International Journal of Learning, Teaching and Educational Research
Vol. 24, No. 11, pp. 561-588, November 2025
https://doi.org/10.26803/ijlter.24.11.27
Received Aug 30, 2025; Revised Oct 20, 2025; Accepted Oct 23, 2025

The Effectiveness of a Story-Based Training Program in Developing Problem-Solving Skills Among Hard-of-Hearing Female Secondary School Students

Amira Jaafar Al-Baqshi, Amerah Nawaf Al-Juhani and Nourah Ibrahim Abdullah Albash*
Special Education Department, College of Education,
King Faisal University, Al-Ahsa 31982,
Saudi Arabia

Abstract. Storytelling has emerged as a promising educational strategy for supporting the cognitive and social development of students who are deaf or hard of hearing. Nevertheless, limited attention has been given to its role in enhancing higher-order thinking skills such as problem-solving in secondary school contexts. Addressing this gap, the present study aimed to examine the effectiveness of a story-based training program in developing problem-solving skills among hard-of-hearing female secondary school students in Al-Ahsa, Saudi Arabia. A purposive sample of nine students was selected, and the study employed a quasi-experimental design (one-group design with two measurements before and after). Two researcher-developed tools were used: the problem-solving skills scale for data collection and a story-based training program for the intervention. Data were analyzed using the Wilcoxon test and the Mann–Whitney test for independent samples. The findings revealed statistically significant improvements in students' problem-solving skills in favor of the post-test, demonstrating the effectiveness of the training program. Importantly, no statistically significant differences were found between students based on their communication method (spoken language/bilingual), indicating that the program is inclusive and adaptable to diverse communication styles. Overall, the results highlight the potential of storytelling to enhance critical thinking, strengthen problem-solving abilities, and foster active engagement among hard-of-hearing students. Based on these findings, the study recommends integrating storytelling approaches into educational programs for deaf and hard-of-hearing learners, given their demonstrated positive cognitive and educational impact.

*Corresponding author: Nourah Albash; *nalbash@kfu.edu.sa*

Keywords: Problem-solving; storytelling; hard of hearing; hearing impairment training program

1. Introduction

Deaf and hard-of-hearing students possess diverse creative abilities and can develop their strengths as long as they are provided with an appropriate educational environment that addresses their needs and characteristics. It should also offer suitable pedagogical methods that enhance their interaction, comprehension, and understanding of educational and social situations (Akay, 2023).

The importance of such a supportive environment increases during adolescence, a critical stage of growth and socio-emotional development, where students need greater mental and emotional maturity and strive to achieve balance between emotions and feelings. At this stage, several psychological and social needs emerge, such as self-awareness, building successful relationships, selecting realistic life goals, and the ability to adapt to environmental pressures, in addition to developing essential skills such as problem-solving (Al-Mansouri and Salem, 2018; Ramadan and Sayyed, 2020).

Problem-solving is considered a complex cognitive process that requires applying knowledge and prior experiences to new situations. It involves several stages, beginning with understanding the problem, then planning a solution, implementing the plan, and finally reviewing and evaluating the solution (Akay, 2023; Çoban et al., 2018). However, deaf and hard-of-hearing students often face greater educational difficulties compared to their hearing peers, particularly in conceptual and cognitive areas, owing to their lack of access to life experiences and information. This limits their ability to link new problems to prior experiences and to understand complex conceptual relationships (Carrano et al., 2014). Furthermore, their limited language skills contribute to poor performance when dealing with unfamiliar situations or in problem-solving tests (Akay, 2023).

Despite these challenges, recent studies confirm that problem-solving skills are learnable and can be developed through systematic pedagogical practices that guide students to employ their mental abilities in logical thinking and decision-making. Developing these skills has been shown to enhance students' self-confidence, communication abilities, and self-esteem, as well as improving their social competence and adjustment to school and community environments. According to Bloom's revised taxonomy of educational objectives, problem-solving is considered one of the higher-order thinking skills that require analysis, synthesis, and inference, and can be developed through effective and well-designed learning strategies (Akay, 2023; Çoban et al., 2018; Heong et al., 2024).

However, many studies have shown that these skills are often taught to deaf and hard-of-hearing students primarily through written language, which reduces their performance in this area owing to reading comprehension difficulties (Al-Abaidi and Al-Zahrani, 2024; Aristizábal et al., 2017; Pagliaro and Ansell, 2012).

To improve the quality of education for these students, there is a pressing need to develop positive learning environments that replace traditional methods with more interactive and inclusive strategies. Among these strategies, storytelling emerges as an effective pedagogical tool, as it provides chronological and spatial sequences, characters, and events that stimulate curiosity and encourage comprehension and interaction, particularly when combined with illustrations and visuals that reinforce abstract concepts (Al-Sawwat and Turkestani, 2020; Walker et al., 2023).

Storytelling is a comprehensive educational approach that links students with their environment, develops critical and creative thinking skills, and helps them imagine multiple alternatives for situations and solutions, thereby enhancing their ability to adapt socially and solve problems (Ramadan and Sayyed, 2020). Digital storytelling adds a new dimension to this approach by integrating auditory, visual, and emotional effects to provide engaging interactive content that is easy to understand and fosters both cognitive and personal development (Abdu and Al-Mukhlafi, 2023; Abu Bakr, 2022).

Within this context, the current study gains its significance by addressing the limited empirical research on the use of story-based training to enhance problem-solving skills among hard-of-hearing secondary school students in Saudi Arabia. The study is particularly justified by the urgent need to provide effective, evidence-based interventions that not only promote academic achievement but also support essential life skills such as critical thinking, self-regulation, and social adaptation. By focusing on this underexplored area, the study aims to contribute to both theory and practice, offering insights that can inform inclusive educational strategies and guide teachers, practitioners, and policymakers in developing programs tailored to the unique needs of deaf and hard-of-hearing learners.

Although the importance of this issue is clear, a review of the literature reveals a notable research gap, as topics related to developing higher-order cognitive skills, such as problem-solving using the storytelling approach among deaf and hard-of-hearing students, have not received sufficient attention. This highlights the importance of addressing this issue to fill the gap and provide practical solutions supported by scientifically validated pedagogical evidence (Aristizábal et al., 2017). While these students possess latent creative abilities, weak reading comprehension and writing skills remain obstacles to their ability to understand and analyze problems logically and creatively.

Thus, there is a pressing need to adopt interactive and comprehensive teaching approaches that consider the characteristics of this group and contribute to the development of higher-order thinking skills, especially problem-solving, which plays a pivotal role in promoting their independence and adaptation to the demands of school and social life.

1.1 Problem Statement

Traditional teaching methods suffer from limitations in developing higher-order thinking skills among deaf and hard-of-hearing students, particularly problem-solving, owing to their lack of interactivity and absence of dynamics that

accommodate the linguistic and cognitive characteristics of this group. These methods also fail to utilize students' creative abilities within meaningful educational contexts (Akay, 2023; Çoban et al., 2018).

Problem-solving skills are essential in fostering students' intellectual capabilities, especially in secondary school, which constitutes a turning point in building critical thinking and decision-making. The role of educational institutions is no longer limited to providing knowledge but extends to preparing students to deal with the complexities of life by equipping them with effective strategies to face challenges (Ismail, 2024).

