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Hearing impairment and teaching basic electronics concepts: An opportunity for educational inclusion in the classroom

La discapacidad auditiva y la enseñanza de conceptos básicos de electrónica: una oportunidad de inclusión educativa en el aula

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SUMMARY

Objective: *To strengthen the knowledge and skills in basic electronics for students with hearing disabilities through a problem-based teaching strategy and an inclusive Digital Educational Resource (DER).* **Methods:** *A mixed-approach study, with an explanatory scope based on action research and a quasi-experimental design, was developed. The sample consisted of four ninth-grade students with hearing disabilities from a Colombian educational institution. A pretest and a posttest were applied to measure the level of knowledge, and a field diary was used to record the students' behavior.* **Results***: The DER requirements were established based on the diagnosis of the teacher's skills to guide the training process, together with the student's prior knowledge. The results of the pretest showed an average approval rate of 41.96 %. Implementing the teaching strategy allowed students to understand the principles and laws of electronics, symbology, and the operation of electronic components and electrical circuits. Following the pedagogical intervention, the posttest yielded an average passing rate of 96.43 %, and the calculation of the Hake factor determined a high learning gain of 0.938.* **Conclusions:** *The teaching strategy and the inclusive DER awakened the interest and strengthened the knowledge and skills in basic electronics of the four students with hearing impairments. Teacher training in the design of inclusive educational materials is recommended, as well as in the implementation of effective teaching strategies that promote truly inclusive and quality teaching of technology.*

Keywords: *Hearing Disability, inclusion, digital educational resource, problem-based teaching strategy, basic electronics fundamentals.*

RESUMEN

Objetivo: *Fortalecer los conocimientos y habilidades en electrónica básica a estudiantes con discapacidad auditiva mediante una estrategia didáctica basada*

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en problemas y un Recurso Educativo Digital (RED) inclusivo. **Métodos:** *Se desarrolló un estudio con enfoque mixto, de alcance explicativo, basado en la Investigación-Acción y con un diseño cuasiexperimental. La muestra estuvo conformada por cuatro estudiantes de noveno grado con discapacidad auditiva de una institución educativa colombiana. Se aplicaron un pretest y un postest para medir el nivel de conocimiento, y un diario de campo para registrar el comportamiento de los estudiantes.* **Resultados:** *Se establecieron los requerimientos del RED a partir del diagnóstico de las habilidades del docente para orientar el proceso formativo, junto con el conocimiento previo de los estudiantes. Los resultados del pretest evidenciaron un promedio de aprobación del 41,96 %. La implementación de la estrategia didáctica permitió a los estudiantes comprender principios y leyes de la electrónica, simbología, funcionamiento de componentes electrónicos y circuitos eléctricos. Tras la intervención pedagógica, el postest arrojó un promedio de aprobación del 96,43 %, y el cálculo del factor de Hake determinó una ganancia de aprendizaje alta de 0,938.* **Conclusiones:** *La estrategia didáctica y el RED inclusivo lograron despertar el interés y fortalecer los conocimientos y habilidades en electrónica básica de los cuatro estudiantes con discapacidad auditiva. Se recomienda la capacitación docente en el diseño de materiales educativos inclusivos, así como en la implementación de estrategias didácticas efectivas que promuevan una enseñanza de la tecnología verdaderamente inclusiva y de calidad.*

Palabras clave: *Discapacidad auditiva, inclusión, recurso educativo digital, estrategia didáctica basada en problemas, fundamentos básicos de electrónica.*

INTRODUCTION

At a global level, the United Nations (UN), through the 2030 Agenda and within its fourth Sustainable Development Goal (SDG), proposes that each country must guarantee inclusive, equitable, and quality education, promoting learning opportunities for all (1). This implies eliminating barriers to access to education, improving teacher training, and developing innovative methodologies that respond to the needs of diverse groups, including students with disabilities (2).

