v. 5, n. 4, 2025

International Journal of Human Sciences Research

Acceptance date: 19/02/2025

RECOMMENDATIONS FOR BUILDING GAMES FROM A UNIVERSAL DESIGN PERSPECTIVE IN THE SCHOOL ENVIRONMENT

Anderson Roges Teixeira Góes
Federal University of Paraná-
Curitiba, PR - Brazil

Adriana Rinaldi Cassano
Federal University of Paraná-
Curitiba, PR - Brazil

Andrea Lannes Muzzio
Federal University of Paraná-
Curitiba, PR - Brazil

Heliza Colaço Góes
Federal University of Paraná-
Curitiba, PR - Brazil

Abstract: This study proposes recommendations for teaching practice, in an inclusive approach, in the construction of mathematical games using Universal Design for Learning as a methodological approach. To this end, it analyzes two studies, one applied to Early Childhood Education and the other to Elementary School - Early Years, which indicate that games built from the Universal Design perspective promote active learning and mathematical skills. It was possible to verify that redesigning games to make them accessible to all students, including those with visual or hearing impairments, reinforced the commitment to school inclusion. With this, the recommendations provide guidance for educators to create equitable learning environments, stimulating the integral development of students.
Keywords: Inclusive education. Mathematics. Early Childhood Education. Primary Education - Early Years. Universal Design for Learning.

At school today, inclusion and the development of pedagogical strategies that cater for the diversity of students have been central topics of discussion. In this context, Universal Design for Learning (UDL) has emerged as an approach that aims to provide educational experiences that include every learner in the ordinary classroom, regardless of their individual characteristics and abilities (Góes; Costa; Góes, 2023). This article aims to contribute to this discussion by presenting recommendations for inclusive action using DUA in the teaching praxis that addresses the construction of mathematical games. To this end, we highlight the results of two studies carried out under the Postgraduate Program in Education: Teaching Theory and Practice (PPGE:-TPEn) at the Federal University of Paraná (UFPR), Brazil.

Both studies make use of Universal Design (UD) and UDL in different educational contexts. Cassano (2022) conducts research in Early Childhood Education, dealing with the construction of path games, as well as the mathematical ideas addressed with young children. The author seeks to understand how the practice contributed to their learning and socialization. In turn, Muzzio (2022) looks at the use of games with rules made by elementary school students, exploring arithmetic operations and discussing the process of inclusion in the teaching and learning of mathematics.

By analyzing these studies, we not only intend to highlight the contributions of DUA in the construction of mathematical games, but also to reflect on the challenges and opportunities associated with the right to an inclusive mathematical education, which is therefore accessible to every student. To do this, we will draw on the theoretical and methodological foundations present in the research, as well as academic references that address the issue of inclusion and DUA. From this, we hope to indicate ways of developing teaching praxis, with an inclusive approach, in the teaching of mathematics, especially in the context of Early Childhood Education and Primary Education- Early Years.

UNIVERSAL DESIGN AND UNIVERSAL DESIGN FOR LEARNING

UD is a perspective that seeks to guarantee accessibility and inclusion for all people, regardless of their abilities or limitations. According to Carletto and Cambiaghi (2007), it is not only aimed at those with specific needs, but consists of designing environments and products to benefit everyone, ensuring that each individual can use spaces and objects safely and autonomously, without the need for adaptations or specialized *designs* (Muzzio, 2022). Ron Mace, an architect and advocate

for the rights of people with disabilities, and his team established seven principles of UD (Figure 1), which include equity, adaptability, simplicity, intuitive perception, safety, minimal physical effort and comprehensiveness (Carletto; Cambiaghi, 2007)

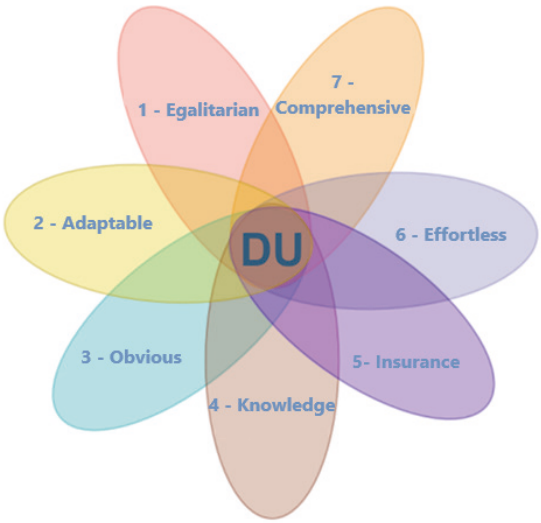


Figure 1: Principles of DU
Source: Cassano (2022, p. 45).