The need becomes even more urgent among female students with hearing impairments, as they face difficulties in communication, understanding and analyzing problems, and finding suitable solutions—factors that negatively impact their academic achievement and social interaction. Çoban et al. (2018) reported that hearing-impaired students are often less efficient than their hearing peers in problem-solving owing to language barriers that hinder their understanding of written problems, whether in terms of phrasing or analysis.

In the search for effective alternatives, Marei and Jaradat (2023) revealed the effectiveness of integrating story-based learning into curricula, as it enables deaf and hard-of-hearing students to develop systematic strategies for dealing with problems. Similarly, Al-Anezi and Turkestani (2024) showed that using educational stories enhances reading comprehension and critical thinking, thereby improving problem-solving skills among female students with hearing impairments by presenting content in a visual and interactive manner suitable for their needs.

Despite the growing trend toward interactive teaching strategies such as problem-based learning and digital storytelling, there remains, however, a clear research gap concerning the effectiveness of storytelling as an instructional tool for developing problem-solving skills among hard-of-hearing female secondary school students. Accordingly, this study seeks to design a story-based educational program and test its effect in developing these skills, thereby contributing to evidence-based educational practices and addressing a gap in the literature. Therefore, the problem of the current study is represented by the following main question:

What is the effectiveness of a story-based program in developing problem-solving skills among hard-of-hearing female secondary school students?
The following sub-questions emanate from this question:
1. Are there statistically significant differences at the 0.05 level between the mean ranks of students' scores in the pre- and post-tests after participating in a story-based training program?
2. Are there statistically significant differences at the 0.05 level between the problem-solving skills scores of students with hearing impairments attributable to the communication method used (spoken language/bilingual)?

2. Theoretical Framework and Previous Studies

2.1 Problem-Solving Skills

Problem-solving skills occupy a central place in preparing individuals for future life, as they contribute to developing self-learning and bridging the gap between theoretical knowledge and practical application, thus making learning deeper and more effective in different domains.

Educational theorists affirm that effective learning is not limited to the transfer of information, but rather extends to developing students' abilities in decision-making, responsibility-taking, and handling daily situations with confidence and competence (Akay, 2023; Heong et al., 2024). A problem is defined as a situation that arises when an obstacle prevents an individual from achieving a specific goal, leading to a state of mental tension and confusion that prompts the search for multiple ways to resolve it. A problem is therefore a situation that does not have a direct or clear solution and may result from one or several factors, known or hidden, that lead to undesirable outcomes.

Thus, dealing with problems requires in-depth analysis of their nature, causes, and dimensions (Al-Mansouri and Salem, 2018). Problems vary in complexity: some are simple and straightforward, while others are complex and intertwined, requiring advanced analytical skills. Some researchers argue that the optimal solution is not always complete elimination of the problem but rather reducing its effects or adapting to its existence, as in the case of pollution or chronic diseases (Al-Yousef and Al-Balawi, 2019; Heong et al., 2024).

Problem-solving requires reliance on higher mental processes such as critical, analytical, and creative thinking. It is a complex cognitive process through which individuals attempt to reach a goal not directly accessible by breaking down the problem into sub-goals, recalling prior knowledge, and integrating it into a systematic solution plan (Al-Musaidiyeen, 2021). These skills are also part of metacognitive thinking, requiring the learner to plan, think, monitor performance, and continuously evaluate progress. The process involves perceiving relationships between concepts and organizing old and new knowledge into a coherent cognitive structure (Çoban et al., 2018; Al-Mansouri and Salem, 2018).

Dimensions and procedural steps of problem-solving, as identified by Gharib et al. (2024), include the following:

1. Problem Definition: Accurate understanding of the problem and its aspects, forming the basis for suitable decision-making.
2. Exploring Alternative Solutions: Investigating and listing as many possible options as feasible.
3. Evaluating and Selecting the Best Solution: Analyzing each proposed solution based on effectiveness, feasibility, cost, and time.
4. Implementing the Solution: Carrying out the selected solution and monitoring results, with adjustments made as needed.

2.2 Problem-Solving Skills in Deaf and Hard-of-Hearing Students

Problem-solving is crucial for enhancing individual performance and ensuring success in life. For deaf and hard-of-hearing students, these skills are essential in enabling them to cope with daily challenges and educational and social demands independently. Mastery of such skills not only improves academic performance but also enhances self-confidence, social interaction, and integration into society (Ismail, 2024).

However, this group faces additional challenges that hinder their problem-solving development, particularly weak reading comprehension and limited written expression, which negatively affect their ability to analyze and interpret problems logically and creatively (Al-Abadi and Al-Zahrani, 2024). They are generally less efficient than hearing peers in handling text-based problems owing to language barriers (Çoban et al., 2018).

To overcome these challenges, studies (Akay, 2023; Ismail, 2024) emphasize designing targeted educational activities that take into account the characteristics of deaf and hard-of-hearing learners. These should employ interactive, visual, and problem-based strategies that enable data organization, problem analysis, planning, and critical decision-making.

2.3 Storytelling as an Instructional Strategy

Storytelling is one of the oldest and most influential forms of human expression, effective in transmitting knowledge, values, and culture. It is defined as a narration of interconnected events revolving around specific characters within a temporal and spatial framework, involving dramatic conflict expressed through dialogue, description, and progressive events (Abdu and Al-Mukhlafi, 2023; Farajallah and Mosleh, 2024).

The educational value of storytelling lies in its ability to present abstract concepts in a tangible form through real or fictional situations, thus enriching learning experiences. It supports moral and social value acquisition, enhances emotional awareness, and provides a balance between enjoyment and knowledge. For deaf and hard-of-hearing learners, stories with visuals, illustrations, and sign language interpretation are particularly recommended (Al-Zahrani and Abdulaziz, 2023; Fayyad et al., 2022).

Therefore, problem-solving represents a core higher-order cognitive skill necessary for critical and creative thinking. Storytelling, by presenting realistic scenarios and conflicts in a narrative framework, allows learners to predict, analyze, and generate alternative skills at the heart of problem-solving. Stories provide a safe, engaging medium for practicing decision-making and critical analysis. This integration highlights storytelling as a promising pedagogical approach for developing problem-solving skills, especially for learners with hearing impairments.

2.4 Previous Studies

This section reviews a set of prior studies related to the research topic, categorized as follows:

2.4.1 Studies on the Effectiveness of Stories

A growing body of research underscores the effectiveness of story-based approaches in supporting the development of linguistic, emotional, and social skills among hearing-impaired students. Ramadan and Sayed (2020) demonstrated that a story-based program significantly enhanced emotional intelligence and internal locus of control, thereby improving self-regulation and independent problem-solving among preparatory students with hearing impairment.

Similarly, Al-Sawwat and Turkestani (2020) found that picture stories contributed to notable vocabulary acquisition in deaf primary students, confirming the linguistic benefits of narrative methods. Extending this line of inquiry, Fayyad et al. (2022) reported that story-based training not only improved vocabulary for gifted hearing-impaired students, but also reduced behavioral and emotional problems among gifted adolescents, with positive effects persisting after one month. More recently, Abdel Nabi et al. (2024) highlighted the potential of digital story-based interventions, showing significant reductions in withdrawal behaviors among hearing-impaired younger children that were maintained at follow-up.

