

GROUNDING DATA THEORY (GDT) APPLIED IN THE NON-FORMAL SETTING OF A ZOO IN THE AMAZON WITH STUDENTS WITH AUTISM SPECTRUM DISORDER (ASD)

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ABSTRACT

This article evaluates the application of Grounded Theory in experiences (GT) of students with Autism Spectrum Disorder (ASD) at the Zoo of the Jungle Warfare Training Center (CIGS) in Manaus, Amazonas. The data derive from a single visit by three students (12–15 years old; 7th–9th grade) who answered semi-structured interviews; these are complemented by guided observation and a logbook. The interviews revealed learning expressed in short, yet informative and situated responses, triangulated with observation and the logbook. It discusses how constructivist GT allows for theorizing autistic experiences in non-formal contexts without imposing normative narrative patterns. It articulates evidence on variation in reports across prompts and the relational reading of communication. A constructivist Grounded Theory showed that students' experiences with ASD at the CIGS Zoo are a mediated process of exploration and meaning-making, in which environmental stimuli, emotional anchors, and relational security support situated learning, reinforcing the inclusive potential of non-formal spaces when mediation, self-regulation, and accessibility are structural dimensions.

Keywords: Education, Person with disability, mediation, Manaus, learning.

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1. INTRODUCTION

Grounded Data Theory (GDT) favors scientific research by guiding theoretical production from processes observed and narrated in the field, through progressive coding, constant comparison, and analytical memos (NASCIMENTO et al., 2021; ACUÑA et al., 2021). Furthermore, constructivist GDT assumes co-production between researcher, participants, and context, which is methodologically relevant in research with students in the school context (OLIVEIRA AND SILVA, 2019).

GDT has proven to be a robust methodological approach for investigating and improving the teaching of Biology, especially when the objective is to understand how students construct meanings about biological phenomena (OLIVEIRA AND SILVA, 2019). Unlike traditional methods, GDT starts from empirical data, such as interviews, classroom observations, student productions, and class records, to generate categories, concepts, and theories that emerge directly from educational reality (OLIVEIRA AND SILVA, 2019). This allows the teacher-researcher to identify learning patterns, conceptual difficulties, and cognitive strategies students use when dealing with topics such as genetics, ecology, evolution, and physiology, including the use of non-formal spaces in the Amazonian context.

Non-formal spaces are environments outside the traditional school, such as museums, non-governmental organizations (NGOs), squares, libraries, and zoos, where intentional educational activities take place, but with greater curriculum flexibility and with objectives of socialization, skills development, and citizenship, complementing formal education and using the local context as a pedagogical resource (ALBERTO AND FERNANDES, 2025).

The Amazon region is known as a biodiversity hotspot and is characterized by high biodiversity (CUNHA et al., 2014; GOMES et al., 2025; LADISLAU et al., 2020; OLIVEIRA et al., 2011, 2016, 2017, 2023; SANTOS et al., 2012, 2025, 2025a; ARIDE et al., 2016, 2018, 2020, 2021, 2024) and by various locations used by teachers and students as non-formal learning spaces (TENÓRIO et al., 2024, 2025). Thus, museums, zoos, botanical gardens, and aquariums are configured as environments that foster differentiated learning by presenting biological diversity to the public and stimulating interest in environmental topics and conservation (MAGRO et al., 2015; OLIVEIRA et al., 2015, 2015a; CASTRO et al., 2020; ANDRADE et al., 2023; GOMES et al., 2024; SOUZA et al., 2025).