These principles are fundamental to ensuring that environments and products are accessible and usable by all people, regardless of their physical or cognitive abilities. For example, the principle of adaptability ensures that products can be used in different ways, meeting the needs of different users, while the principle of safety aims to minimize the risk of accidents or injuries (Góes; Costa, 2022).

Although the concept of UD has been gaining recognition and acceptance over the years, there are still challenges to overcome, such as the perception that it generates additional costs or that it only applies to a segment of the population. However, evidence suggests that its benefits outweigh the initial costs and that it benefits society as a whole, increasing productivity, preventing accidents and promoting equal rights (Muzzio, 2022). It is therefore essential to promote greater awareness and adoption of the concept of UD in all sectors of society, recognizing its potential to transform environments and products in order to make them accessible and inclusive for all.

With this conception, in the educational contextUD is a perspective that helps to promote the inclusion of each student, going beyond physical accessibility, being incorporated into teaching materials by educators and those produced by students, in order to develop learning environments that promote equity and diversity (Cassano, 2022), from conception to implementation, to ensure that products and environments are truly inclusive (Muzzio, 2022).

Thinking about the didactic process, we can say that UDL appears as a natural extension of DE, not just in terms of teaching materials and physical environments, but considering accessibility and inclusion for each student in the ordinary classroom (Góes; Costa; Góes, 2023). It considers flexibility and an understanding of human diversity, recognizing that people have different ways of learning and interacting with the environment, promoting an inclusive and equitable approach to the teaching and learning process.

DUA was developed in the United States in 1999 at the Center for Applied Special Technology (Cast), and is made up of three principles (Cast, 2019): multiple forms of Engagement; multiple means of Representation; and multiple modes of Action and Expression, which are based on modern neuroscience and learning networks, which highlight the importance of understanding how each student engages in the learning process.

Each of these principles is subdivided into three guidelines, which guide teachers in creating learning environments that take into account each student, so it is an approach seen as appropriate for inclusive education (Góes; Costa; Góes, 2023). These guidelines aim to increase access, promote the construction of knowledge, empower students through self-regulation, among other considerations (Figure 2)