Complementing these student-focused findings, Al-Taqatqa and Al-Ahmadi (2024) explored teachers' perspectives and revealed that picture stories are perceived as highly important tools for developing expressive language among hearing-impaired students, despite their moderate application in practice. Also, Carden et al. (2024) demonstrated through a pilot study that narrative interventions for preschoolers using listening and spoken language led to measurable improvements in story retelling and maintenance of narrative skills for deaf and hard-of-hearing students.

Similarly, Hardebeck et al. (2024) compared German-speaking children with hearing loss to their typically hearing peers, finding close associations between narrative micro- and macrostructure and vocabulary size. Miller et al. (2024) also advanced the field by presenting a clinical trial protocol, Hear Me Read, which integrates digital storybooks into speech-language therapy with the aim of improving vocabulary, speech, language, and literacy outcomes for young children who are deaf or hard of hearing.

Building on this evidence, Ibrahim et al. (2025) introduced the Oral Narrative Language Intervention Program (ONLIP) and compared its impact with conventional auditory and language training. The findings demonstrated that oral narrative intervention significantly improved comprehension and narrative production skills among children with hearing impairments, reinforcing the argument that storytelling serves as a powerful medium for linguistic and cognitive development.

From a broader perspective, Rosen (2025) emphasized the theoretical and affective dimensions of storytelling by analyzing life-story narratives of deaf and hard-of-hearing individuals. His study revealed how personal narratives function as

sensory autobiographies, helping individuals articulate their lived experiences and construct their identities within social and cultural contexts. Together, these recent contributions extend the literature by showing that storytelling is not only an instructional technique for improving linguistic and problem-solving skills but also a vital tool for fostering self-expression, identity formation, and social inclusion among individuals with hearing impairments.

2.4.2 Studies on Problem-Solving Skills

Research on enhancing problem-solving skills among deaf and hearing-impaired learners has adopted diverse pedagogical approaches, highlighting both cognitive and socio-emotional dimensions. Pagliaro and Ansell (2012) found that deaf children approached math word problems with strategies similar to their hearing peers, though with greater reliance on counting, while modeling strategies became more prominent as tasks grew more complex.

Building on applied methodologies, Carrano et al. (2014) integrated experiential learning with the A3/PDCA cycle among first-year deaf students, leading to sustained improvements in STEM-related problem-solving. Beyond formal instruction, creative and interactive methods also proved effective with Kadwani (2018) demonstrating that a theatrical role-play program significantly enhanced decision-making and problem-solving among kindergarten children, while Al-Sheikh et al. (2018) confirmed that recreational sports activities could foster these skills in adolescents with hearing impairments.

Similarly, Al-Musaidiyeen (2021) showed that counseling through educational games improved both self-esteem and problem-solving abilities among primary students. Complementing these group interventions, Akay (2023) provided a longitudinal case study of a cochlear-implanted student, revealing developmental progress in identifying, analyzing, and justifying solutions, though difficulties remained in transferring these skills to novel contexts. Collectively, these findings suggest that problem-solving in deaf and hearing-impaired learners can be effectively nurtured through a variety of strategies—ranging from structured academic methods to experiential, recreational, and individualized approaches—while also underscoring the importance of addressing challenges in skill generalization.

2.4.3 Commentary on Previous Studies

The reviewed literature highlights two main research directions:

1. Storytelling as an educational tool (Abdel Nabi et al., 2024; Abu Bakr, 2022; Fayyad et al., 2022; Ramadan and Sayed, 2020). These studies, mostly quasi-experimental with primary or preparatory students, confirmed that digital or illustrated stories improved scientific concepts, emotional intelligence, vocabulary, engagement, and expressive language.
2. Problem-solving skill development (Akay, 2023; Al-Musaidiyeen, 2021; Carrano et al., 2014; Kadwani, 2018; Pagliaro and Ansell, 2012). These studies employed applied, participatory, or game-based interventions, showing that interactive learning environments significantly enhanced logical thinking and problem-solving, though they rarely used stories as the central tool.

The gap lies in the lack of research explicitly combining storytelling as an instructional strategy with the development of problem-solving skills, particularly among secondary-level hearing-impaired female students. This underlines the significance of the present study, which integrates both approaches into a unified program tailored to the target group's linguistic, educational, and developmental needs.

2.5 Study Hypotheses

1. There are no statistically significant differences at the level of 0.05 between students' ranks in the pre- and post-tests after receiving the story-based training program (Null hypothesis).
2. There are no statistically significant differences at the level of 0.05 in the problem-solving skills scale among hearing-impaired students attributable to the communication method (spoken language/bilingual) (Null hypothesis).

3. Materials and Methods

3.1 Methodology

The study employed a quasi-experimental design using a one-group pre-test/post-test method. This design is appropriate for investigating the effectiveness of training programs on developing specific skills, as it enables comparison between pre- and post-measurements to determine whether significant differences exist that can be attributed to the program (Creswell, 2009).

3.2 Study Sample

The population consisted of all female secondary school students with hearing impairments enrolled in inclusive schools in Al-Ahsa Governorate. According to the official statistics issued by the Ministry of Education during the academic year 1446 AH (2025), the total number amounted to 49 hard-of-hearing female students. The study sample was purposively selected and consisted of nine hard-of-hearing female students in the first year of secondary school at the Ninth Secondary School in Al-Ahsa. They were selected purposively according to a set of criteria:

a) The appropriateness of their characteristics to the study objectives in terms of homogeneity of external variables such as age, grade level, and diversity of communication methods.

b) Their enrollment in the same school—which had the largest number of hard-of-hearing female students in the same grade level—facilitated the implementation of the training program within the available temporal and spatial resources.

All students who met the inclusion criteria were involved in both the pre- and post-application of the study instrument. (See Table 1 for the distribution of the study sample according to communication method.)

Table 1: Distribution of the Sample by Communication Method

Communication Method	Number of Students
Spoken Language	6
Bilingual	3
Total	9

Table 1 shows that six students use the oral communication method, while three use the bilingual method. The bilingual approach combines sign language (L1) with the written/spoken language (L2), recognizing sign language as the main medium for communication and learning. This approach enhances comprehension, bridges linguistic gaps, and promotes academic and social inclusion by allowing students to first access content in their natural language. Studies confirm that bilingual education improves academic performance, communication skills, and cultural identity among deaf and hard-of-hearing learners (Humphries et al., 2014; Marschark & Hauser, 2012).

3.3 Study Variables

The study included the following three variables:

- Independent Variable: The story-based training program.
- Dependent Variable: Problem-solving skills of the participating students.
- External Variable: There are a number of external factors that may affect the effectiveness of the program, such as: parental support, teacher training, peer interactions, and institutional or community support.

3.4 Study Tools

The researchers used two main tools in this study, which were designed in line with the research objectives and the nature of the target group, as follows:

3.4.1 Problem-Solving Skills Scale (developed by the researchers)

3.4.1.1 Purpose and Description of the Scale:

This scale aims to measure problem-solving skills among hard-of-hearing female secondary school students. The scale consists of eight items that evaluate the understanding of a three-member family's experiences while planning a vacation together by identifying the questions they need to answer in order to find a solution.

The scoring method is based on assigning 1 point for a correct answer and 0 for an incorrect answer. The maximum possible score on the scale is 8.