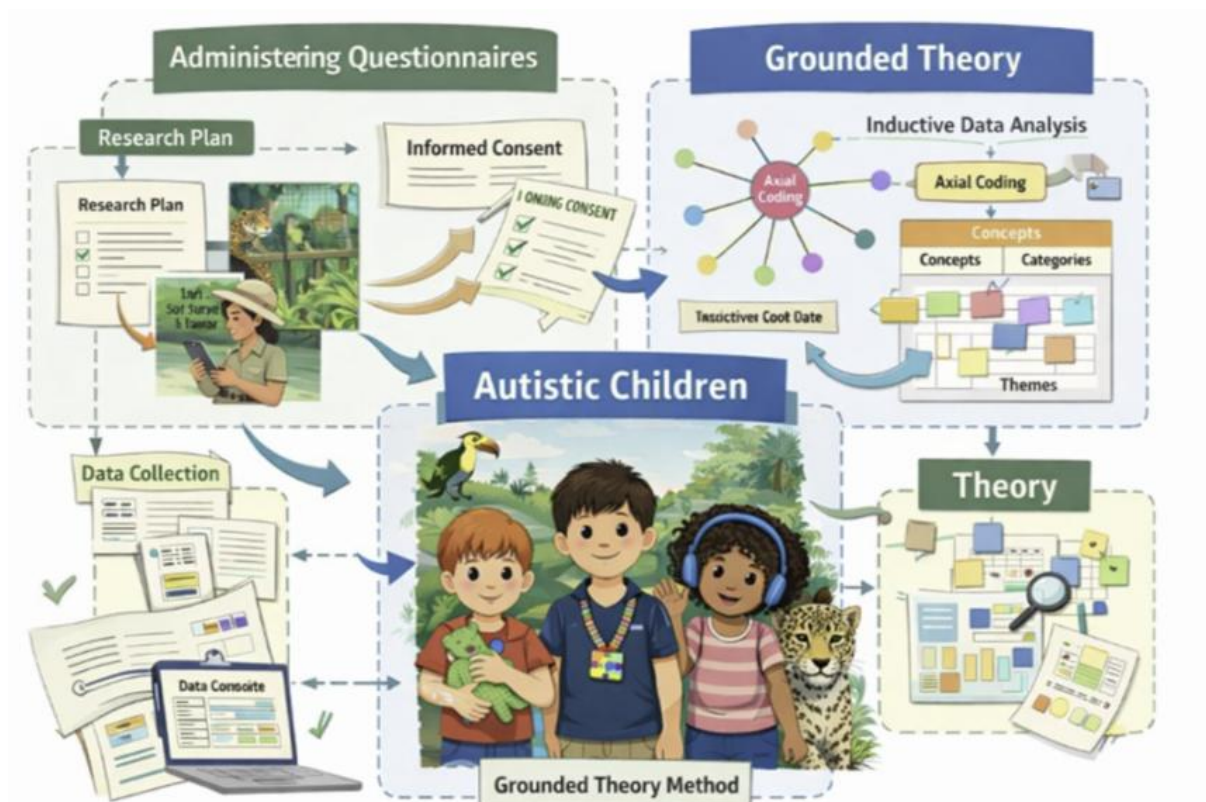
In this context, we find the Zoo of the Jungle Warfare Training Center (CIGS), located in Manaus, Amazonas, in the central Amazon region (MOREIRA et al., 2024). This Zoo constitutes an important non-formal space that aims to conserve biodiversity, acting through four fundamental pillars: environmental education, scientific research, species conservation, and leisure (BRANDÃO et al., 2021). In this space, research has been conducted evaluating science teaching (CARVALHO et al., 2019), the strategy of raising environmental awareness (SILVA et al., 2019), and the tool for teaching Amazonian biodiversity (BRANDÃO et al., 2021).

Although different research projects are being developed at the CIGS Zoo, all studies carried out so far have targeted regular students without disabilities, with none targeting this clientele. Among people with disabilities (PWD), those with autism spectrum disorder (ASD) stand out, possessing distinct characteristics in how they perceive, communicate, and interact with the world (BREDÁ et al., 2025). Autism is called a spectrum because there are different levels and profiles; that is, each person is unique in their abilities, needs, and ways of expressing themselves (MASSARONI et al., 2023). Among the most common challenges are sensory difficulties, as autistic individuals may be more sensitive (hypersensitive) or less sensitive (hyposensitive) to stimuli such as sounds, lights, smells, textures, tastes, and movements (PAREDES AND RAMOS, 2023). In this sense, the use of non-formal spaces, such as the CIGS Zoo, can be fundamental in fostering interest, development, and the teaching-learning process of autistic students in schools in the Amazon region, in Manaus, Amazonas, Brazil.

2. MATERIALS AND METHODS

The research was planned and conducted to evaluate the application of GDT in children with ASD during a guided tour of the CIGS Zoo (Figure 1).

Figure 1 – Infographic on the use of Grounded Data Theory (GDT) at the Jungle Warfare Training Center (CIGS) with students with Autism Spectrum Disorder (ASD).



Source: The Authors (2026)