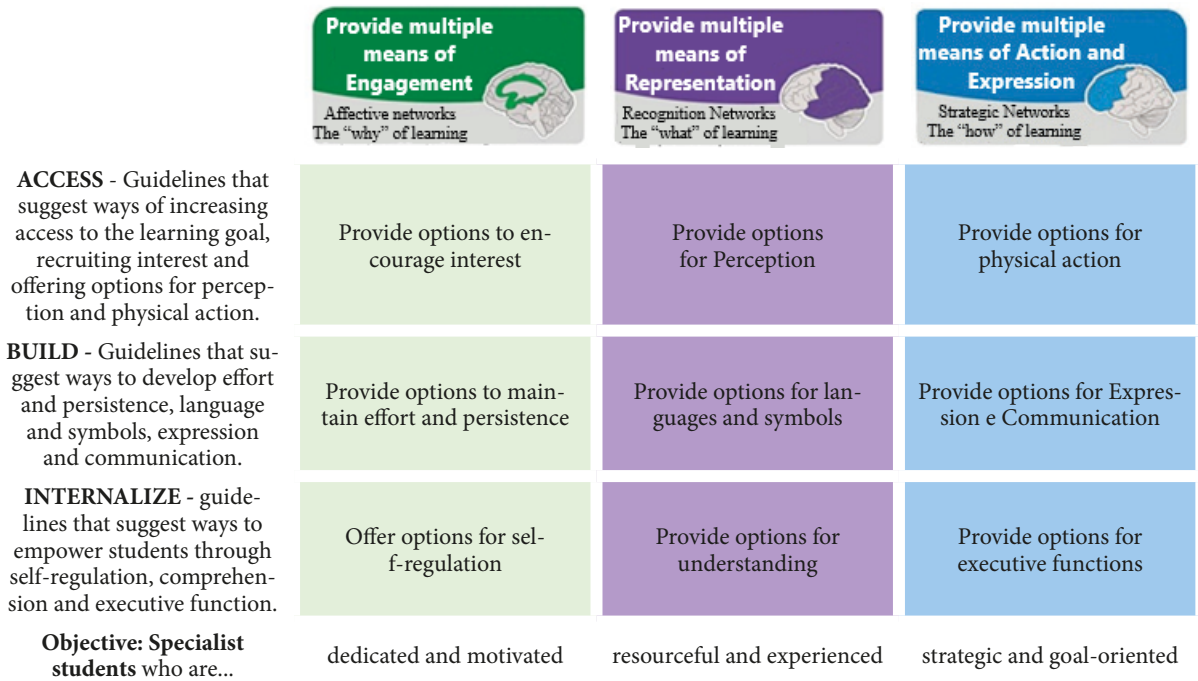


Figure 2: DUA principles

Source: Coelho and Goés (2021, p. 12).

The Engagement principle, related to the "why" of learning, concerns how students are motivated, challenged and involved in the educational process. It is linked to the brain's affective networks and represents a crucial aspect for learning, since each student differs in their motivations and interests. The Representation principle, referring to the "what" of learning, addresses the diversity of ways in which students can perceive, understand and assimilate information. This includes different ways of presenting content, such as text, audio, video, among others, to ensure that each individual has access to knowledge. Finally, the principle of Action and Expression, related to the "how" of learning, concerns the different ways in which learners can demonstrate what they learn and how they can act on this knowledge. This involves offering variety in activities and assessments, allowing them to express their understanding in different ways.

It should be noted that for each guideline, there are checkpoints, the purpose of which is to indicate ways of accessing, constructing and internalizing learning. These checkpoints can be consulted on the CAST *website* (2019), in English, or we suggest the text by Góes *et al.* (2023), which presents and systematizes them in Portuguese

DUA, therefore, is a change in the educational paradigm, as well as considering the individuality of students, putting their learning plan in focus, rather than the teaching plan devised by teachers and principals before even getting to know the universe in which they will be working, the classroom (Góes; Costa; Góes, 2023).

STUDY METHODOLOGY

This study seeks to contribute to the discussion of paths for teaching praxis using DUA in the construction of mathematical games. In this sense, we take a reflective and systematic look at "the confrontation between the data, the evidence, the information collected on a given subject and the theoretical knowledge built about it" (Lüdke; André, 2018, p. 2).

To this end, we present two studies carried out under the PPGE:TPEn program at UFPR, the objectives of which are to discuss DUA and DUA, with DU present in the construction of the games and DUA in the didactic process planned and developed by the researcher teachers. Next, we discuss the results and analysis, considering the themes addressed by the authors. Finally, we carry out our analysis, seeking to indicate how the path outlined in these studies can constitute a teaching praxis in inclusive mathematics education.

RESEARCH IN EARLY CHILDHOOD EDUCATION

Cassano's (2022) research methodology began with documentary analysis, examining documents such as the political-pedagogical project and the school regulations of the Municipal Center for Early Childhood Education (CMEI) where the research was conducted, as well as the *Early Childhood Education Curriculum: dialogues with the BNCC*. This was followed by the construction of the theoretical framework and in-depth study of the research topic, using authors who explore similar areas. It should be noted that the research was approved by the Ethics Committees of UFPR and Curitiba City Hall.

The research consisted of developing a pedagogical proposal to build games in a pre-school class, with records made using images, video recordings and the teacher-researcher's logbook, all with a view to later analysis. Twenty-nine children took part in the study, including two with autism reports, one of whom received after-school care (resource room) and the other full time at the CMEI. Over the course of 19 weekly meetings, each lasting 60 minutes, the research was conducted in such a way as to ensure the active participation of the young children.

In order to better cater to the individuality of each child and promote effective listening, three groups of seven children and one group of eight were organized. Family participation was encouraged and integrated into the proposal, especially by collaborating in the creation and use of the games built by the young children.

The results were analyzed based on the observations recorded and the materials produced by the children, with an approach that contrasted the situations observed with the theoretical basis. The analysis included observation of the pedagogical practice applied in the study, the (field) logbook, video recordings and photos, always dialoguing with the sources and the established theoretical framework.