In this regard, in recent years, Colombia has been promoting educational policies that seek to guarantee the right to education for all, regardless of their economic situation, beliefs, culture, or physical, sensory, or psychological disabilities (3). In addition to this last aspect, provisions guarantee the full exercise of the rights of people with disabilities, established in Statutory Law 1618 of 2013 (4). This law seeks that each entity, such as health, work, education, and culture systems, adopt measures of inclusion, affirmative action, and reasonable adjustments, promoting the elimination of all types of discrimination based on disability (5).

In this sense, the Colombian educational system has promoted the inclusion of students with disabilities in the classroom at all educational levels (6). However, this inclusion has represented, in some cases, an enormous challenge for pedagogical practice. Among the limitations faced by Colombian educational centers is the lack of access to physical and technological equipment, as well as the lack of adequate infrastructure that allows the mobility of students with disabilities within institutions (7,8). Another limitation, in the case of deaf students, is the lack of knowledge and use of Colombian Sign Language (LSC) by teachers, directors, students, and other educational community members (9). This prevents students from being effectively included in the classroom due to communication difficulties.

Regarding the teaching-learning processes, in Colombia, there are repositories such as "Colombia Aprende", "Píldoras Informáticas" and higher education repositories, where some guidelines for the development of educational materials for blind people are found (10,11). However, there is a lack of inclusive teaching materials that allow students with hearing disabilities to learn autonomously (12). In addition, although some websites with teaching materials aimed at the deaf community can be found on the Internet, many of them use sign systems other than the Colombian one, which generates confusion in students during their learning process (13,14).

One of the areas of knowledge with the greatest lack of inclusive teaching materials for deaf people is the area of Technology (15,16). In this field, students are expected to acquire knowledge about computer systems, mechanics, graphic expression, electricity, and electronics (17-19). However, due to the complexity and technicality of the topics addressed, the production of accessible teaching materials in this area is very limited (20).

This research sought to answer the following question: How can learning basic electronics fundamentals be improved for ninth-grade students with hearing disabilities? Thus, the aim was to strengthen knowledge and skills in basic electronics fundamentals for students with hearing disabilities through a problem-based teaching strategy and the use of an inclusive digital educational resource.

METHODS

The study used a mixed-methods approach, incorporating action research and a quasi-experimental design. The mixed-methods approach combines the quantitative approach, which allows for the collection of numerical data, and the qualitative approach, which gathers opinions from the studied population (21).

For this study, the quantitative approach was used to collect numerical data to corroborate the variation in learning in the study sample. On the other hand, the qualitative approach allowed the analysis of the students' attitudes towards the pedagogical intervention. Regarding the type of research, Action Research (AR) was chosen, since the researchers were involved in the study execution process and interacted directly with the population (22).

The population under study was students with hearing disabilities enrolled in an educational institution in the city of Duitama, Boyacá (Colombia). The study sample was selected by convenience and consisted of four deaf students in the ninth grade at the Instituto Técnico Industrial Rafael Reyes.

This research used two questionnaires and a field diary as data collection instruments. The questionnaires were applied two times: as a pretest and a posttest. Each consisted of 28 questions with different response options, as illustrated in Table 1.

Table 1. Characteristics of the Pretest and Posttest Questionnaires

Components	**Number of Questions**	**Response Type**
C1. Device identification	9	Short answer
C2. Understanding how devices work	9	Multiple choice with only one answer
C3. Type of Circuits	3	Multiple choice with open response
C4. Fundamental Principles and Laws of Electronics	2	Long Answer
C5. Symbolism	5	Match

The field diary, on the other hand, was used as a qualitative instrument to record detailed observations on the behavior, participation, and evolution of students' learning during the implementation of the teaching strategy and the use of the Digital Educational Resource (DER) in learning the fundamentals of electronics (23). The field diary is very useful as it allows researchers to record context observations for later analysis (24).

In order to apply the measurement instruments and the pedagogical intervention, informed consent was obtained from each parent or legal representative of the students. Likewise, authorization was obtained from the principal of the educational institution to carry out the intervention during class hours. Since the study sample was made up of minors, respect for their integrity and the confidentiality of their names was guaranteed throughout the process.

Procedure

This research was developed in five phases

Phase 1: Characterization of communication and teaching strategies. How students communicated and interacted in the classroom was identified. In addition, the teaching strategies used by the Technology and Information Technology teachers for teaching this population were analyzed.

