individuals with ID experience academic and functional challenges due to cognitive delays. However, these challenges might be alleviated through the mediation of an adult using graduated prompting within the ZPD framework to enhance their social interactions and improve their learning outcomes. Future research may build upon these findings by exploring storytelling methods and DA methods among a broader array of student groups, encompassing various disability categories and severity levels. Such investigations would yield valuable insights into effective teaching practices and contribute to a more comprehensive understanding of the capabilities and learning experiences of these students.

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