In the first stage of the research, carried out in three 60-minute sessions each, the children were introduced to the study through multiple means of representation, such as reading, images, music and videos, with an emphasis on raising awareness of inclusion. In the second stage, they took part in activities aimed at expanding their repertoire on play, involving association, memory and path games, with a focus on diversity and inclusion. These activities provided interaction, socialization and reflection on differences, contributing to the learning process through games

During the game definition stage, there were two moments. In the first, the children suggested different types of game, such as a journey game, a memory game and a plate game. They chose their favorite games by voting, resulting in the selection of the trail game. In the second, four themes were defined for the trail games, based on the children's preferences and on activities they had experienced at the CMEI.

At the game-building stage, each theme was worked on in groups, with the children taking an active part in drawing up the trails,

a)

CAR AND CAT RACING GAME

How to play

The game is for four players.

- To start the game, each player throws a dice and whoever rolls the highest number starts the game:
- The player rolls the dice and travels the number of squares that came up on the dice, following the rules on the board;
- When the pawn lands on the square with a circle, it wins 3 (three) coins,
- When the pawn lands on the square with a rough texture, it moves back two (2) squares;
- When the weight lands on the square with a soft texture, it moves forward 2 (two) squares.

Whoever has the most coins wins the game

b)

TRAIL GAME: THE CASTLE AND THE PRINCESSES

How to play

The game is for four players.

- To start the game, each player throws a dice and whoever rolls the highest number starts the game:
- The player rolls the dice and travels the number of squares that come up on the dice, following the rules on the board;
- When the pawn lands on the square with a hard texture and waves, it is out of the game for one round;
- When the pawn lands on a rough texture, it wins 5 (five) coins,
- When the pawn lands on the square with several dots, it returns 2 (two) squares.
- When the pawn lands on the soft-textured square, it wins 2 (two) coins.

The person who collects the most coins wins the game.

c)

TRAIL GAME: THE ANIMALS OF THE FARM

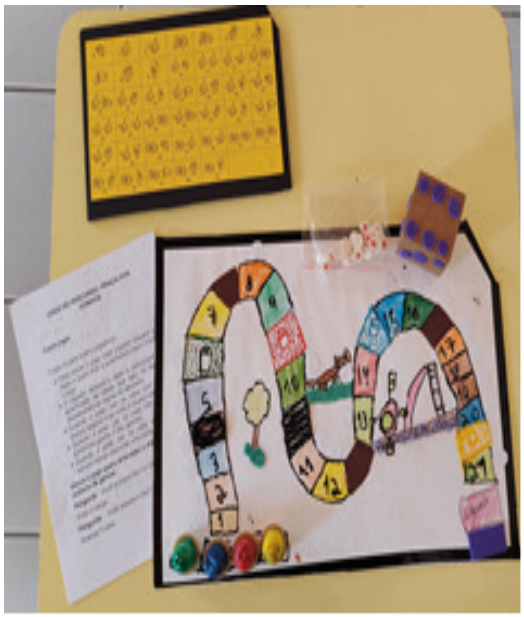
How to play

The game is for four players.

- To start the game, it's two or one - whoever wins starts the game;
- The player rolls the dice and travels the number of squares that come up on the dice, following the rules on the board.
- When the pawn falls into the house with a hard texture (wooden sticks) open the house and find out what's inside;
- When the pawn lands on the square with a polka-dot texture, it wins 3 (three) coins.

Whoever raises the most money wins the game number of coins.

d)



ROUTE GAME: PLAZA DOS DREAMS

How to play

The game is for four players.

- To start the game, each player throws a dice and whoever rolls the highest number starts the game;
- The player rolls the dice and travels the number of squares that come up on the dice, following the rules on the board:
- When the pawn lands on the square with a rough texture (sandpaper), it moves back 2 (two) squares;
- When the pawn lands on the square with several dots, it wins three gems:
- When the pawn lands on the square with a soft texture, answer a question.

Whoever collects the most gems wins the game
Question - Have you ever thrown garbage on the ground?
Back 2 houses
Question - Do you separate the waste?
Advance 3 places

Figure 3: Games and their rules: a) Cars and Cats ; b) The Castle and the Princesses; c) Farm Animals; d) Dream Square.

Source: Cassano (2022, p. 108-113).

Figure 4: Poster used to express the experience during the research

Source: Muzzio (2022, p. 93).

rules and components of the games. The materials used were diverse, according to each theme, seeking to meet the needs and interests of the children (Figure 3).