Phase 2: Diagnosis of prior knowledge. The deaf students' prior knowledge of basic electronics fundamentals was evaluated by applying a pretest. The results were organized according to the evaluation system proposed by the educational institution, which classifies performance into four levels: superior performance (S), with a numerical equivalence between 9.5 and 10.0; high performance (A), from 8.0 to 9.4; basic performance (BS), from 6.0 to 7.9; and low performance (BJ), from 1.0 to 5.9.

Phase 3: Design of the teaching strategy and educational material. The teaching strategy was structured, and the educational material for teaching the basic fundamentals of electronics was designed.

Phase 4: Implementation of the pedagogical intervention. The pedagogical intervention was carried out with the study sample, using the resources and strategies designed in the previous phase.

Phase 5: Learning assessment. A post-test was applied to assess the knowledge acquired after the pedagogical intervention. Subsequently, a comparison was made between the pre-test and the post-test results to determine whether there was a gain in student learning. Equation 1 was applied to calculate the Hake factor (G).

$$G = \frac{(Postest\ (\%)\text{-}Pretest\ (\%))}{(100\text{-}Pretest\ (\%))}$$

The value of G is interpreted based on the improvement obtained after the educational intervention. According to Hake (1998, cited by 25), the gain is classified into three levels: low ($G \leq 0.3$), medium ($0.3 < G \leq 0.7$), and high ($G > 0.7$). A higher value of G indicates greater effectiveness of the teaching-learning process.

RESULTS

Characterization of communication and teaching strategies

The characterization of communication and performance of students with hearing disabilities in the classroom was carried out through direct observation in the Technology and Information Technology subjects. During four class sessions, it was identified that deaf students interacted very little with their 32 ninth-grade classmates. Communication between them and the other students was limited to some basic signs for greeting or joking. However, to engage in a fluid conversation, it was necessary to resort to text messages through WhatsApp or written notes on paper. In addition, during breaks or group activities, the four deaf students worked and socialized among themselves, even though their other classmates invited them to join the group.

Regarding communication between the deaf students, it was observed that one of them had some slight difficulties interacting with the other three classmates, as he used unofficial signs to refer to certain objects or actions. Faced with this situation, the interpreter intervened to help unify the sign language among them and, in addition, to teach them to their families, to improve communication between the students, and in various contexts.

In the classroom, the students had the support of a sign language interpreter, who accompanied them in some class sessions. However, his availability to assist them was limited due to the high demand for his work in other courses and schools in the region.

Regarding the learning processes, deaf students were receptive to the teacher's information on the board or through slides projected on the television. However, this material was insufficient to guarantee the subject's understanding, since the teacher's verbal explanation complemented the concepts. Due to the absence of the interpreter on several occasions, the students had difficulties clarifying doubts and fully understanding the topics addressed.

In relation to the teaching strategies used by the teacher, two main approaches were identified: traditional classes and practical classes (26). The teacher explained the theory in traditional classes, and the students took notes on the central topic to later carry out consultation activities or develop written workshops. In practical classes, the teacher implemented challenge-based learning, where students had to solve a problem based on prior theoretical conceptualization (27). In these types of activities, deaf students always worked in groups, while the others could choose between group or individual work.

When the interpreter was absent, the teacher tried to use some basic signs to communicate with the deaf students. On other occasions, he prepared teaching materials, such as brochures or extracts from books, so that the students could read and understand the subject matter. However, doubts could only be resolved in writing, which created difficulties in the class dynamics. This situation required the teacher to focus his attention on the deaf students, which sometimes caused indiscipline among the rest of the group, who felt excluded from the teaching process.

Diagnosis of prior knowledge

After the initial observation, in which the student's way of communicating and the teacher's teaching methodology in the classroom were analyzed, a pretest was applied to evaluate prior knowledge of basic electronics fundamentals. This pretest was carried out in a one-hour class session using a Google Form that allowed the inclusion of short videos in sign language to facilitate the students' understanding of each question.