The items were classified according to the dimensions of problem-solving skills as follows:

- Clearly defining the problem: Items 1 and 3.
- Generating possible solutions: Item 2.
- Selecting the most appropriate solution: Items 4 and 5.
- Implementing the solution and following up results: Items 6, 7, and 8.

3.4.1.2 Steps of Preparing the Scale

The development of the scale went through several stages to ensure its validity, reliability, and suitability for the study objectives, as follows:

- Review of Literature and Previous Studies: Relevant works on problem-solving skills were examined to determine the theoretical dimensions the scale should measure. Key references included Al-Mansouri and Salem (2018), Çoban et al. (2018) and Gharib et al. (2024).
- Drafting the Initial Items: Preliminary items were written to reflect all identified dimensions of problem-solving skills. These were designed in a simplified way suitable for the characteristics of the target group.
- Validation and Modification: The initial version of the scale was presented to five experts in the field of special education to evaluate the appropriateness of the items for the target group, the clarity of the wording, the adequacy of coverage across dimensions, and the suitability of accompanying visual aids. Necessary modifications were made based on their feedback, which enhanced the scale's face validity and content validity. Reliability was also checked by applying the scale to a pilot sample of eight students and calculating Cronbach's alpha. The overall reliability coefficient of the scale reached 0.840, indicating a high level of reliability and internal consistency.
- Final Approval: After incorporating modifications and reviewing the items, the final version of the scale was approved for application to the main study sample (See Appendix A).

3.4.2 The Story-Based Training Program (Developed by the Researchers)

3.4.2.1 Rationale for Developing the Program

This training program was designed based on several educational and developmental justifications that highlight the importance of targeted intervention to enhance problem-solving skills among hard-of-hearing female students. The most notable justifications include the following:

- The need to develop thinking and problem-solving skills among hard-of-hearing female students owing to the difficulties they face in information processing and decision-making as a result of communication challenges, which affect their ability to interact effectively with daily situations.
- The importance of the educational story as an engaging tool that presents life situations within a realistic context, which helps simplify concepts and present skills in a manner that relates closely to the students' lives.

3.4.2.2 Program Objective and Description:

The training program aims to develop problem-solving skills among hard-of-hearing female secondary school students through the use of stories as an educational tool. The program was developed by researchers to include a set of practical life situations and problems that reflect the students' reality and align with their developmental and linguistic needs. It is presented in the form of short educational stories supported by visual aids. The stories include engaging dramatic events that involve a clear problem requiring thought and analysis.

Each story focuses on one dimension of problem-solving skills and encourages students to do the following:

- Understand the situation or problem,
- Generate multiple solutions,
- Select the most appropriate solution, and
- Implement the solution and monitor its outcomes.

3.4.2.3 Steps of Developing the Program:

3.4.2.3.1 Review of Previous Studies

The program was built upon studies addressing the education and training of deaf and hard-of-hearing students, studies on developing problem-solving skills, and literature on the use of storytelling in education (Abdu and Al-Mukhlafi, 2023; Al-Harbi and Al-Mazroui, 2025; Al-Sawwat and Turkestani, 2020; Aristizábal et al., 2017; Dashti et al., 2024; Fayyad et al., 2022; Kwon et al., 2023; Ramadan and Sayed, 2020). The Teacher's Guide for Students with Hearing Impairments issued by the Ministry of Education (2020) was also used to ensure alignment with approved educational standards.

3.4.2.3.2 Defining Objectives

General and specific objectives of the program were identified to match the needs of hard-of-hearing students, including the following:

- Developing the students' ability to solve problems by clearly defining the problem and generating multiple solutions using critical and analytical thinking skills;
- Improving planning and decision-making skills and selecting the most appropriate solution from available alternatives;
- Enhancing mathematical thinking through the use of calculation processes;
- Developing classification skills by organizing information and ideas into clear categories, facilitating understanding and problem-solving;
- Promoting communication skills through group work and social interaction in the classroom;
- Supporting independence, self-confidence, and a sense of responsibility among hard-of-hearing students through story-based training;
- Clearly defining problems when facing different situations.
- Proposing multiple solutions to a given problem;
- Selecting the most appropriate solution based on analysis of available information;
- Implementing the solution and following up on the results to ensure effectiveness; and
- Communicating effectively with others during problem discussions and solutions.

3.4.2.3.3 Psychological, Educational, and Social Foundations of the Program

- Stories should be clear and realistic, avoiding abstract meanings.
- Story events should progress logically and sequentially, with balance in their number.
- More than one sense should be engaged during story presentation.
- Simple and accessible language should be used, suitable for the characteristics of hard-of-hearing students.

- A variety of reinforcement techniques and strategies should be applied.
- The environment should be adapted to match the characteristics of the target group during implementation.
- Sufficient time should be allocated during training sessions to effectively achieve program objectives.

3.4.2.3.4 Designing Program Content

The content was designed in light of the realistic learning theory, which emphasizes presenting learning through meaningful real-life situations. This allows hard-of-hearing students to interact with contexts similar to their daily lives, enhancing deep understanding and real-world application of skills. Targeted concepts were integrated into realistic educational stories connected to their school and social environments, requiring problem analysis, proposing solutions, selecting the most appropriate, implementing the solution, and monitoring results.

3.4.2.3.5 Selecting Appropriate Strategies and Methods

A set of strategies suitable for the nature of hard-of-hearing students was adopted, such as visual aids, cooperative learning, inquiry-based learning, problem-solving strategy, guided discovery, dialogue and discussion, brainstorming, mind mapping, feedback, and reinforcement.

3.4.2.3.6 Validation of the Program

The initial version of the program was presented to five specialists in special education to obtain feedback ensuring content clarity, appropriateness for the target group, and relevance to developing problem-solving skills. Necessary modifications were made based on their feedback.

3.4.2.3.7 Implementation of the Program

The program was implemented with the target sample and consisted of 10 training sessions distributed over five weeks, at a rate of two sessions per week, with each session lasting 60 minutes. The sessions involved researchers, teachers, and the hard-of-hearing students, and activities were delivered in a supportive learning environment (see Table 2).

3.4.2.3.8 Evaluation of Program Effectiveness

- Formative Evaluation: Continuous evaluation during program implementation through observations, activities, and tracking forms, contributing to improving performance, adjusting content immediately, and reinforcing the educational impact.
- Post-Evaluation: Application of the Problem-Solving Skills Scale after completing the program and comparing results with the pre-test to determine the extent of the program's impact on improving the targeted skills.