In the reflection stage of the game, detailed analyses were made of the games designed by the children, focusing on the UD perspective, in order to make them accessible to blind and deaf children. Each game had additions, including the use of alternative materials, numbers in Braille, numbers in Brazilian Sign Language (Libras) and tactile markings. Modifications were applied to each game, such as the use of puff glue, string, EVA and sandpaper for the track and houses, ensuring different textures and tactile elements.

Finally, the games were presented to the families at an integration event at the CMEI, providing a moment for the children and their families to actively participate in the learning process. The spaces were organized to welcome the families and the games, with rules written in Portuguese, Libras and Braille, promoting inclusion and the sharing of experiences between everyone involved.

RESEARCH IN PRIMARY EDUCATION - EARLY YEARS

Muzzio's (2022) research methodology began with an analysis of documents such as the political-pedagogical project and the *Elementary School Curriculum: dialogues with the BNCC - 1st to 9th*. Next came the construction of the theoretical framework, followed by approval by the Ethics Committees of UFPR and Curitiba City Hall.

The participants were students in the 4th year of elementary school. Due to the return after the Covid-19 pandemic, of the 26 students, 18 attended classes in person, while the others did the activity remotely, receiving activities every 15 days. Of the 18 present, 12 were authorized to take part in the research by signing the Informed Consent Form. However, because they were part of the prescribed content, they all took part in the activities, but their activities, actions and other records were not taken into account in the analysis. In the class, there was one Venezuelan immigrant student and another with mild autism.

The study focused on inclusion in math teaching, using rule games made by the students themselves. The content covered followed the curriculum of the Curitiba Municipal Department of Education, including addition and subtraction operations with natural numbers. The data was mainly collected through observations by the teacher-researcher, recorded in notes and other means, respecting the ethics and privacy of the students

During the presentation stage of the research, the teacher-researcher contextualized inclusion using the video *The Colors of Flowers* and presented four dolls representing different disabilities to the students, who took part in dynamics to get to know Braille and Libras. Practical activities were proposed, such as filling egg cartons with lids to represent numbers in Braille and making number signs in Libras. Videos about DU and DUA were used to contextualize the perspective of the construction of the games and the way the teacher would conduct the activities.

A poster (Figure 4) was made for the students to express their experiences, assessing their engagement and seeking to prioritize individuality at each stage.

The second stage involved building references and expanding their repertoire of educational games. Initially, the students discussed their favorite games and drew characters for a game they were going to make, which they named according to characteristics similar to those of the Gumball gang (an animated series aimed at children and young adults that combines elements of comedy, adventure and fantasy and is popular with children and pre-teens). They then tried out different games,

such as Ganha Cem Primeiro (Win a Hundred First), a memory game with numbers in Braille and Libras, and Passa Lata (Pass the Can), among others. After each game, they evaluated their experience and left their impressions on the poster.

The third stage consisted of the students making the games over the course of eight meetings, six of which were dedicated to creating the games, while in the last two there was a small seminar with the school's 4th grade classes as a way of socializing

The first game developed was the Memory Game: Gumball Beads (Figure 5a), covering addition and subtraction operations. The challenge was to redesign the game so that students with visual or hearing impairments could take part; to do this, they decorated the cards with drawings of the Gumball character and numbers in Libras, as well as inserting stickers with the numbers in Braille. The second game, called Christmas Operations (Figure 5b), originally planned as a dominoes game, evolved into a mathematical operations game involving addition and subtraction. The cards were made in colors reminiscent of the Christmas season (red and green). Numbers were also written in Braille and Libras. For the third game, Math Game for Everyone (Figure 5c), 40 cards were made with operations and answers, and numbers were also added in Braille and Libras, in order to provide greater accessibility.

The games were presented by the students, who explained their rules and peculiarities. All the groups had the opportunity to try out each of the games, promoting interaction and engagement in the class

The final stage was a semi-structured interview with the class, to clarify and deepen our understanding of the proposal.

RESULTS AND ANALYSIS

The researchers carried out their analysis considering four themes. Cassano (2022) discussed the reflection of the game built from the perspective of UD, the contributions of UDL in inclusive games as a resource for learning in Early Childhood Education, the contributions of games built by children to mathematical knowledge and CMEI-family integration. Muzzio (2022) discussed the construction of mathematical games from the perspective of DU in the classroom, the DUA approach during the game construction process, the DUA approach during the use of games and mathematical learning.