The pretest results showed that two students reached a basic level, with scores of 6.43 and 6.07, while the other two obtained a low level, with scores of 2.86 and 1.43. According to the Technology and Information Technology curriculum for ninth grade, these data reflect deficiencies in learning fundamental electronics concepts, which should have already been addressed. Table 2 presents the pretest results, broken down by correct and incorrect answers in each evaluated component.

As can be seen in Table 2, the component with the lowest performance was C4. "Fundamental principles and laws of electronics", in which none of the four students answered correctly. This indicates difficulties in relating theoretical concepts such as Ohm's Law and identifying essential definitions, such as electricity, insulating materials, and conductive materials, among others.

Table 2. Pretest results by components

Components	**S1**		**S2**		**S3**		**S4**	
	C	I	C	I	C	I	C	I
C1. Device identification	9	0	9	0	4	5	6	3
C2. Understanding how devices work	5	4	5	4	0	9	0	9
C3. Type of Circuits	2	1	0	3	0	3	0	3
C4. Fundamental Principles and Laws of Electronics	0	2	0	2	0	2	0	2
C5. Symbolism	2	3	3	2	0	5	2	3

S = Student C = Correct I = Incorrect

On the other hand, the component in which the students obtained the best results was C1. "Device identification", since two of them correctly answered the nine questions of the pretest, while the other two obtained scores of six and four correct answers, respectively. This suggests that most of the students recognize the names of the components used to assemble basic electronic circuits, such as motors, LEDs, resistors, batteries, transistors, and diodes, among others.

Design of the teaching strategy and educational material

Based on the methodology implemented by the Technology and Information Technology teacher to guide the subject content, it was decided to apply Problem-Based Learning (PBL), with the aim of students acquiring a better command of the concepts (28). However, it was ensured that students were not limited to solving problems only on paper, but also did so through virtual simulators and real laboratory practices. Based on the above, the teaching strategy shown in Figure 1 was designed.

Figure 1 shows the proposed teaching strategy, which is based on PBL. Within this strategy, it is proposed to start with the theoretical conceptualization during a class hour, in which the student will learn, through texts and videos in sign language, the principles and laws that support the experiment to be carried out. Subsequently, the problem to be solved is presented, and, if the student has not understood the necessary theory, they will be able to consult it again through a Digital Educational Resource (DER), to which they will have unlimited access.

Once the student acquires the theoretical knowledge necessary to address the problem, he/she will proceed to use Tinkercad software to simulate the assembly of the circuit. After verifying that the design works correctly in the digital environment, the laboratory practice is carried out, using real electronic components. In this way, the student will be able to support his/her solution and, in case of doubts or improvements, he/she will receive feedback from the teacher.

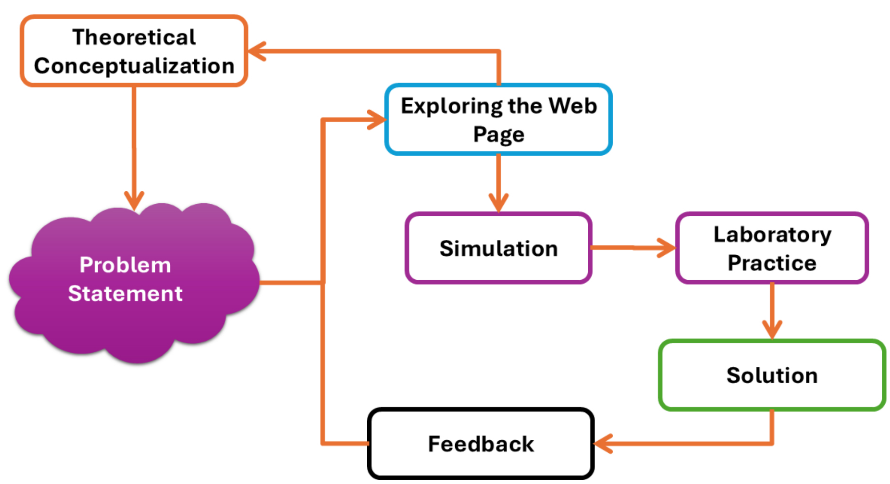

Figure 1. Teaching strategy based on PBL.