Table 2: Content of the Program Sessions

#	Session Title	Behavioral Objectives	Techniques and Strategies	Evaluation Methods
1	Introduction + Pre-Assessment	- The student introduces herself clearly and understandably. - The student expresses her expectations from the training sessions. - The student responds to the Problem-Solving Skills Scale.	Dialogue and discussion Feedback Reinforcement	Direct observation Asking questions Pre-test
2	Story: A Successful Trip Day	- The student identifies the main problem clearly. - The student analyzes the causes of the problem. - The student proposes multiple alternatives and solutions. - The student chooses the most appropriate solution based on criteria (e.g., timing, safety of transportation, participation of all). - The student communicates with peers and teachers during problem-solving stages.	Visual presentation Cooperative learning Inquiry-based learning Guided exploration Brainstorming Mind mapping Problem-solving	Feedback Reinforcement Direct observation Asking questions Practical application Peer evaluation
3	Story: Organizing the Family's Financial Plan	- The student accurately identifies the financial problem in the story. - The student analyzes the causes of poor expense management. - The student distinguishes between essential and luxury expenses. - The student classifies expenses into clear categories. - The student applies calculations to determine financial ratios. - The student communicates with peers and teachers during problem-solving stages.	Visual presentation Cooperative learning Inquiry-based learning Guided exploration Brainstorming Mind mapping Problem-solving	Feedback Reinforcement Direct observation Asking questions Practical application Peer evaluation
4	Story: From Waste to Benefit – Water	- The student identifies problems related to water waste in school. - The student calculates wasted water using simple	Visual presentation Cooperative learning Inquiry-based	Feedback Reinforcement Direct observation Asking questions

	Conservation and Reuse	numerical data. - The student compares causes of waste to determine the most influential factors. - The student demonstrates practical ways to reuse leftover water in bottles. - The student expresses her opinion on the success of applied measures. - The student proposes improvements to solutions if needed. - The student communicates with peers and teachers during problem-solving stages.	learning Problem-solving Brainstorming Mind mapping	Practical application Peer evaluation
5	Story: The Bridge that Unites Us	- The student identifies the problem at the beginning of the story and its effect on teamwork. - The student describes how commonalities were identified to build strong social relations. - The student analyzes the team's solutions and their role in improving relationships. - The student evaluates how proposed activities improved communication and relationships. - The student suggests additional solutions or hobbies that may strengthen social relationships. - The student communicates with peers and teachers during problem-solving stages.	Visual presentation Cooperative learning Inquiry-based learning Problem-solving Brainstorming Mind mapping	Feedback Reinforcement Direct observation Asking questions Practical application Peer evaluation
6	Story: Managing Time Smartly	- The student identifies the problem Sarah faced in managing her time. - The student lists methods used in the story to organize daily tasks. - The student classifies daily tasks by priority. - The student designs a personal model to organize tasks using visuals (e.g., tables, mind maps).	Visual presentation Cooperative learning Inquiry-based learning Problem-solving Brainstorming Mind mapping	Feedback Reinforcement Interactive observation Asking questions Practical application Peer evaluation

		- The student compares Sarah's previous time management style with the new method. - The student analyzes factors leading to wasted time and task delays. - The student suggests further improvements for efficient scheduling. - The student communicates with peers and teachers during problem-solving stages.		
7	Story: Decision for the Future (Part 1)	- The student identifies the problem Sarah faced in choosing her university major. - The student describes how Sarah analyzed various fields. - The student compares majors Sarah considered (Agriculture vs. Arts) based on personal interests. - The student identifies the major Sarah selected and explains the reasons behind her choice. - The student applies Sarah's comparison and analysis method in decision-making. - The student explains how logical analysis influenced Sarah's decision. - The student communicates with peers and teachers during problem-solving stages.	Visual presentation Cooperative learning Inquiry-based learning Problem-solving Brainstorming Mind mapping	Feedback Reinforcement Direct observation Asking questions Practical application Peer evaluation
8	Story: Decision for the Future (Part 2 – Noura's Major Selection)	- The student identifies the problem Noura faced in selecting her university major. - The student describes how Noura analyzed fields in Agricultural Sciences. - The student compares majors Noura considered based on personal interests. - The student identifies the major Noura selected and explains the reasons. - The student applies	Visual presentation Cooperative learning Inquiry-based learning Problem-solving Brainstorming Mind mapping	Feedback Reinforcement Direct observation Asking questions Practical application Peer evaluation

		Noura's method of comparison and analysis in decision-making. - The student communicates with peers and teachers during problem-solving stages.		
9	Story: Noura's Dream and the Path to Success	- The student identifies the problem Noura faced in achieving her dream of becoming a doctor. - The student explains how Noura used the SMART methodology to set her goal. - The student clarifies how Noura defined a specific and measurable academic goal. - The student explains how Noura linked her academic goal with her career ambitions. - The student identifies the importance of setting a time frame to achieve the goal. - The student states how volunteering in hospitals helped Noura gain experience. - The student communicates with peers and teachers during problem-solving stages.	Visual presentation Cooperative learning Inquiry-based learning Problem-solving Brainstorming Mind mapping	Feedback Reinforcement Direct observation Asking questions Practical application Peer evaluation
10	Conclusion + Post-Assessment	- The student evaluates the achievement of the program objectives. - The student discusses satisfaction with the program. - The student responds to the Problem-Solving Skills Scale.	Dialogue and discussion Feedback Reinforcement	Direct observation Asking questions Post-test

3.5 Ethical Considerations

The researchers were keen to adhere to all ethical aspects related to conducting the research, in accordance with the standards adopted in educational studies. Official approval was obtained from the Research Ethics Committee at King Faisal University prior to the commencement of the study, in addition to securing the necessary administrative permissions from the relevant authorities to facilitate the implementation of the research instruments in the approved schools.

The objectives and content of the study were explained to the participants in a simplified manner appropriate to the nature of the target group. It was emphasized that participation in the study was entirely voluntary, and that any

student had the right to withdraw at any time without incurring any negative consequences. The researchers committed to maintaining full confidentiality of participants' data and personal information, restricting its use exclusively to scientific research purposes, ensuring that it would not be shared with any party outside the scope of the study, and storing it securely in a way that safeguards privacy.

3.6 Data Collection Procedures

After obtaining the official approvals, the researchers proceeded to administer the study instruments in the field to the targeted sample. During data collection, communication methods and approaches were adapted to suit the characteristics of hard-of-hearing female students. Additionally, an appropriate educational environment was provided to ensure their psychological comfort and to encourage free and accurate responses.

3.7 Data Processing and Analysis

To answer the study questions and verify its hypotheses, the researchers employed a set of statistical methods appropriate to the nature of the data and the sample size, using the Statistical Package for the Social Sciences (SPSS), as follows:
- Wilcoxon Signed-Rank Test for paired samples to determine the significance of differences between the mean ranks of students' scores in the pre- and post-tests after receiving the story-based training program.
- Mann-Whitney U Test for independent samples to determine the significance of differences in students' scores attributable to the communication method used (spoken language/bilingual) in the pre- and post-tests.

4. Results

4.1 Results of the first question

To answer this question, the Wilcoxon test was applied, the results of which are shown in the following Table 3:

Table 3: Wilcoxon Test Results for Differences Between Pre- and Post-Test Scores on the Problem-Solving Skills Scale

Dimension	Negative Ranks	Positive Ranks	Z Value	Significance (p)
Problem Identification	0	9	-2.81	0.005
Generating Alternatives	0	9	-2.81	0.005
Selecting a Solution	0	9	-2.81	0.005
Implementation and Evaluation	0	9	-2.81	0.005
Total Score	0	9	-2.81	0.005

The results in Table 3 indicate statistically significant differences at the 0.05 level in all dimensions and in the total score, in favor of the post-test. This confirms the effectiveness of the story-based training program in developing problem-solving skills among hard-of-hearing female secondary school students.