This study analyzes three themes that converge in both studies, in order to indicate ways of promoting inclusive education in mathematics teaching, namely: the contributions of the game built from the perspective of DU, the contributions of the DUA approach in the process of building games and mathematical learning

CONTRIBUTIONS OF THE GAME BUILT FROM A DU PERSPECTIVE

When building the games, both Cassano (2022) and Muzzio (2022) highlighted the importance of UD in providing accessibility and inclusion in the educational environment, despite the different approaches and audiences.

According to Cassano (2022, p. 106), "the children in each group building the trail games reflected on their game and listed possible modifications to make it accessible to blind children". This arose from the fact that a child had been asked to close their eyes and use their hands to identify the route of the trail and where the challenges were; however, the children realized that this was not possible.

Figure 5: Cards and rules for the games: a) Gumball Beads Memory Game; b) Christmas Operations; c) Math for Everyone Game.

Source: Muzzio (2022, p. 93).

> Teacher-researcher: Were you able to identify the trail?
>
> Bianca: No. I don't know where the obstacles are.
>
> Carlos: It's all smooth.
>
> Bianca: Those who can't see can't play (Cassano, 2022, p. 106).

Cassano (2022) then talked to the children about how to make games accessible, and the following dialog emerged:

> Tabata: I'll pass the glue.
>
> Mara: I want to put the glue on too.
>
> Tabata: I'll put some in, then you do it.
>
> Mara: After you pass I'll put the EVA that Samuel cut out (Cassano, 2022, p. 108).

The students realized that they would need to create reliefs and used black wool to build the lines of the trail. For the obstacles, they used EVA circles, sandpaper and wool.

Muzzio's (2022) results also indicated the need to incorporate different textures into games to make them accessible to a variety of students. For example, the students understood the need to include different textures in the games to make them accessible, including those with different characteristics or abilities from those seen in the classroom. To do this, they made "cards made from ethyl vinyl acetate and puff paint, which allowed all the students to use them" (Muzzio, 2022, p. 117). "For blind students, the resource shows Braille; for students with low vision, it shows the numbers in enlarged font; for deaf students, it shows the numbers in Libras" (Muzzio, 2022, p. 117).

Both studies emphasized that UD not only applies to teacher-made materials, but also to student activities and creations, promoting awareness of the importance of accessibility and inclusion from an early age.

CONTRIBUTIONS OF THE DUA APPROACH TO THE GAME-BUILDING PROCESS

The teacher-researchers highlighted the DUA in their research, highlighting its principles, guidelines and checkpoints. They emphasize student engagement by using various games and dynamics to reflect on school accessibility and inclusion. As for the principles of Representation and Action and Expression, they were most evident in the actions to make information accessible, which directly interfered in the ways in which knowledge was demonstrated, by ending the actions with games accessible to different audiences.

As a methodological approach, DUA can have theoretical support from various perspectives. In this sense, both studies relied on the writings of Vygotsky (2016) and Kishimo-

to (2016) to support the actions on inclusion and the use of games in the school environment. The actions were in line with Vygotsky's (2106) view of the zone of proximal development, since the interactions and active engagement of students are essential for learning, and also aligned with Kishimoto's (2016) idea of promoting the integral development of students, considering their individual needs and providing opportunities for expression and communication.

In addition, Vygotsky (2016) highlights the importance of games in the development of social interactions and in the students' zone of proximal development, which was evidenced by the observations of the researcher teachers when the students engaged in dialogues, exchanged experiences and respected different ideas during the construction of the games.

> Penny: I like heroines.
>
> Teri: I think we can use Wonder Woman.
>
> Eight: No, Wonder Woman isn't cool.
>
> Tina Rex: Yes, she's nice, I like her.
>
> João Banana: But the Gumball characters are more fun (Muzzio, 2022, p. 118).

These interactions demonstrated an action for socialization, as well as mutual respect and collaboration between students, fundamental aspects advocated by Kishimoto (2016) for integral development.

In this way, the research contributed to the scientific community, presenting theoretical support for the DUA approach, with the aim of providing equitable learning opportunities, taking into account the diversity of students.