The contents to be developed are structured in ten class sessions, as presented in Table 3.

Finally, a Digital Educational Resource (DER) was designed and programmed on the Wix platform, in which videos and GIFs in sign language were inserted, in order to facilitate the learning of some theoretical concepts of electronics.

Table 3. Curricular content for learning basic electronics fundamentals

Session	The problem to be addressed	Learning Guides
1	How do you use the breadboard and basic electronic components correctly?	- Identify the proper use of the breadboard by assembling a simple circuit with an LED. - Recognize an LED's characteristics and operation and correct the connection by assembling it on the breadboard with two LEDs. - Identify the value of resistors using the color code.
2	How is Ohm's Law applied in electrical circuits?	- Interpret Ohm's Law and apply it in basic exercises to calculate voltage, current, and resistance.
3	How are series and parallel circuits identified and analyzed?	- Classify series and parallel circuits by their configuration and perform basic calculations using Ohm's Law. - Assemble and observe the characteristics of series and parallel circuits in experimental practice.
4	How to configure and analyze a mixed circuit?	- Identify mixed circuits and perform calculations using Ohm's Law. - Simulate mixed circuits to analyze their behavior and characteristics.
5	How do batteries, diodes, and potentiometers work in an electrical circuit?	- Analyze the behavior of batteries connected in series and parallel through practical and theoretical exercises. - Understand the operation of diodes through simulation and assembly, observing their ability to conduct current in only one direction. - Explore the relationship between resistance and luminosity in an LED by using a potentiometer in a circuit.
6	How can switches, transistors, and motors be used in a circuit?	- Understand how switches and push buttons work by building a circuit to turn on an LED. - Identify the role of transistors as switches by simulating and building them with LEDs. - Control the speed of a motor using a potentiometer, understanding its effect on the current.
7	How are technical datasheets interpreted and how do sensors work in circuits?	- Develop the ability to read technical datasheets through practical exercises. - Build a circuit with the QRD114 sensor to analyze its behavior.
8	How to design a mobile robot that follows a line by applying the concepts studied?	- Apply the acquired knowledge to design, assemble, and test a line-following robot. - Incorporate sensors and new electronic components into the circuit design. - Perform adjustments and tests to optimize the robot's operation.
9	How to design a robot that can grab an object using motors and switches?	- Implement motors and pushbuttons in a circuit to design a robot capable of holding an object. - Apply control and mechanics principles in the assembly of the gripping system.
10	How to design a mobile robot that moves based on light?	- Develop a circuit that allows a mobile robot to move according to the intensity of the light in its environment. - Use light sensors and electronic components to implement the movement mechanism.

Likewise, the guides that guide students in the creation of the assemblies, both in simulators and in physical laboratory practices, were hosted on the website. This DER was developed to provide students with accessible teaching material, which they could use both inside and outside the classroom. This material is available at the following link: https://redelectronicaelem.wixsite.com/my-site-1

Implementation of the pedagogical intervention

The pedagogical intervention was carried out in ten class sessions, each lasting two hours, developed during the fourth academic period of the year 2024. In this intervention, the work was performed exclusively with the four students who made up the study sample. During the first five sessions, there was support from a sign language interpreter; subsequently, communication with the students was carried out through signs and written messages.

At the beginning, the students showed little interest in learning the theoretical concepts of the course. During the use of the digital educational resource (DER), they skipped the theoretical section and went directly to the guide. However, when they encountered difficulties in continuing due to a lack of knowledge, they needed to consult the theoretical component to understand how to make the requested electronic assembly.

During the accompaniment process, it was observed that one of the students had a higher level of progress than his classmates. This was due to his interest in the subject, which led him to investigate social networks such as TikTok and YouTube independently. In contrast, the other three students only studied inside the classroom.

As for the development of the simulations, the four students demonstrated an adequate handling of this computer tool. The wide availability of electronic components within the simulator allowed them to explore various solutions to the problems posed, such as the development of series, parallel, and mixed circuits, using diodes, potentiometers, switches, and transistors.