4.2 Results of the second question

To answer this question, the Mann-Whitney U test was applied, and the results are shown in the following Table 4:

Table 4: Mann-Whitney U Test Results of Post-Test Scores According to Communication Method

Dimension	U Value	Z Value	Significance (p)
Problem Identification	5.00	-1.10	0.27
Generating Alternatives	6.00	-0.98	0.32
Selecting a Solution	7.00	-0.80	0.42
Implementation and Evaluation	8.00	-0.65	0.52
Total Score	6.00	-0.98	0.32

The results in Table (4) indicate no statistically significant differences at the 0.05 level between the students' scores in the post-test attributable to the communication method (spoken language or bilingual). This demonstrates that the story-based program was equally effective regardless of the communication method used.

5. Discussion

The findings of the present study indicate that the hard-of-hearing female students were able to achieve remarkable progress in their problem-solving skills after the implementation of the story-based training program, as the differences between the pre- and post-tests were statistically significant in favor of the post-test.

These results reflect the effectiveness of the program in achieving higher-order educational and cognitive objectives, particularly in developing the ability for critical thinking, analysis, and decision-making, which are essential characteristics of problem-solving skills. This improvement can be attributed to the program's use of storytelling as a central tool, designed to be closely aligned with the daily realities of hard-of-hearing students, consistent with the principles of the realistic learning model, which emphasizes linking learning to learners' life experiences to activate knowledge and transform it into practical behavior (Al-Musaidyieen, 2021; Ismail, 2024).

This result is supported by Abu Bakr (2022) who demonstrated that digital stories integrated with sign language enhanced comprehension, critical thinking, and engagement in learning among hearing-impaired students. This aligns with the present findings, which revealed a clear improvement in performance after the program. Similarly, Ramadan and Sayed (2020) confirmed the effectiveness of storytelling in developing emotional intelligence, which positively influenced interaction and problem-solving skills among preparatory-level students with hearing impairments—a group comparable to the current study's sample. Likewise, Fayyad et al. (2022) showed that a story-based program helped reduce

behavioral and emotional problems while also enhancing vocabulary and concepts, highlighting the integrative impact of storytelling on both cognitive and emotional domains.

Furthermore, Abdu and Al-Mukhlafi (2023) indicated that adopting storytelling as a training approach supports reflective thinking, which directly enhances learners' ability to handle new life situations and derive innovative solutions—the core of problem-solving skills. Also, the findings of Ibrahim et al.'s (2025) study demonstrated that oral narrative intervention significantly improved comprehension and narrative production skills among children with hearing impairments, strengthening the argument that storytelling serves as a powerful medium for linguistic and cognitive development.

These results reinforce the strength of the current program, which was built on realistic stories tied to actual life situations faced by students (e.g., time management, career decisions, budgeting). This made learning more meaningful and closely connected to real experiences, as all sample participants showed progress on the problem-solving skills scale, with no evidence of regression or stagnation in performance.

In light of this, it is confirmed that storytelling as an instructional approach is not merely a motivational tool, but rather a cognitive strategy that enables learners to engage in organized thinking, analysis, planning, implementation, and evaluation—all essential phases in problem-solving (Al-Mansouri and Salem, 2018; Gharib et al., 2024; Heong et al., 2024). The study findings also indicated that the story-based training program was effective across all communication modes, whether spoken language or bilingual. All sample participants showed notable improvement regardless of the communication method they relied upon. This demonstrates that the program design incorporated the principle of educational inclusion, as well as visual and linguistic integration, consistent with the recommendations of numerous educational studies.

This result is in line with Fayyad et al. (2022), who emphasized the importance of designing educational stories that meet the visual and linguistic characteristics of hearing-impaired learners through the use of realistic images, their translation into sign language, and the incorporation of visual elements to facilitate content interaction. These features were evident in the current program, which explains its equal effectiveness across groups. Similarly, Al-Zahrani and Abdulaziz (2023) confirmed that the use of interactive stories supported with multimedia is an effective teaching tool that overcomes individual differences in communication modes, providing an equitable and stimulating educational environment for hard-of-hearing students.

This result also aligns with Al-Taqatqa and Al-Ahmadi (2024) who showed that employing illustrated stories improved expressive language skills among deaf students regardless of teachers' experience or the communication method used, reflecting the importance of visual and interactive content as a common effective factor. Moreover, Walker et al. (2023) supported this direction by revealing that

differences in narrative performance among hearing-impaired children are not solely determined by the mode of communication but are also influenced by the quality of linguistic and visual inputs. This suggests that preparing stories in a rich and stimulating manner—as done in the present program—helps reduce performance gaps between different communication modes.

This consistent impact across communication modes reflects the success of the program in ensuring equitable access to knowledge through the integration of visual language with realistic educational dialogue. This enabled all students to understand and practice the stages of problem-solving with equal effectiveness. Accordingly, it is evident that the story-based program was effective, not only in enhancing students' problem-solving competence but also in achieving equity across different communication modes. This confirms that its design considered individual differences and the needs of the target group of hard-of-hearing students. Such results support the directions of modern special education, which advocate for inclusive, flexible, and interactive educational programs.

Overall, the results indicate that the story-based training program achieved high effectiveness in developing problem-solving skills among hard-of-hearing female students, regardless of their communication method. From the researchers' perspective, these results can be explained by several factors, most notably the program's reliance on the Realistic Learning Model, which connected content to students' daily experiences; the use of realistic and interactive educational stories that reflected relevant life situations; consideration of the characteristics of the hearing-impaired group by employing visual media and simplifying language; and reliance on active teaching strategies such as brainstorming, discussion, and role-play.

These elements promoted interaction and critical thinking. In addition, the program was characterized by its flexibility in accommodating different communication modes, its inclusion of activities that foster higher-order thinking, and the provision of continuous feedback, which contributed to enhancing understanding and improving performance. Therefore, the success of the program can be attributed to its comprehensiveness in content, methodology, learning environment, and strategies employed, all of which were tailored to meet the needs of hard-of-hearing students. This was reflected in the positive results achieved.

6. Conclusion

The study confirmed the effectiveness of the story-based training program in developing problem-solving skills among hard-of-hearing female secondary school students. This success is attributed to its design based on realistic learning principles, the integration of real-life educational stories, and the use of flexible interactive strategies suited to the linguistic and visual needs of the target group. The findings highlight that educational stories are not merely motivational tools, but a comprehensive pedagogical framework that fosters thinking, analysis, and decision-making.

The study enriches inclusive education literature by providing empirical evidence on the effectiveness of storytelling in enhancing higher-order cognitive skills among deaf and hard-of-hearing students. It offers practical guidance for educators and curriculum designers to integrate purposeful storytelling and interactive strategies into teaching. The findings also inform specialists in developing interventions that support both academic success and socio-emotional growth.

7. Recommendations and Future Studies

Based on the findings, the study recommends integrating educational stories into curricula for deaf and hard-of-hearing students to promote thinking and develop cognitive and social skills. Teachers should adopt interactive visual strategies such as role-play and picture-based games, supported by institutions through training and inclusive learning environments. Curriculum developers are encouraged to incorporate storytelling and modern technologies—such as AI and augmented reality—into programs. Future research should explore storytelling's impact on other skills (e.g., critical thinking and decision-making) and examine its long-term educational effects.