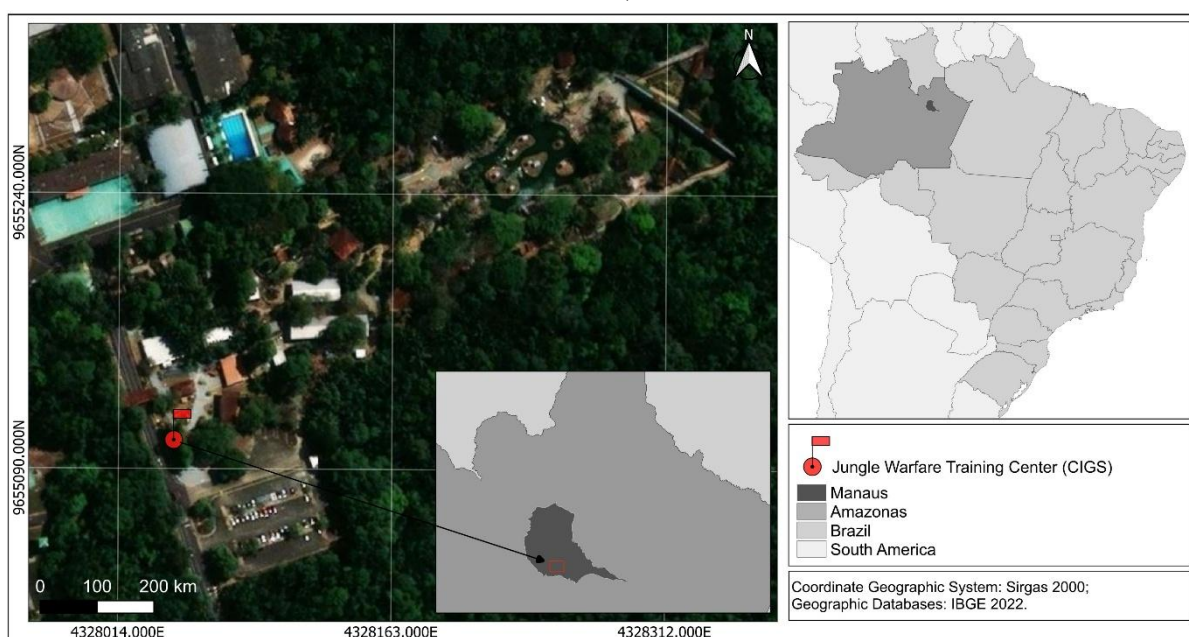
2.1. Grounded Theory approach constructivist

The research adopted constructivist Grounded Theory, in which data and analysis are constructed in a situated manner; theory emerges through progressive coding and constant comparison, with memos as a central tool for theorizing (CHARMAZ, 2014). The operationalization followed these steps: (1) initial incident-by-incident coding; (2) focused coding; (3) constant comparison; (4) analytical memos; and (5) theoretical integration. These procedures are described as structuring the development of a grounded and coherent theory (MILLS et al., 2006; HALLBERG, 2006). As a guideline for rigor, reducing “grounded theory” to thematization without integration was avoided, as cautioned against misuse of the method (SUDDABY, 2006).

2.2. Study Area

The data collection took place at the CIGS Zoo in Manaus, Amazonas, which is characterized as a space dedicated to biodiversity conservation, animal care, leisure, and environmental education activities (SILVA et al., 2019; NASCIMENTO et al., 2021). CIGS is located in the São Jorge neighborhood of Manaus, in a forest fragment in the city's central zone (Figure 2). A visit was conducted in the afternoon of December 2025, totaling four hours (13–17) of activity.

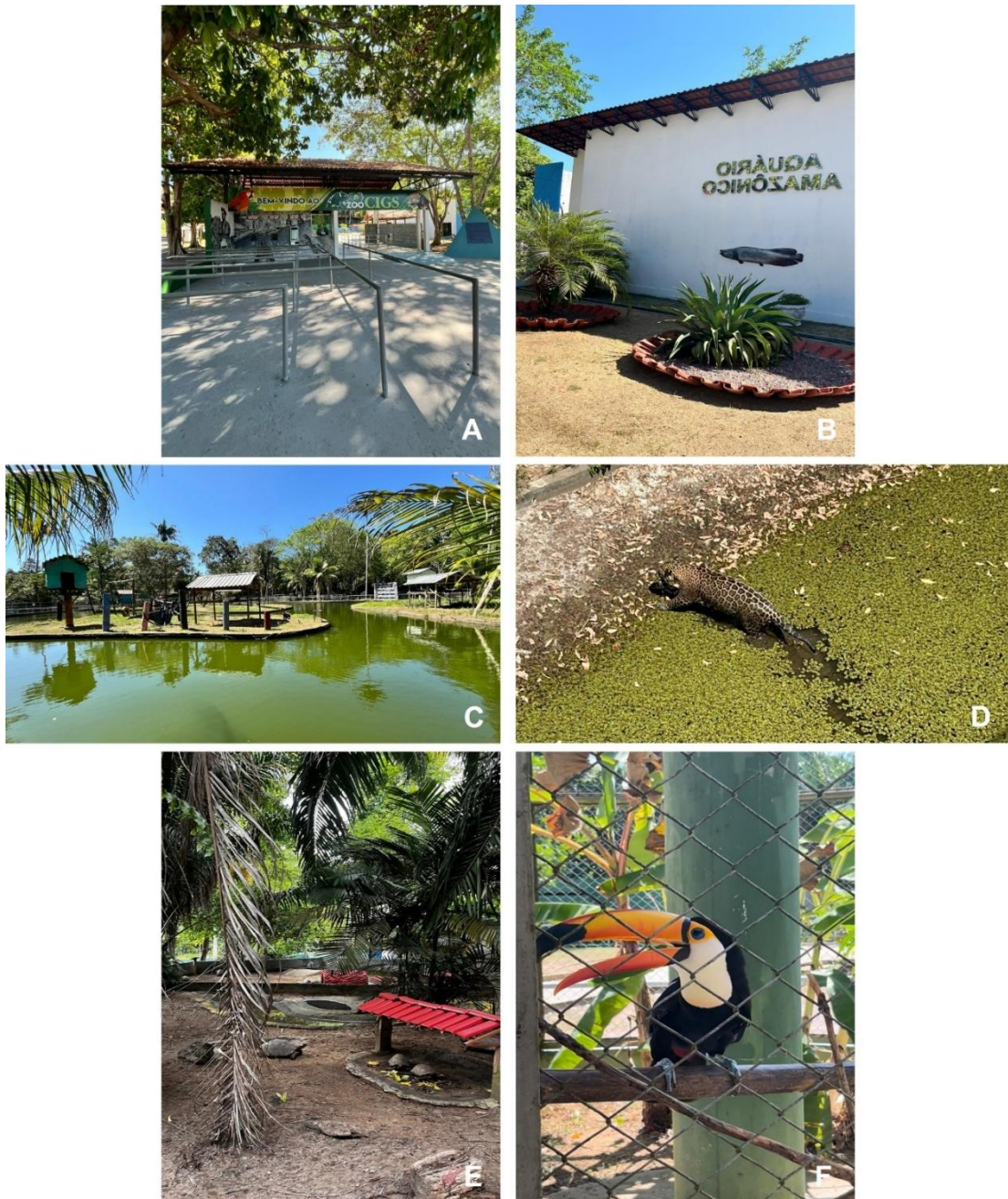
Figure 2 – Location map of the Zoo at the Jungle Warfare Training Center (CIGS), in Manaus, Amazonas, Brazil.