However, in the laboratory practices, difficulties arose in the realization of the electronic assemblies, especially in tasks such as controlling the speed of a motor using potentiometers, varying the light intensity of an LED, and taking measurements with a multimeter. This was due to the fact that, in the Tinkercad simulator, the students were not afraid of damaging the components, since they were virtual, which led them to neglect the polarities. However, in the real assemblies, they expressed fear of burning the electronic components and, on some occasions, the connections did not respect the correct polarities.

As the sessions progressed and after the execution of the first experiment in the laboratory, the students showed a greater interest in learning, noticing that what they had simulated could work in reality. Based on this experience, the solutions proposed by each student to the challenges posed were innovative and functional. For example, for the challenge of designing a mobile robot that followed a line, they developed a line-following car; for the challenge of creating a robot that grabbed objects, they designed an articulated arm with a gripping system controlled by potentiometers; and for the challenge of building a light-detecting robot, they created a mobile spider that moved depending on the direction where it received the greatest light intensity.

Learning assessment

Once the pedagogical intervention was completed, the posttest was applied with the objective of identifying the level of learning achieved by the students in relation to the fundamentals of electronics. The posttest used contained the same number of questions and evaluated the same components as the pretest. The results showed that the four students passed the evaluation: one of them obtained an average of 9.28, corresponding to a high-performance level, while the remaining three achieved a higher performance level, with averages of 10 and 9.64.

Table 4 shows each student's correct and incorrect answers in the five components evaluated in the posttest. It can be observed that two students still had difficulties in the component of "fundamental principles and laws of electronics." However, it is evident that the students recognized the symbology of the different electronic components and understood their function within a circuit.

Table 4. Posttest results by components

Components	E1		E2		E3		E4	
	C	I	C	I	C	I	C	I
C1. Device identification	9	0	9	0	9	0	9	0
C2. Understanding how devices work	9	0	9	0	8	1	9	0
C3. Type of Circuits	3	0	2	1	3	0	3	0
C4. Fundamental Principles and Laws of Electronics	2	0	2	0	1	1	1	1
C5. Symbolism	5	0	5	0	5	0	5	0

S = Student C = Correct I = Incorrect

To evaluate the impact of the PBL-based teaching strategy, each student's pretest and posttest results were compared, as illustrated in Figure 2. A general improvement in the scores obtained in the posttest was identified, reaching a higher level of performance in the case of student 1. Likewise, significant improvements were observed in students 3 and 4, who went from failing the pretest with low levels (1.42 and 2.85) to passing the posttest with high and superior levels (9.28 and 9.64, respectively).

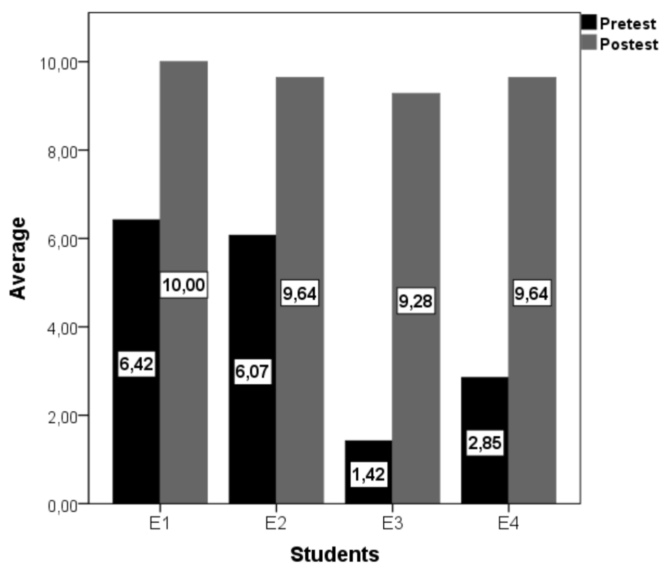

Figure 2. Comparison of pretest and posttest results.