8. Limitations of the Study

This study's generalizability is limited by its small sample (nine students) and short intervention period. The quasi-experimental design may not fully control external variables, while the focus on problem-solving excluded other skills such as creativity and communication. Future studies should involve larger samples, longer durations, and broader measures to confirm and extend these findings.

Declaration of interest statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Availability of data and material: All data generated or analysed during this study are included in this published article [and its supplementary information files].

Authors Contributions: The authors (A, A, N) collected the data, analyzed the data, and wrote the paper.

Acknowledgement: This work was supported by the Deanship of Scientific Research, Vice Presidency for Graduate Studies and Scientific Research, King Faisal University, Saudi Arabia [Grant No. KFU253786].

9. References

Abdel Nabi, A., Helmy, G., & Al-Nabrawi, O. (2024). The effectiveness of a digital story-based training program in reducing withdrawal behavior among a sample of hearing-impaired children. *Journal of Special Needs Sciences, 6*(13), 1–33. https://doi.org/10.21608/jshm.2024.237049.1333

Abdu, S., & Al-Mukhlafi, M. (2023). Effectiveness of a story-based strategy in developing reflective thinking skills among fifth-grade students in basic education in Yemen.

Arab Journal for Child Media and Culture, 6(26), 69–108. https://doi.org/10.21608/jacc.2023.322403

Abu Bakr, Z. (2022). The effect of teaching science using digital stories supported by sign language on acquiring scientific concepts, developing reflective thinking skills, and engagement in learning among hearing-impaired preparatory school students. *Educational Journal of the Faculty of Education, Sohag University, 104*(104), 147–198. https://doi.org/10.21608/edusohag.2022.272242

Akay, E. (2023). Development of problem-solving skills of a student with cochlear implant in social studies: Action research. *Participatory Educational Research, 10*(6), 175–191. https://doi.org/10.17275/per.23.95.10.6

Al-Abadi, N., & Al-Zahrani, A. (2024). Reading comprehension skills among hearing-impaired female students in the higher education program for the deaf and hard of hearing at King Saud University. *Journal of the Faculty of Education, 90*(4), 549–587. https://doi.org/10.21608/mkmgt.2024.326781.1824

Al-Harbi, K., & Al-Mazroui, S. (2025). Employing learning objects and digital storytelling in enhancing the effectiveness of education: An applied study in learning environments. *International Journal of Technology and Educational Computing, 4*(10), 1–28. https://doi.org/10.21608/ijtec.2025.346778.1004

Al-Mansouri, A., & Salem, D. (2018). Developing a problem-solving skill scale for counseling students. *Basra Research Journal for Human Sciences, 43*(4), 104–118. https://doi.org/10.33762/0694-043-004-005

Al-Musaidiyeen, S. (2021). The effect of a counseling program using educational games on developing self-esteem and problem-solving skills among third-grade students in the Directorate of Education in Busaira District. *Jordanian International Areeam Journal for Humanities and Social Sciences, 3*(3), 1–17. https://doi.org/10.5281/zenodo.4963861

Al-Anzi, W., & Turkestani, M. (2024). The effect of the strategic and interactive writing instruction (SIWI) strategy on the development of written expression skills among hearing impaired female students in secondary school. *Journal of Educational and Psychological Studies - Sultan Qaboos University, 18*(1), 51-76, http://dx.doi.org/10.53543/jeps.vol18iss1pp51-67

Al-Sawwat, N., & Turkestani, M. (2020). The effect of using picture stories on developing the vocabulary of deaf female primary school students. *Saudi Journal of Special Education, (14),* 51–84. https://doi.org/10.33948/1640-000-014-002

Al-Sheikh, S., Bouras, F., & Gourari, B. (2018). The impact of a proposed recreational sports program on problem-solving skills among hearing-impaired individuals. *Sciences et Pratiques des Activités Physiques Sportives et Artistiques, 7*(1), 1–11.

Al-Taqatqa, F., & Al-Ahmadi, S. (2024). The extent of employing picture stories in developing expressive language skills among hard of hearing female primary students from the perspective of their teachers. *Journal of Special Education and Rehabilitation, 17*(61.2), 71–107. https://doi.org/10.21608/sero.2024.353399

Al-Yousef, R., & Al-Balawi, H. (2019). The effect of a training program based on the Treffinger model for creative problem-solving in developing perceived self-efficacy among first-year secondary students in Tabuk, Saudi Arabia. *Journal of Educational Sciences, 46*(2), 1–17. https://archives.ju.edu.jo/index.php/edu/article/view/16101/10184

Al-Zahrani, H., & Abdulaziz, O. (2023). Using illustrated short stories to enhance language development of deaf and hard of hearing students from their teachers' perspectives. *Journal of Educational and Psychological Sciences, 7*(38), 58–83. https://doi.org/10.26389/AJSRP.H010623

Aristizábal, L. F., Cano, S., & Collazos, C. (2017). Using storytelling to support the education of deaf children: A systematic literature review. In A. Marcus, & W. Wang (Eds.), *Design, ser experience, and usability: Theory, methodology, and*

management (pp. 371–382). Springer. https://doi.org/10.1007/978-3-319-58640-3_26

Carden, K. C., Andrus, D., & Bunta, F. (2024). Narrative intervention for preschoolers who are deaf and hard of hearing using listening and spoken language: A pilot study. *Language, Speech, and Hearing Services in Schools, 55*(2), 342–359. https://pubmed.ncbi.nlm.nih.gov/38215241/

Carrano, A. L., Dannels, W. A., & Marshall, M. M. (2014, June). Integration of experiential learning to develop problem solving skills in deaf and hard of hearing STEM students. [Paper presentation] *2014 ASEE Annual Conference & Exposition*. Indianapolis, IN. https://doi.org/10.1093/deafed/enw050

Çoban Budak, E., Deveci Topal, A., & Kolburan Geçer, A. (2018). Developing the scale of problem-solving skills for secondary school-aged deaf and hard of hearing students. *Pedagogical Research, 3*(1), 1–8. https://doi.org/10.20897/pr/86824

Creswell, J. W. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches* (3rd ed.). Sage. https://psycnet.apa.org/record/2008-13604-000

Dashti, J., Abdul Jalil, A., & Shaker, M. (2024). The effect of using digital stories on improving academic skills among children with autism. *Journal of the Faculty of Education (Assiut), 40*(6.2), 279–304. https://doi.org/10.21608/mfes.2024.376701

Farajallah, H., & Mosleh, O. (2024). The effect of storytelling strategy on developing linguistic vocabulary and attitudes toward Arabic among first-cycle students. *International University of Madinah Journal of Educational and Psychological Sciences (MIJEPS), (14),* 1–28. http://ojs.mediu.edu.my/index.php/MIJEPS/article/view/4958

Fayyad, H., Abdel-Naeim, H., & Al-Samman, M. (2022). Effectiveness of a story-based approach program in developing linguistic vocabulary and reducing emotional and behavioral problems among gifted students with hearing impairment. *Journal of Special Education, 11*(40), 138–203. https://doi.org/10.21608/mtkh.2022.295092

Gharib, S., Ali, H., & Suleiman, S. (2024). Psychometric properties of an objective problem-solving skills scale based on multiple true-false (MTF) items. *Journal of Educational Sciences – Faculty of Education, Qena, 58*(58), 227–255. http://search.mandumah.com/Record/1452517