Source: The Authors (2026)

The CIGS Zoo comprises approximately 150 animals from the Amazon, including jaguars, monkeys, alligators, and birds, as well as a forest environment (Figure 3) (CIGS, 2026). Furthermore, facilities such as the Amazonian Aquarium, the Oca do Conhecimento (Knowledge Hut), and the Colonel Jorge Teixeira Memorial are attractive for educational and leisure activities.

Figure 3A-F – Visitation areas at the Zoo of the Jungle Warfare Training Center (CIGS), in Manaus, Amazonas, Brazil. (A) Entrance to the CIGS Zoo; (B) Amazonian Aquarium; (C) Monkey Island; (D) Jaguar *Panthera onca*; (E) Enclosure of the tortoises *Chelonoidis* spp.; (F) Toucan *Ramphastos toco*.



Source: The Authors (2026)

2.3. Participants and mediation arrangement

Three students with ASD (aged 12–15; in 7th-9th grade) enrolled in the resource room at the municipal school participated. The visit included continuous guidance from the resource room teacher and the presence of two mothers, providing socio-affective and organizational support throughout the experience.

2.4. Data production: observation and interviews

Data production was based on observation and interviews, described below:

a) Field observation guide: focusing on interests, reactions, interactions, language, and possible discomforts during the visit. The instrument guided the recording of engagement, verbal and nonverbal communication, and responses to the environment. Records and consolidation of empirical material. The observation data were recorded in a field diary, emphasizing descriptions of the context (temperature, visitor flow, rooms), actions and interactions, and episodes that triggered questions and mediations.

b) Semi-structured interview: applied at the end of the visit, during a quieter time, with questions about feelings, preferences, interactions, and learning. The script recommended clear, measured language, respect for silences, and the recording of nonverbal cues. The interviews, conducted at the end of the visit, constituted a second axis of triangulation with the guided observation and the diary.

2.5. Analysis procedures (Constructivist Grounded Theory)

The analysis procedure followed 6 fundamental topics: a) Initial coding (incident by incident), using gerund codes to capture processes (CHARMAZ, 2014); b) Constant comparison, contrasting responses between students and between interviews and field notes (HALLBERG, 2006); c) Focused coding, selecting codes with greater recurrence and explanatory power (CHARMAZ, 2014); d) Analytical memos, produced to record emerging hypotheses, variations, and relationships between categories (CHARMAZ, 2014); e) Initial theoretical integration, culminating in a core category that articulates conditions, interactions, and consequences (HALLBERG, 2006); f) Audit trail. Codes, comparisons, and memos were maintained as an audit trail of the analytical process, recording decisions on categorical refinement and justifications for selecting focused codes and for theoretical integration (CHARMAZ, 2014; HALLBERG, 2006).

3. RESULTS

3.1. Central analytical incidents (field diary)

The observational diary recorded little movement and noise in the CIGS Zoo, along with intense heat, and noted agitation in some animals, with repercussions for interactions and student questions with ASD (Table 1).

