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Technological Resources for the Bilingual Education of Deaf Students

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ABSTRACT – Technological Resources for the Bilingual Education of Deaf Students. This research investigates the use of playful resources structured in Power Point for the bilingual education of deaf students in a school located in the municipality of Timon, in the state of Maranhão. This study aims to analyze how digital games contribute to language acquisition. Methodologically, this is a exploratory and qualitative field research. Class observation, a semi-open questionnaire, and bibliographic research were carried out for data collection and analysis. Results show that the games used promote engagement and motivation for learning. We also observed that the presence of deaf cultural elements creates a more empathetic and inclusive school environment.

Keywords: Technological Resources. Inclusion. Learning. Deaf.

RESUMO – Recursos Tecnológicos na Educação Bilíngue de Estudantes Surdos. Esta pesquisa investiga o uso de recursos lúdicos estruturados com a ferramenta *Power Point* no ensino bilíngue de estudantes surdos, em uma escola situada no município de Timon, no estado do Maranhão. O objetivo é analisar a contribuição de jogos digitais no processo de aquisição linguística. Metodologicamente, trata-se de uma pesquisa de campo, do tipo exploratória e de cunho qualitativo. Para coleta e análise dos dados, foram realizadas observação das aulas, aplicação de questionário semiaberto e pesquisas bibliográficas. Os resultados demonstram que os jogos promovem engajamento e motivação para a aprendizagem. Observa-se ainda que a presença de elementos culturais surdos proporciona a criação de um ambiente escolar mais empático e inclusivo.

Palavras-chave: Recursos Tecnológicos. Inclusão. Aprendizagem. Surdos.

Introduction

Educational technologies stimulate a pedagogical practice connected to the numerous available resources and possibilities of teaching and learning. Teacher training fails to use all the digital skills necessary to productively use these learning environments. Thus, students are unable to experience those competences as they should.

A reality marked by sharp changes in several societal sectors drives new concepts, paradigms, interactive experiences, and perceptions of the world (Schlemmer; Di Felice; Serra, 2020). In this sense, schooling and including deaf students can positively use the multiple visual stimuli of digital spaces and communicative possibilities.

Technological educational games configure a resource which may potentiate both students' and teachers' learning and development regardless of the curricular matrix they use (Vieira; Olive tree; Pimentel, 2020). This resource is part of young people's daily lives and may have uses other than entertainment.

Thus, this study aims to broaden the discussion on the use of technological games as a potentiating resource for deaf students' literacy. For such purpose, we approach a didactic experience with games structured on Power Point, experienced in a state school of the public network in the municipality of Timon, in the state of Maranhão.

We justify this study by reflecting on deaf students' educational and digital inclusion and describing technological games in their bilingual teaching process under a perspective that shows how digital technologies corroborate teaching in a meaningful learning.

We should also highlight the relevance of this research by showing, with these results, the positive aspects of using digital games to teach deaf students. Moreover, many professionals seem to need to improve their skills in sign language to understand those who use it to communicate and express themselves, critically and clearly perceive the world and its scientific and technological advances (Quadros, 2003). Bibliographic studies and our result analysis show that trained professionals and access to technological tools, allied to educational games, are potential learning and inclusion elements.

Interactions From a Bilingual Perspective

Teaching Portuguese implies developing skills and competencies on its normative rules and the ability to understand the numerous communicative multiplicities its users can find since all legal documents use that language. Thus, deaf students' appropriation of Portuguese as a second language requires strategies that contemplate visual experiences as a teaching and learning basis.

We should point out that teaching Portuguese to deaf students in a bilingual proposal requires reflecting natural experiences with sign language in interactive processes since their cognitive gains result from

developed skills and acquired linguistic competence (Quadros, 2003). However, participants, whose parents can hear, still find themselves in the phase of effective appropriating the Brazilian Sign Language, which occurs together with second-language teaching since the former is associated with writing and they lack a relation with the sound structure of the language but showing an association with the visualized orthographic rules.