MATHEMATICAL LEARNING

The verification of mathematical learning in the research did not use written records/drawings made by the students, as it was considered that the teacher's observation, with awareness of each student's learning plan, was expressed above all in interpersonal relationships.

Muzzio (2022) conducted an interview with the head teacher to check on learning, who said that she had incorporated games as part of her teaching practices and mentioned that, when she introduced games into her math classes, she noticed an improvement in the students' learning.

> Teacher: In the game we could see that, as they played, they internalized the calculations. At times, the answers were very quick because the mental calculation was perfected [...] it happened spontaneously. When they played, they would say: 'Gumball will win because he gets all the math right, but Peny also knows the answers' or they would say 'but now it's very easy to solve' (Muzzio, 2022, p. 135).

From the teacher's account, it is possible to highlight the internalization of mathematical calculations, as they actively participated in the games, reflected in the speed of the answers at times during the game.

Cassano (2022) presented the observations he made directly from the children's speeches, such as about learning to count:

> Magali: I'm going to play. Which number did I fall on? Beatriz asked.
>
> Beatriz: Look here.
>
> Magali: One, two (counting the number on the dice) I'm going to count two houses (referring to the trail).
>
> Magali: I fell into the house on the line. I won two coins, one, two.
>
> PP: Why did you get two coins?
>
> Magali: Because I fell on the soft line, right here (pointing to the house with the texture) (Cassano, 2022, p. 131).

From the dialog, we can see that, while playing, the children were able to correlate the numerical representation on the dice with counting the houses on the track, which had different textures. In this way, they associated the numerical count with the symbolic representation of the number of houses.

Also in Cassano's (2022) results, a dialog demonstrates counting to identify who got the most pairs or quantity and association:

> Olavo: I'm going to count my cards (pointing to them)
>
> Ernesto: I have six cards.
>
> Olavo: I have two of the same.
>
> PP: Who has the most cards?
>
> Ernesto: me, Olavo only has four (Cassano, 2022, p. 126).

While the children were counting the cards, they were able to identify the corresponding pairs and organize them in sequence. Therefore, in general, the games contributed to the development of mathematical concepts, establishing a relationship between quantity and numbers in the game, without keeping records.

In addition, Muzzio (2022) highlighted the participation of students with disabilities in the proposed games, mentioning challenges faced and strategies adopted to ensure the inclusion of all. This reflects Cassano's (2022) concern with adapting educational practices to meet the specific needs of each child, regardless of their abilities or disabilities.

CONSIDERATIONS

Cassano's (2022) and Muzzio's (2022) research, based on DUA, indicated ways to build mathematical games from an inclusive education perspective. The methodology, which included a repertoire of games, followed by the construction and analysis of the games built, provided reflections on how to meet the diversity of students in the classroom context. The final action of Cassano's research (2022) - socializing the games built by the children with their families - sought to spread inclusion and accessibility to society, as well as demonstrating to parents how these issues are addressed at school.

Analysis of the results revealed that the games built on the basis of DU and approached with DUA provided learning opportunities, with active student participation, and developed mathematical skills such as counting, identifying patterns, problem solving, among others. In addition, redesigning the games to make them accessible to students with visual or hearing impairments demonstrated a commitment to school inclusion and valuing diversity.

These studies, which analyzed teaching practices, not only highlighted the benefits of using DUA in mathematics education, but also the importance of involving families and the school community in the educational process. By involving parents and guardians in the use of games, Cassano (2022) strengthened the partnership between the school and the community

The research by Cassano (2022) and Muzzio (2022) represents an important contribution to promoting school inclusion in the teaching of mathematics, when the actions envisaged are related to the construction of games by students or children. From this, we indicate some paths for teaching praxis, with an inclusive approach, in the construction of mathematical games:

1. Documentary analysis and theoretical basis: studying official documents, such as the institution's political-pedagogical projects and the guidelines of the institution's parent company, and checking the theoretical basis.

2. Methodological approach: using DUA in the teaching process and the DU perspective in the construction of teaching materials.

3. Sensitization and awareness: when starting teaching practice, sensitize students to the importance of inclusion through practical and dynamic activities that involve sensory experience and empathy.

International Journal of Human Sciences Research ISSN 2764-0558 DOI: https://doi.org/10.22533/at.ed.558542505023

Use videos, stories and playful activities on the subject of inclusion as resources.