Table 1 – Incidents from the field diary regarding the informal use of the Zoo at the Jungle Warfare Training Center (CIGS), Manaus, Amazonas, Brazil.

Order	Incident	Description
1	First	Intense heat and "activation" of the animals: the animals were agitated and exhibited stereotypies, which were noticed by the students who focused on this observation.
2	Second	The macaws exhibited intense vocalization: they were agitated and vocalizing. The mediation addressed territoriality, small enclosures, and stress, and introduced the themes of animal rescue and trafficking.
3	Third	Jaguars exhibiting stereotyped movement: the jaguars walked in circles, and the students asked why they behaved this way; thus, territoriality and enclosure boundaries were discussed, as well as vegetation and low visibility.
4	Fourth	Dirtiness and naturalization of the enclosure: the students commented that the animal enclosures were dirty; therefore, mediation was carried out, with an explanation of environmental enrichment.
5	Fifth	Cooling baths: the jaguars regularly bathed in the water within their enclosures, which was interpreted as a strategy to alleviate heat.
6	Sixth	Agitated monkeys and fear: the monkeys were hitting their arms against structures in their enclosures; thus, the students demonstrated fear and curiosity, and the explanation of stress and intra- and interspecific competition was thereby mediated.
7	Seventh	Human interference: visitors make sounds to attract animals; this behavior has been attributed as a factor in causing agitation.
8	Eighth	Co-mediation by the teacher and mothers: the teacher would call them in to observe and repeat information, and the mothers would support their attention and engagement, thereby building a bond of trust as a determining factor.
9	Ninth	Pace regulation: breaks for snacks, hydration, and restrooms, along with a flexible route to avoid rigidity and maintain student engagement.
10	Tenth	Interview at the end: interviews were conducted more calmly after the snack, with support from the teacher and the mothers.
11	Eleventh	Scheduled activity unavailable (Oca do Conhecimento closed): the component planned for the itinerary could not be carried out, shifting the experience's focus to the spaces and the mediation in circulation.

Source: The Authors (2026)

3.2. Interviews: responses and analytical notes

The interviews, conducted at the end of the visit, yielded concise responses. Nevertheless, essential patterns emerged, as presented in Table 2. The contrast between striking emotions—fear (jaguar), joy (macaws), and excitement (monkeys)—was treated as a significant variation (HALLBERG, 2006), relating to the field diary entries on enclosures of peak interest.

Table 2 – Recorded patterns of students with Autism Spectrum Disorder (ASD) during a guided tour at the Zoo in the Center of Manaus, Amazonas, Brazil.

Students	Remarkable	Favorite	Feeling	Learning
Student 1	When I saw the black jaguar, I got scared	Black jaguar	Happy	Hawks and scarlet macaw
Student 2	I was delighted by the macaws	Black jaguar	Happy. She likes the zoo because it's really cool; she likes the atmosphere.	Snakes
Student 3	I was excited about the monkeys	Puma and black jaguar	Excited during the visit, tired and happy	Differences between macaws, their song, aviaries, and rescue

Source: The Authors (2026)

3.3. Initial encoding (Charmaz): codes close to the data

Following Charmaz, the initial coding was produced with verbs in the gerund form, close to actions and processes (CHARMAZ, 2014).

3.3.1. Initial codes from the field diary (representative selection)

Conditions and context recorded in the representative selection:

- Experiencing intense heat;
- Observing animals reacting to the heat and confinement;
- Perceiving visitor stimuli (sounds) as environmental triggers;
- Noticing low visibility of the enclosure due to vegetation.

Student actions and responses:

- Perceiving animal agitation/activation;
- Selecting enclosures with "agitated animals" as a focus of interest;
- Asking why the animal is "agitated";
- Interpreting vegetation as "dirt";

- Feeling fear in the presence of agitated monkeys;
- Remaining animated and curious during movements;

Mediation and co-mediation:

- Explaining territoriality as an interpretative key;
- Connecting rescue/trafficking to the presence of animals in the zoo;
- Translating “dirt” as naturalization of the habitat;
- Repeating information to promote retention;
- Drawing attention to observing and listening (teacher/mothers).

Regulating the pace

- Adjusting the route to maintain fluidity;
- Interspersing rooms with hydration/snack/bathroom breaks;
- Finishing with an interview in a calmer environment.

3.3.2. Initial interview codes (question → process)

- Responding with gestures instead of speech (Student 1 in “Do you like the zoo?”);
- Naming positive affect (happy/excited);
- Anchoring interest in a big cat (black jaguar);
- Retaining punctual learning (birds, snakes);
- Elaborating on learning connected to conservation (rescue);
- Ending the interaction with minimal responses (“no”, “I don’t want to ask”).

In Grounded Constructivist Theory, these patterns of conciseness and silence are integrated into the communicational context of the encounter rather than discarded (CHARMAZ, 2014).