Hardebeck, L., Schwarze, J., & Sachse, S. (2024). Narrative and related spoken language skills—a comparison study of German-speaking children who are hard of hearing and their peers with typical hearing. *Frontiers in Communication, 9,* 1473075. https://doi.org/10.3389/fcomm.2024.1473075

Heong, Y. M., Mahmad, M. F. B., & Kiong, T. T. (2024). Exploring demographic disparities in the mastery of higher-order thinking skills among primary school pupils. *9th International STEM Education Conference (iSTEM-Ed)* [Conference presentation]. https://doi.org/10.1109/iSTEM-Ed62750.2024.10663173

Humphries, T., Kushalnagar, P., Mathur, G., Napoli, D. J., Padden, C., Rathmann, C., & Smith, S. R. (2014). Language choices for deaf infants: Advice for parents regarding sign languages. *Clinical Pediatrics, 53*(5), 513–518. https://doi.org/10.1177/0009922814528032

Ibrahim, S., Sobhy, O., El-Maghraby, R., & Hamouda, N. (2025). Efficacy of an oral narrative language intervention program on children with hearing impairment: a randomized controlled trial. *Egyptian Journal of Otolaryngology, 41*(1), 56. https://doi.org/10.1186/s43163-025-00807-5

Ismail, K. (2024). Problem-solving skills among students of Garmian University. *Journal of the College of Islamic Sciences, 30*(3), 1–22. https://doi.org/10.51930/jcois.21.2024.77.0429

Kadwani, L. (2018). A theatrical program to develop decision-making and problem-solving skills in kindergarten children. *Studies in Childhood and Education, 5*(2), 132–200. https://doi.org/10.21608/dftt.2018.134954

Kwon, E. Y., Cannon, J. E., Knight, V. F., Mercer, S. H., & Guardino, C. (2023). Effects of social stories on increasing social interaction and engagement of deaf and hard of hearing students with autism spectrum disorder in inclusive settings. *Journal of Autism and Developmental Disorders, 53*(5), 1915–1929. https://doi.org/10.1007/s10803-022-05430-4

Marei, S. S., & Jaradat, S. A. (2023). The effect of teaching science using digital storytelling in developing creative thinking skills among third graders in Jordan. *Dirasat: Educational Sciences, 50*(2), 477–490. https://doi.org/10.35516/edu.v50i2.17 8

Marschark, M., & Hauser, P. C. (2012). *How deaf children learn: What parents and teachers need to know*. Oxford University Press.

Miller, C., Boone, K. M., Pattisapu, P., & Malhotra, P. (2024). Study protocol for Hear Me Read (HMR): A prospective clinical trial assessing a digital storybook intervention for young children who are deaf or hard of hearing. *PLOS ONE, 19*(4), e0302734. https://doi.org/10.1371/journal.pone.0302734

Saudi Arabia. Ministry of Education. (2020). *Teacher's guide for students with hearing impairments.* MoE.. https://www.moe.gov.sa/en/aboutus/aboutministry/RPRLibrary/%D8%AF%D9%84%D9%8A%D9%84%20%D9%85%D8%B9%D9%84%D9%85%20%D8%A7%D9%84%D8%A7%D9%95%D8%B9%D8%A7%D9%82%D8%A9%20%D8%A7%D9%84%D8%B3%D9%85%D8%B9%D9%8A%D8%A9.pdf

Pagliaro, C. M., & Ansell, E. (2012). Deaf and hard of hearing students' problem-solving strategies with signed arithmetic story problems. *American Annals of the Deaf, 156*(5), 438–458. https://doi.org/10.1353/aad.2012.1600

Ramadan, A., & Sayed, S. (2020). The effectiveness of a story-based program in developing emotional intelligence and its impact on improving internal locus of control among hearing-impaired students in inclusive preparatory schools in Beni Suef. *Journal of the Faculty of Education in Psychological Sciences, 44*(4), 351–424. https://doi.org/10.21608/jfeps.2020.199344

Rosen, R. S. (2025). Life-story narratives of deaf and hard-of-hearing people as sensory autobiographies of deafness. *Life Writing*, 1–20. https://doi.org/10.1080/14484528.2025.2531441

Walker, E. A., Harrison, M., Baumann, R., Moeller, M. P., Sorensen, E., Oleson, J. J., & McCreery, R. W. (2023). Story generation and narrative retells in children who are hard of hearing and hearing children. *Journal of Speech, Language, and Hearing Research, 66*(9), 3550–3573. https://doi.org/10.1044/2023_JSLHR-23-00084

Appendix A

Problem-Solving Skills Scale for Secondary School Students with Hearing Impairment

Part 1: Choosing the Vacation Date

Fatimah and her family plan to travel during the vacation. Let us find the date when the whole family can go together. The shaded days are suitable for both the mother and the father.

Mother's Holiday

July

Sun	Mon	Tue	Thu	Wed	Fri	Sat
-	-	-	-	-	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31	-	-	-	-	-	-

August

Sun	Mon	Tue	Thu	Wed	Fri	Sat
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

Father's Holiday

July

Sun	Mon	Tue	Thu	Wed	Fri	Sat
-	-	-	-	-	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31	-	-	-	-	-	-

August

Sun	Mon	Tue	Thu	Wed	Fri	Sat
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

When will they be able to go on a two-week vacation together?

Part 2: Determining the Vacation Destination

Where do the family want to go together, knowing that the vacation will take place during the summer?

() Dhahra () Al-Ahsa

() Riyadh () Al-Ula

Part 3: What is the family's problem?
o Determine the number of family members who will be traveling together.

o Choose the appropriate vacation date.

o Choose the appropriate vacation location.

o Know how to allocate the budget.

Part 4: Evaluating Tourism Company Prices

Price (SAR)	Tourism companies
4800	عطلات ربيع الخليج Gulf Spring Holidays
4000	Rexon Holidays عطلات ركسون
5400	سفريات أيس ACE TRAVEL

Which tourism company offered the best price?

o Gulf Spring Holidays

o Rexon Holidays

o Ace Travel

Part 5: Comparing Bus Ticket Prices

Price (SAR)	Tourism companies
240	سابتكو SAPTCO
300	شركة المواصلات العامة Public Transportation Co
350	النقل العام لمدينة الرياض riyadh public transport Capital Metro

Which of the following statements is correct?
☐ The cost of Capital Metro is cheaper than the Public Transport Company.
☐ The cost of SAPTCO is cheaper than the Public Transport Company.
☐ The cheapest cost is the Capital Metro bus.
☐ The cost of the Public Transport Company is higher than Capital Metro.

Part 6: Calculating Price Distribution and Discount
Fatimah's family paid 4,350 SAR for the vacation. The cost is distributed among family members as follows: 4350 ÷ 3 = 1450. The tourism company provided a 300 SAR discount because the family paid in cash.

What is each family member's share of the discount?
☐ 300 ÷ 3
☐ 300 ÷ 2

Part 7-8: Fuel-Related Problems for the Car Trip

Fatimah's family will travel by car for their vacation and
road distance is 200 km.
Which of the following statements is correct?
☐ 1 liter for every 10 km
☐ 10 liters for every 2 hours

How much fuel does the car need?
☐ 10 liters
☐ 15 liters
☐ 20 liters