A bilingual and bicultural educational proposal allows deaf students to build their identity and perceive themselves as an important part of their community (Quadros, 2008). The school where we set this study, however, lacks educators for deaf students and the deaf culture still needs a greater representativeness. Thus, the school fails to meet the bilingual perspective proposed. Schools must constitute an environment where deaf students can develop language and manifest their thinking in a visually based language, which would allow the teaching of a second language (Quadros, 2003). Understanding that both languages assume their proper importance and functions in deaf students' social and school life is, then, essential.

Libras (the Brazilian Sign Language), in turn, is their legitimate form of communication, whereas Portuguese, its written expression. Libras, although not the basic language of the education system, is deaf people's official language. Thus, the fact that Written Portuguese is considered necessary for competence in legitimate culture ends up not invalidating the importance of sign language (Albres, 2015). The school must then create conditions to ensure access to both languages.

As Decree No. 5,626/2005, which regulates Law No. 10,436/2002 (on deaf people's right to bilingual education), ensures its compliance, schools, field of this research, has professional Libras interpreters and instructors who accompany students at their regular classes, also working with them in a specialized educational care room to teach them both in Portuguese and in Libras (Brazil, 2005).

Special educational service classes are important so students perceive the structure of their second and natural language, Libras, from a bilingual approach. Thus, students expand their linguistic repertoire and have more possibilities to appropriate their natural language.

Sign languages, rather than deriving from oral languages, stem from a natural need for communication between people, who, by visibility, can understand and manifest their thinking, which takes place by special visibility rather than by orality (Quadros, 2003). Thus, both the deaf and hearing community develop and use them since communication is a human necessity.

In the teaching context analyzed, Libras is not used in regular classes as instruction language; however, we could see some effort of the professionals (especially of interpreters) to include it in all environments.

Regarding Portuguese teaching, a bilingual proposal for the deaf must consider second language teaching techniques (Quadros, 2008).

That is, valuing students' experiences and knowledge with their first language is important so second language teaching emphasizes the care with the orthographic structure of words since deaf students find significance in the visual aspect. Thus, technological tools emerge as an important support for literacy, given their strong visual nature.

Didactic Games and Deaf Students

Technological advances have collaborated with many sectors of society, especially in education, in which innovations have evolved and contributed significantly to include deaf students in pedagogical practice.

Technological didactic games not only develop students' cognitive and intellectual skills, but also potentiate those essential for good social interactions, such as: respect for others, teamwork, and discipline to overcome problems and achieve objectives (Vieira; Oliveira; Pimentel, 2020). Games can, thus, stimulate and develop students' learning, from logical reasoning to the ability to interpret and provide opportunities for self-knowledge and emotional strengthening since it is a playful learning strategy.

The gaming world is an environment that prioritizes users and values their perception (Prensky, 2012). A pedagogical proposal centered on students and their learning results in a full development. Moreover, school spaces often seek to standardize their evaluations as if everyone learned at the same pace and in the same way. Thus, knowing individuals' characteristics in the classroom and using different methodologies is a way to democratize teaching.

In this line, Prensky (2012, p. 515) states that: "[...] learning based on digital games is currently being designed for audiences of different ages." In addition to age groups, games are elaborated by relating to a certain audience and intentionality. In this sense, didactic games must consider students' profile and skills so learning happens in a playful and natural way.

In his studies, Huizinga (2020) finds that recognizing a game is recognizing the spirit, since it configures something beyond the material regardless of the game. The experiences digital didactic games provide cannot be touched but observed and attested in interpersonal relationships, learning, and posture toward the digital. Such experiences must be increasingly present in learning environments.

Deaf students, in the reality of the assessed school, lack digital games contemplating their culture and strengthening their cultural identity since the entire teaching and management team can hear.

Lorn (2015, p. 83) claims that:

Deaf educational games, in my view, are necessary, i.e., they cannot be absent in bilingual education because they bring values and ideas and allow the acquisition of

knowledge by play. Their task is undoubtedly to make learning pleasant and lead the deaf student to the most pleasurable perception of knowledge.

The playful character of these games, together with the engagement they provide, shows an experience of involvement in the educational environment that favors interest in collaboratively performing tasks and searching for knowledge.

Games emerge as an educational proposal that aims to strengthen the learning process in a context of great media influence on young people and that can arouse individuals' interest, curiosity, and engagement, use modern and pleasurable elements to conduct the proposed activities, and manage learning (Silva; Pimentel, 2021). Strengthening learning processes more effectively develop students.