Finally, to determine whether there was a significant gain in learning, the Hake factor was calculated using equation 1, established in the study methodology. The value obtained was 0.938, which indicates a high level of learning. These results corroborate the effectiveness of the strategy and the teaching material used, which allows us to conclude that students with hearing disabilities managed to strengthen their knowledge and skills in the basic fundamentals of electronics.

DISCUSSION

The results demonstrate a high learning gain, with a value of 0.938 in the Hake factor. This is reflected in the students' academic performance, who went from an average score of 41.96 % in the pretest to 96.43 % in the posttest. From these data, it can be inferred that the teaching strategy based on PBL and the use of the Digital Educational Resource as teaching material contributed significantly to improving students' knowledge and skills in basic electronics. These findings support multiple investigations on the incorporation of new methodologies for teaching science and technology in the classroom, since it is evident that pedagogical success in teaching a concept is directly related to the teaching material used (16,29). However, this must be designed based on each student's particular needs (18).

On the other hand, during the pedagogical intervention, it was observed that the interpreter had to be absent on repeated occasions due to commitments in other educational institutions. This reflects the urgent need to have more interpreters or to establish training programs for teachers in topics such as Sign Language, Braille, and attention to psychological problems in the educational sector (9,20,30). In this way, teachers could orient their content in an accessible way for all students, regardless of their condition.

Regarding the challenges and challenges of teaching students with hearing disabilities, it was observed that they have a predominantly kinesthetic learning style. In this sense, strategies such as reflections, essays, or consultation activities are not motivating for them (31). In contrast, practical classes generate greater interest and add more value to their learning process, as they allow them to experiment with knowledge and learn from mistakes (28). In this research, students showed greater engagement in practical sessions than in theoretical ones, which supports recent studies indicating that new generations prefer a brief theoretical introduction, followed by a detailed practical experience (23,32). However, theoretical teaching cannot be separated, since there is no effective practice without a theoretical basis, nor theory without practical application.

Regarding the students' behavior in the classroom, it was evident that they work well in teams, although mainly with classmates who have the same disability. This highlights the need for educational institutions to implement truly inclusive projects, in which the integration of all students is encouraged (33). This is because, despite the efforts made in many school contexts based on diversity in the classroom, some activities are not sufficiently inclusive, and students end up being classified according to their academic performance, behavior, or disability (34,35).

The teaching material used in the study consisted of a Digital Educational Resource developed on the Wix platform, chosen for its multiplatform compatibility and the possibility of integrating various multimedia materials (36). However, it was identified that, nowadays, websites should include accessibility plugins that allow information to be presented in multiple formats (12,13). This would facilitate access to content for people with disabilities, reducing barriers in the learning process.

CONCLUSION

The research shows that it is possible to strengthen knowledge and skills in basic electronics in ninth-grade students with hearing disabilities through a problem-based teaching strategy and the use of an Inclusive Digital Educational Resource. To achieve these results, first, direct observation of the students in the study sample was carried out to determine how they learned and interacted with their peers, as well as to identify the methodology used by the teacher to guide the content. Subsequently, the student's prior knowledge was characterized, finding that only 2 of the 4 participants managed to pass the pretest with a basic performance level. Based on these results, the teaching strategy was structured, and inclusive teaching material was designed. Throughout 10 class sessions, the students were guided in strengthening their knowledge and skills in basic electronics fundamentals. At the end of the study, the results of the post-test were highly satisfactory, showing that the 4 students managed to pass with high and superior performance levels.

The above represents a possible solution to the challenges posed by the UN and the Ministry of National Education, which seek to guarantee inclusive and quality education from educational institutions. However, it is urgent to incorporate innovative methodologies in the classroom to ensure that all students learn effectively, regardless of their physical, cognitive, or psychological limitations. Likewise, in the future, it is expected that studies will emerge that propose mechanisms for teacher training in pedagogical, technological, and didactic aspects, allowing adequate attention to students with disabilities.

Authors' contribution

All authors participated in the review's conception, creation of objectives, setting of inclusion criteria, interpretation of the data, critical review of the manuscript, translation of the manuscript, and approval of the final version for publication.

Conflict of Interest

The authors state that they have no conflict of interest

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