3.4. Focused coding: selecting codes with greater explanatory power

Focused coding selected codes with higher recurrence and greater explanatory power (CHARMAZ, 2014), supported by constant comparisons (HALLBERG, 2006). The focused codes were:

- Transforming animal activation signals into curiosity and questions;
- Mediating to give ecological-conservationist meaning (territoriality, rescue, habitat);
- Co-mediating with trusted figures to sustain engagement (teacher/mothers);
- Regulating experience through adaptability and pauses;
- Oscillating between fear, joy, and excitement as memory anchors;

- Extracting “nameable” learning even with economic discourse.

3.5. Emerging categories (properties and dimensions)

Category 1: Attention guided by “animals in activation”.

Definition: the experience is organized when visible behaviors (intense vocalization, agitation, repetitive movement) become salient and trigger attention and questions.

Properties/dimensions:

- Signal type: vocalization (macaws), agitation/beating (monkeys), repetition of paths (jaguars);
- Effect on the student: fear (black jaguar), joy (macaws), excitement (monkeys);
- Cognitive trigger: search for causality (“why is it like this?”).

As a support for interpretive caution, reviews on the effects of visitors in zoos highlight that visual and auditory stimuli can alter the behavior and well-being of animals, with variable impacts across species and contexts (SHERWEN AND HEMSWORTH, 2019). Studies on pacing in big cats describe it as an observable stereotypy in captive environments, often linked to environmental and management factors (MOHAPATRA et al., 2014; MEULENDIJKS et al., 2024). In this study, the central point is that the animal's perceived behavior triggered student engagement.

Category 2: Ecological-conservationist mediation as a translation of observation.

Definition: observations (activation, “dirt,” noise, repetition) were translated into explanations about territoriality, habitat, conservation, rescue, and trafficking.

Properties/dimensions:

- Explanatory key: territoriality and spatial organization of felines;
- Conservation component: trafficking and rescue as a narrative that gives meaning to the zoo;
- Form: micro-explanations during enclosures, revisits, and repetition;

Mediation on territoriality is supported by studies of the spatial ecology of jaguars, which examine the organization of space, home ranges, and patterns of overlap/avoidance that vary by sex, resources, and environmental context.

Category 3: co-mediation through trusted figures supporting participation.

Definition: The resource room teacher and the mothers acted as "relational infrastructure," stabilizing attention, encouraging repetition, and supporting engagement.

Properties/dimensions:

- Prior trust and daily bonding;
- Repetition and reorientation as a support strategy;
- Maintenance of morale and adherence over four hours.

This reading is consistent with the constructivist premise that data are produced in interaction and that relationships of care and trust are part of the phenomenon under investigation (CHARMAZ, 2014; MILLS et al., 2006). In discussions about inclusion in cultural institutions, the importance of structured support and accessibility practices for audience participation with autism is also highlighted (HLADIK et al., 2022; KULIK AND FLETCHER, 2016).

Category 4: Pace regulation and adaptability as conditions for permanence.

Definition: Sustaining participation in a warm and potentially stimulating environment requires pauses and a flexible approach.

Properties/dimensions:

- Pauses (snack/hydration/bathroom) as a care technology;
- Route flexibility to avoid rigidity and "stiffness";
- Interview at the end, as a data collection strategy, at a calmer time.

In public settings, with ASD, environmental adjustment strategies and adaptive predictability are identified as relevant to accessibility and inclusion in cultural and educational experiences (HLADIK et al., 2022; KONG et al., 2017).

Category 5: Emotional anchors as organizers of experience.

Definition: Fear, joy, and excitement appeared as anchors of memory and meaning associated with specific spaces.

Properties/dimensions:

- Fear associated with a large feline (Student 1);
- Joy associated with birds and vocalization (Student 2);
- Animation associated with primates and social agitation (Student 3);
- Ambivalence: tiredness coexisting with joy (Student 3).

3.6. Central category and explanatory model (integration)

Core Category

Co-constructing engagement and learning from animal activation signals.

This core category integrates conditions, interactions, and consequences, as described by Hallberg (HALLBERG, 2006).

Explanatory model (conditions → actions/interactions → consequences)

Conditions:

- Intense heat + enclosures with limitations (space, visibility) + human stimuli (sounds);

- Salient behaviors (intense vocalization, activation/agitation, repetition);
- Relational support (teacher/mothers).

Actions/interactions:

- Students perceive animal activation → ask/express emotion → mediation translates observations into ecological-conservation explanations → co-mediation reinforces attention and repetition → pauses regulate fatigue and overload.

Consequences:

- Sustained engagement (attention, curiosity, participation);
- “Nameable” learning (birds, snakes, differences between macaws, rescue);
- Positive evaluation and desire to return (in interviews).