In the context of cognitive gains and engagement with educational games, it is interesting that, for an inclusive proposal, deaf cultural aspects also belong to the constitution of games. Thus, exploring the visual aspects of sign languages or handshapes is a proposal that values deaf culture.

Visual resources, as constituent elements of the games, have significant value to deaf students, which is absent in sound elements and relevant to those that can hear. Therefore, in an inclusive learning environment, conceiving bicultural educational games is an innovative and positive pedagogical strategy.

Methodological aspects

This is an exploratory field research. According to Lakatos and Marconi (2003, p. 186), it "[...] aims to collect information and/or knowledge about a problem for which an answer is sought, a hypothesis one wants to prove or even discover new phenomena or the relations between them." This study was developed in the state school of the public network Centro Educa Mais Anna Bernardes, in the municipality of Timon, in the state of Maranhão.

Results from a pedagogical experience with two digital games, "Sign Roulette" and "Burst Dictation" were qualitatively analyzed and described below. In total, two deaf students, enrolled in the first year of high school, and two Libras interpreters were included as participants in this experience. In addition to a bibliographic survey and observation of pedagogical practice, semi-open questionnaires were applied to the participants before and after the activities with the games.

Deaf students, identified by the initials A and B, respectively, are in the process of acquiring both Libras and Portuguese. They are followed-up by interpreters C and D in their regular classroom (which includes hearing students) and in a special room, which aims to promote linguistic acquisition.

Power Point was used for the proposed games, which dispense with the internet, a positive fact since the school has no computers and

students are unable to bring their cell phones with due to school's internal rules.

Students' knowledge about the entertainment and learning aspects of digital games and their experiences with digital technology at their school were investigated by a semi-open questionnaire applied before the games. The questions elaborated were:

- a) Do you use any digital technology to enhance learning? If so, which?
- b) If the previous response was positive, name them and how these technologies contribute to your learning.
- c) Do you use digital games for fun?
- d) If the previous response was positive, name which.
- e) Have you ever used any digital educational games at home or at school?
- f) If the previous response was positive, name which.
- g) Do your teachers or interpreters use or have they ever used digital games in the classroom? If the previous response was positive, name which.

A semi-open questionnaire was also applied to assess interpreters' experiences with digital educational games and their use in the classroom. The following questions were elaborated:

- a) Do you use any digital technology in your classes? If so, which?
- b) Do you use digital games for fun?
- c) If the previous response was positive, name which.
- d) Do you use or have you ever used digital games in the classroom to teach?
- e) If the previous response was positive, name which.

"Sign Roulette" was applied first. It consists of rotating two roulette wheels. The first has handshapes indicating a number from one to six and the second, eight different handshapes. After the roulette stopped spinning, players must signal different signifiers with a certain handshape, according to the number of times indicated by the first roulette. The game has a sound resource to instigate hearing students' inclusive participation.

The second experience was composed of "Burst Dictation." It consists of a sequence of 12 animal gifs that appear after a command to change slides. It is called "burst" because these gifs appear after an animated image of a balloon being blown up. "Burst Dictation" also has a sound feature that mimics a balloon burst so hearing students would also feel contemplated by the activity. In this game, in addition to signaling, students were invited to write the word according to normative Portuguese grammar. Then, students' answers were checked by their teacher, who would score their spelling and show the required normative answer.

Both proposals aimed to stimulate dactylology understanding and practice via Libras classifiers and graphically recording Portuguese so its written structure could be analyzed by students. The pedagogical activity can also be carried out in rooms with hearing students. The sound resources incorporated into the games stimulate hearing players' participation to promote their interaction and respect their peculiarities.

After these experiences, other questionnaires were applied to students and interpreters to assess which aspects of the games and their technological configuration stimulate Libras learning. The following questions were asked to students:

- a) What do you think about Sign Roulette?
- b) Do you believe that Sign Roulette helps to learn Libras? Why?
- c) What do you think about Burst Dictation?
- d) Do you believe that Burst Dictation assists the learning of Sign Language and Portuguese? Why?
- e) Do you believe that the use of digital educational games helps your learning? Why?
- f) Do you believe that the use of digital educational games improves students' interactions? Why?
- g) Would you like teachers and interpreters to use digital teaching games in their classes? Why?