4. Expanding the game repertoire: promoting discussions about the students' favorite games and exploring different types of mathematical games, so that they have a basis for building games.

5. Defining and building games: allowing students to actively participate in choosing the type of game to build, as well as the theme, providing collaborative construction, creative expression and team problem-solving.

6. Definition of concepts and content to be explored: depending on the purpose of the game, describe the content that needs to be covered.

7. Redesign and accessibility: provide moments of reflection based on dynamics, so that they can identify barriers that prevent people with visual, hearing or motor disabilities from having full access to the game.

8. Inclusion of other forms of language: presenting elements such as numbers in braille, in Libras, tactile markings and alternative materials to make the games accessible.

9. Presentation and experimentation: carry out an activity in which the students/children present their games to the class, explaining the rules and game strategies in a clear and accessible way. Then allow them to try out each game, promoting interaction and collaborative learning.

10. Evaluation: evaluations should be formative throughout the process, observing students' engagement and progress in building and using the games.

It should be noted that these guidelines are based on research results in Early Childhood Education and Primary Education - Early Years, and need to be validated at other levels of education. In any case, with the ten recommendations indicated, we affirm that educators can create an inclusive learning environment, developing important mathematical and social skills for life.

THANKS

The authors would like to thank the National Council for Scientific and Technological Development (CNPq) and the Araucária Foundation for their support in carrying out this research.

REFERENCES

Carletto, A. C. & Cambiaghi, S. (2007) *Desenho Universal: um conceito para todos*. Brasil.

Cassano, A. R. (2022). *A construção de jogos na perspectiva do Desenho Universal para Aprendizagem: caminhos possíveis para experiências de aprendizagem na educação infantil*. 159f. Dissertação (Mestrado do Programa de Pós-Graduação em Educação: Teoria e Prática de Ensino), Universidade Federal do Paraná, Curitiba, PR.

Cast (2019). *Universal Design for Learning Guidelines version 2.2.* Wakefield, MA, 2019.

Coelho, J. R. D. & Góes, A. R. T. (2021) Geometria e Desenho Universal para Aprendizagem: uma revisão bibliográfica na Educação Matemática Inclusiva. *Educação Matemática Debate*, 5 (11), 1-26.

Góes, A. R. T. & Costa, P. K. A. (2022) Do Desenho Universal ao Desenho Universal para Aprendizagem. Góes, A. R. T. & Costa, P. K. A. (Org.) *Desenho universal e Desenho universal para aprendizagem: fundamentos, práticas e propostas para Educação Inclusiva – Vol 1*. (pp. 25-33). 2022. São Carlos, SP: Pedro & João Editores.

Góes, A. R. T.; Cassano, A. R.; Muzzio, A. L. & Stellfedl, J. Z. R. (2023) Desenho Universal para Aprendizagem: estratégias baseadas em princípios, diretrizes e pontos de verificação. Góes, A. R. T. & Costa, P. K. A. (Org.) *Desenho universal e Desenho universal para aprendizagem: fundamentos, práticas e propostas para Educação Inclusiva – Vol 2.* (pp. 30-45). 2022. São Carlos, SP: Pedro & João Editores.

Góes, A. R. T.; Costa, P. K. A. & Góes, H. C. (2023) Desenho Universal para Aprendizagem: a transformação necessária e urgente na educação. Góes, A. R. T. & Costa, P. K. A. (Org.) *Desenho universal e Desenho universal para aprendizagem: fundamentos, práticas e propostas para Educação Inclusiva – Vol 2.* (pp. 23-30). 2023. São Carlos, SP: Pedro & João Editores.

Kishimoto, T. M. (2016). *O jogo e a Educação Infantil*. São Paulo.

Lüdke, M.; André, M. E. D. A. (2018). *Pesquisa em educação*: abordagens qualitativas. 2. Ed. Rio de Janeiro: EPU,.

Muzzio, A. L. (2022). *O jogo matemático com princípios do Desenho Universal para Aprendizagem na perspectiva da Educação Inclusiva*. 160f. Dissertação (Mestrado do Programa de Pós-Graduação em Educação: Teoria e Prática de Ensino), Universidade Federal do Paraná, Curitiba, PR.

Vygotsky, L. S. (2016). *A formação social da mente: o desenvolvimento dos processos psicológicos superiores*. 7. ed. São Paulo: Martins Fontes.