4. DISCUSSION

4.1. Central analytical incidents (field diary)

The literature describes how visitors can produce negative, neutral, or positive effects on animal behavior and welfare, depending on the intensity and the animal's perception (SHERWEN AND HEMSWORTH, 2019). These findings are regularly observed in non-formal spaces, such as zoos, where, due to the wild nature of the animals on display, visual and auditory contact between animals and humans has caused stress and stereotypy (SHERWEN AND HEMSWORTH, 2019).

In addition to the stress caused by contact with humans, an evident aspect that also promotes stress in animals in the Amazon region is the extreme heat combined with high humidity (GARCIA et al., 2022). Studies on these abiotic variables reveal that thermal discomfort in the

Amazon region significantly increases stereotypies and stress in animal groups (CUSSEN AND MENCH, 2015), as observed in this study.

When assessing discomfort in people with ASD, who naturally exhibit environmental sensitivity, discomfort is significantly higher, indicating that a visit to a free-exposure environment must be planned and that student monitoring must be continually evaluated during the visit, since a class that may be attractive can turn into a process capable of triggering crises among those with ASD (CANIATO et al., 2022).

When evaluating the incidents presented in Table 1, in addition to the aspects of noise, stress, and animal stereotypies in a zoo environment, the co-mediation activity, especially among family members recorded in this study, stands out (CANIATO et al., 2022). Parental co-mediation in the development process of children with Autism Spectrum Disorder (ASD) is a fundamental factor for strengthening social, communicative, and emotional skills (ALKINJ et al., 2025). When parents actively participate in interventions, therapies, and educational activities, they become mediators of learning, helping the child to understand the world around them in a more accessible and safe way (ALKINJ et al., 2025).

The presence of parents facilitates the generalization of skills learned in therapeutic environments to everyday life, such as at home, at school, in social spaces, and at the CIGS Zoo during classes in a non-formal setting. In addition, co-mediation fosters stronger affective bonds, promoting emotional security and trust in the child, both of which are essential for cognitive and behavioral development. In this sense, it promotes greater trust between the student with ASD and the teacher (ALKINJ et al., 2025).

Another relevant point is that parents, by better understanding the characteristics of ASD, become active agents in identifying specific needs, adapting routines, communication, and stimuli according to the child's sensory and social profile, thus mediating the identification of stress, crises, and learning and pleasure (ALKINJ et al., 2025). The incidents and categories indicate that the teacher and mothers supported engagement, attention, and self-regulation. This result aligns with research on accessibility and inclusion as the construction of institutional and relational conditions for the participation of families and autistic children (HLADIK et al., 2022; KULIK AND FLETCHER, 2016).

In zoos, initiatives focused on sensory challenges have been associated with improved perceived experience and interaction, reinforcing the relevance of planned supports (KONG et al., 2017). In the case analyzed, pauses and route flexibility served as practical strategies for maintaining engagement. This allows for more effective, personalized interventions based on the findings of this study. Therefore, parental co-mediation, as described in Table 1, promotes the inclusion, autonomy, and quality of life of the child student with ASD, reinforcing the family's role as an essential foundation in the development process.

4.2. Interviews: responses and analytical notes

By treating short responses as a legitimate form of expression and a record of lived experience, as observed in Table 2, this study aligns with perspectives that view communication as a relational and contextual phenomenon, avoiding deficient, automatic interpretations (MILTON, 2012). This stance is methodologically consistent with constructivist Grounded Theory, which prioritizes emergent and co-produced meanings in the field (CHARMAZ, 2014).

In addition, the literature demonstrates that prompts influence how autistic children organize accounts of events. Thus, conciseness can coexist with informativeness and the retention of central elements, especially when triangulated with observation and diary entries (ALMEIDA et al., 2024). Here, conciseness does not appear as an impoverishment of the data but as a form of semantic anchoring to name animals, affections, and learning experiences, functioning as a marker of experience, reinforced by diary entries.

In the comparison of the 3 students with ASD evaluated, a striking difference in preferred animals was observed: some preferred black jaguars, others macaws, and others monkeys (Table 2). Emotions were clear markers: fear (black jaguar), joy (macaws), and excitement (monkeys) (Table 2). In a zoo, the affective dimension organizes memory and attention, paving the way for explanations and learning. The “visitor effect” contextualizes the fact that animal behavior and human presence make up a dynamic that alters what is seen and felt, visiting a situated and variable event (SHERWEN AND HEMSWORTH, 2019).

In this study, the perceived activation signals (intense vocalization and repetitive movements) became a pedagogical opportunity: the mediations on territoriality, conservation, and

rescue/trafficking connected observation, emotion, and explanation. The literature on repetitive behaviors in large felines in captivity helps to understand why repetition attracts attention and raises questions among visitors (MOHAPATRA et al., 2014; MEULENDIJKS et al., 2024). The interpretative focus here, however, remains on the student: how they transform what is perceived into a question, and how mediation translates this transformation into learning.