The same questions were asked to interpreters, except for the last one since it is directly related to pedagogical practices and, given interpreters' positive involvement with our games, they showed interest in seeking more resources in this format.

Experiences with Games at School

The chosen school use no games aimed to assist the learning of curriculum components routinely. Our observations and interviewees' reports show that students have access to board, card, or guided games during physical education classes and leisure (as it is a full-time school).

Our playful experiences aimed to teach Portuguese happen with the interpreters, using games they made or acquired in specialized stores. These materials consist of memory games, dominoes, roulette tables, cards, among others that require no digital technologies. Due to this lack of digital environments and since we recognize the importance of these games to digitally and socially include students, we adapted the used analog games to *Power Point* so students could experience other possibilities and expand their linguistic and technological knowledge.

Students should have contact with games or playful experiences that stimulate the expression of their thoughts (Antunes, 2017). Thus, creating or adapting games that support the development of language and learning is a strategy that enriches teaching and learning processes.

Sign Roulette

This playful learning activity uses a didactic game composed of two roulette wheels created on Power Point. It aims to assist the learning of sign language in a fun and interactive way since more than one player can use it, inside and outside the classroom (Figure 1).

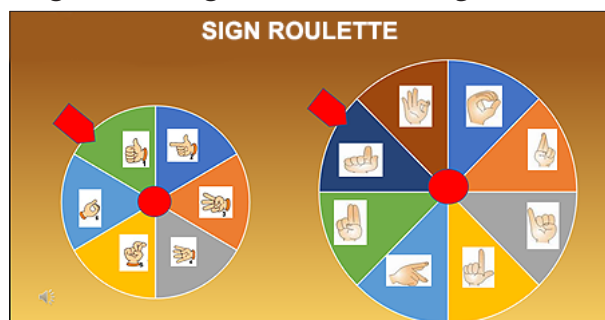
We chose Power Point to develop our game due to the difficult internet access in the assessed school. Moreover, we considered the possibility of interacting with the game in environments without internet access, making it more democratic and accessible.

Learning is as important as social development, and games are a pedagogical possibility to promote cognitive, emotional, and social development (Antunes, 2017). Hoping to provide interactive Libras experiences that stimulate and enhance learning, the game has no age limit and anyone learning Libras can use it.

We designed its imagery to honor deaf culture since the game uses Libras signs (unlike those privileging hearing culture), including sound resources to respect individualities and promote effective inclusion. All cultures and identities are productive and related both to the produced discourses and to the nature of social relations that establish themselves naturally (Gesser, 2020), thus constituting a salutary relation, built by playing to form social beings.

Creating, adapting, or translating educational games that contemplate deaf culture is an important teaching aspect since knowing students' identities directs teachers to positively guide teaching-learning processes (Lorn, 2015). This interaction between deaf and hearing cultures in the playful resource is important for the effective perception of subjectivities and respect for others.

Figure 1 – Image from the Game *Sign Roulette*



Source: Elaborated by the authors.

Burst Dictation

What is “dictating?” Etymologically, dictating means saying aloud to those who write, to repeat, to recite (Michaelis, 2019), a common word in the hearing culture and without real experience in deaf culture. And what is “burst?” Burst refers to blowing up. “Bursting,” in turn, in its etymological root, means to break open, apart, or into pieces usually from impact or from pressure from within (Michaelis, 2019). Another word that, for the deaf, has no practical meaning (Figure 2).

The analysis of this educational resource by its defining nomenclature shows the exclusion of deaf culture, which, according to Quadros (2003, p. 86), “[...] is multifaceted, but with specific characteristics; it is visual, visually translating itself.” It has visuality. We must, then, analyze the other elements that compose the game.

The suggestion in “Sign Roulette” is very common in hearing students’ literacy processes. Associating a sound with the letter that composes each syllable of the spoken word or presented image is what normal dictation proposes to those can hear. However, this linguistic association happens differently with deaf students. Libras and Portuguese are two distinct languages, with their own linguistic characteristics and formations and different construction and manifestation channels (Gesser, 2020). Thus, the structure of the activity shows a cultural overlap that privileges hearing players.

On the other hand, this game give emphasis to visual resources. The strategy of presenting words as animations establishes an atmosphere of expectation of what will come and shows the commitment to involve deaf students. It also rereads an old, oral pedagogical proposal and adapts it to the technological scenario. Thus, Vieira, Oliveira, and Pimentel (2020, p. 279) state that “[...] times have changed, generations have changed and with the advancement of technologies, games have also changed.” Schools, in turn, follow these changes and evolve with them.

Figure 2 – Image from the Game *Burst Dictation*



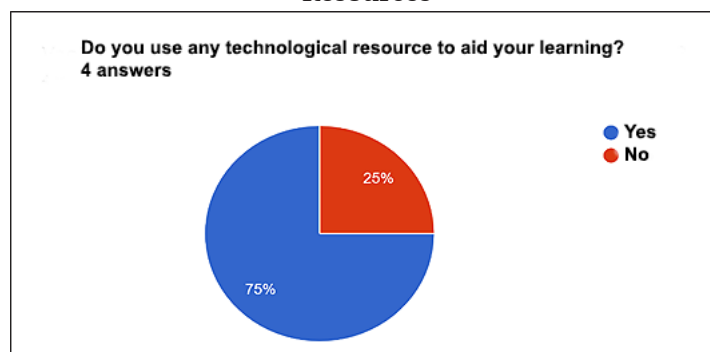
Source: Adapted from Omena (2021).

Recreational and Learning Experiences

In the wake of events, we found different eyes requiring validation. Each experience and learning process is unique and, although unique, experiences must be shared to build cognitively and culturally impacting interactions since, as Vygotsky (2003) claims, the experiences lived in individual contexts bring teachings that, when transposed into the school environment, make the educational process stronger and more dynamic.

Since technologies share so much knowledge and establish countless interactive and collaborative possibilities, schools must follow the current digital technological evolution and appropriate the benefits it adds to teachers and students so school learning has practical meaning outside it (Baladelli; Baby; Altoé, 2012). When asked about the use of digital technologies to enhance learning, based on participants' answers, we obtained the following Graph 1:

Graph 1 – Questionnaire Results on The Use of Technological Resources



Source: Elaborated by the authors.

Participants mentioned computers, tablets, cell phones, video players, and printed materials among the used technologies. Only one participant mentioned the internet. Thus, we can see how much digital exclusion is present and how much we need to move forward to democratize access to the internet. Another participant claimed lacking access to digital technologies that could enhance their learning outside the school.

To know students' and interpreters' experiences in the universe of games, we questioned about the use of games only for entertainment. Only interpreters stated using games in their leisure; among them, dominoes, cards, Sudoku, and Bubble Shooter. Students, on the other hand, use no games for fun.

Cognitive learning is as important as emotional and social development. In this sense, games are a pedagogical proposal that promotes the construction of these skills (Antunes, 2017). Games, therefore, po-

tentiate students' development and learning. Having experiences with games only at school, the young deaf people participating in this study stated:

I would like teachers and interpreters to use more games in classes because then deaf people would learn faster (Student A);
Learning with games in the classroom is different and very good. I would like teachers to use more educational games (Student B).

A game is a voluntary activity and, thus, engaging (Huizinga, 2020). This voluntary nature creates the desire to participate. Participation builds learning. The playful nature of the activity stimulates the desire to know and learn more. Furthermore, learning not only relates to school content. Thus, when searching for new words or signs, one learns the culture of the other.

The game is fascinating, captivating, playful, and pleasurable. It offers, in its nature, a rhythm and harmony aiming at relations with the environment and people (Huizinga, 2020). Despite their characteristics adding much to teaching and learning processes, the use of games still must be spread in educational environments.

Analyzing the playful and pedagogical aspects of "Sign Roulette," students and interpreters reported as follows:

Sign Roulette is a very good game. Very fun (Student A);
I liked the game because it playfully teaches Libras (Student B);
It is a game that stimulates students' learning, such as teaching them numerals and handshapes. With this game we can work several dynamics that reinforce the acquired learning (Interpreter C);
It is a game that stimulates memorization, attention, and especially the learning of signs, because, as the student uses the game, the student's range of signals increases significantly (Interpreter D).

Participants' statements show their motivation to learn and different approaches to the game. Motivation influences learning, the manifestation of previous knowledge, and identification with deaf culture by working with handshapes. Thus, we found that games can boost knowledge beyond those we predicted for the activity, constituting a positive element for cognitive development and students' inclusion.

The playful resource "Burst Dictation" aims to stimulate writing in Portuguese. Regarding this, participants reported that:

I liked the game. Burst Dictation assists in learning Portuguese because it teaches writing (Student A);
I believe it helps in learning because you have to sign and then write. I liked it too (Student B);
Burst Dictation is an extremely interesting game because it focuses on the student's literacy, involving writing and signing (Interpreter C);
Burst Dictation is a game that stimulates the student's perception, as well as the knowledge of signs and written Portuguese. It encourages the student to write in Portuguese and relate signs with images because deaf students read the world by visual experiences concretized in their natural language so that this student can then learn Portuguese as a language (Interpreter D).

Sign languages are natural languages, sharing a number of characteristics that give them a specific character and distinguish them from other communication systems. This is because, rather than arising from the oral-auditory channel, visuality constitutes the basis of their existence (Pictures; Karnopp, 2007). Thus, Libras has a syntactic and lexical structure that can generate different sentences just like oral languages.

Interpreter 2's observation shows a concern to relate image and writing to contemplate visual learning, agreeing with Quadros (2003, p. 37): "[...] the Portuguese language will be taught with emphasis on writing, considering that the learning channel of the deaf is visual." Thus, we found that "Burst Dictation" meets the proposal of teaching written Portuguese to deaf students, although adapted from the hearing culture.

Regarding the use of didactic games to enhance learning that effectively includes deaf students in mixed regular classes (deaf and hearing), participants stated that:

Digital games help with learning because it's a different way of learning. They help in inclusion because it is fun and everyone participates (Student A);

With the games we learn playing and talking with friends (Student B);

I believe that with digital didactic games we can develop learning in a dynamic way and with a lot of interaction between students, favoring inclusion (Interpreter C);

In addition to exciting students, it is a very present tool in their daily lives. [...] Digital games help in their wide use, especially considering the use of images, which are essential in deaf students' teaching and learning process. Digital games function as a common language among young people, facilitating their socialization (Interpreter D).

Considering these observations, playful learning experiences seem to motivate cognitive development and an inclusive posture. Learning based on digital games can play an important role in internalizing content and understanding the applicability of these contents in everyday life (Prensky, 2012). Such contents go beyond the school curriculum since perceiving and respecting differences is essential for constituting human beings.

Therefore, in an inclusive educational proposal between deaf and hearing students, we understand that imagery resources with hand-shapes and/or sign writing and sound resources provide greater interaction between students, enhancing their learning.

Final Considerations

Technological advances have implications for all social spheres, such as the demand for seeking knowledge and developing digital skills so subjects can fully interact in the society in which they are inserted, regardless of their physical, social, economic or cultural conditions.

Thus, educational spaces also need to appropriate this knowledge so teachers and students expand their interactive and cognitive possibilities using technologies. This is a process that requires constant learning, organization of an entire range of information, and its transformation into pedagogical possibilities, motivated by perceiving strategies that lead students to also engage with their studies (Sena et al., 2021). Thus, deaf students' education must also include digital technologies since digital environments belong to the cyberculture in which society inhabits.

A bilingual proposal that reflects upon strategies becomes an indispensable need, especially since individuals have their own pace of learning which rigid and standardized methodologies failed to uniformly meet, given the heterogeneity of society, in addition to the need for representativeness of deaf culture elements for their effective inclusion.

In this sense, finding something that brings students' interests closer to the classroom in a bicultural strategy to promote educational engagement is the best way to combine knowledge and inclusion. As deaf and hearing cultures are experienced in parallel, this creates a collaborative, motivating, and inclusive educational environment as it offers the opportunity for cognitive development and the appreciation of each student's peculiarities.

The analysis in this study shows the potential of didactic and technological games in deaf students' literacy and inclusion and the need for teacher training focused on digital skills. Thus, we stress the need for further studies to research, debate, and popularize the benefits of this didactic resource.

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