4.3. Initial coding

From an interpretative point of view, “activation” was adopted as an emic term to describe perceived and named signals during the visit (e.g., intense vocalization, restlessness, repetition of the path). These signals were treated as organizers of the experience rather than as diagnostic inferences about animal welfare. Reviews on the “visitor effect” show that auditory and visual stimuli associated with visitors can influence behavioral responses and welfare indicators in zoos, with variations by species and context (SHERWEN AND HEMSWORTH, 2019). In large felines, repetitive behaviors, such as pacing, are considered abnormal and associated with welfare issues, although they are influenced by multiple determinants (MOHAPATRA et al., 2014; MEULENDIJKS et al., 2024).

The interviews resulted in frequently short responses (isolated words, brief phrases, gestures). In constructivist GT, short responses and silences are not treated as “failures,” but as situated data that inform about limits of verbalization in the context and require triangulation with observation and field interactions (CHARMAZ, 2014).

Transcription is an essential interpretive task for coding, which converts multidimensional communication into text; it must be done faithfully to the spoken word, marking relevant nonverbal cues, identifying speakers and stamping times, keeping a record of methodological decisions, protecting confidentiality, and reviewing by comparing with the audio, ensuring rigor, transparency, and reproducibility of the coding (TAROZZI, 2011).

According to Charmaz (2009) and Tarozzi (2011), the most critical practical strategies of initial coding include word-for-word, line-by-line, segment, and incident coding, due to their analytical relevance. These strategies aim to maintain openness to all theoretical possibilities suggested by the data. Word-by-word coding allows for precise identification of what the author intended

to express, without resorting to arbitrary interpretations. Line-by-line coding enables the selection of small text excerpts that are significant to the research. Coding by segments and/or incidents identifies the episodes expressed in the transcripts. Thus, divisions were identified, including the conditions and context recorded in the representative selection, student actions and responses, mediation and co-mediation, and rhythm regulation.

4.4. Focused coding

Focused coding is a step in qualitative analysis in which the researcher revisits initial transcripts and codes to select, refine, and integrate the most significant and recurrent codes, building denser and more explanatory analytical categories that guide the theoretical synthesis of the data (SOUZA AND SOUZA, 2022).

In the present study, codes such as the following were observed: mediating to give ecological-conservationist meaning (territoriality, rescue, habitat), co-mediating with trusted figures to sustain engagement (teacher/mothers), regulating experience through adaptability and pauses, oscillating between fear, joy, and animation as memory anchors, and extracting "nameable" learning even with economic discourse. In a similar study, the same codes were identified at the Emílio Goeldi Zoobotanical Park in Belém, Pará (MASSARANI et al., 2023). In that study, experiences that generated positive feelings, such as happiness and joy, as well as negative emotions, such as fear and distress, were evidenced (MASSARANI et al., 2023). Furthermore, a positive association with elements of Amazonian fauna is suggested, as exemplified by the present study's findings.

4.5. Emerging categories

In grounded theory, emergent categories are analytically constructed concepts that arise inductively from the systematic analysis of data, rather than from a priori hypotheses (JOHNSSON, 2020). These categories are developed through constant comparison, in which incidents are compared with each other, codes with codes, and codes with categories, allowing patterns of meaning and action to emerge (JOHNSSON, 2020). Each category is defined by a set of properties, which describe the essential characteristics or attributes that give the category its analytical specificity, and by dimensions, which capture the variation, scope, or intensity with which each property can vary (JOHNSSON, 2020).

The properties answer the question of what constitutes the category, while the dimensions explain how and to what extent the category manifests itself in different contexts, actors, or conditions (JOHNSSON, 2020). As data collection and analysis proceed simultaneously, the categories become increasingly dense and, theoretically, saturated, with properties and dimensions refined through the elaboration of memos and theoretical sampling (JOHNSSON, 2020). This process ensures that the emerging categories are not mere descriptive labels, but robust theoretical constructs capable of explaining processes, relationships, and social conditions, ultimately forming the basis for the development of a grounded, substantive, or formal theory (JOHNSSON, 2020).

In the present study, a total of 5 categories were observed in the non-formal space of the CIGS Zoo with students with ASD. These findings portray the good use of this Amazonian space in teaching activities. Silva et al. (2019), when evaluating the use of the CIGS Zoo with regular students, portrayed that this space is strategic for raising awareness, promoting knowledge about Amazonian fauna and flora, and arousing feelings. Abrão et al. (2021) report that emerging categories should arise after visits to the Goiânia Zoo, Goiás, and that this space contributes substantially to awakening a sense of protection for local fauna and flora.

From this perspective, it is possible to affirm that the CIGS Zoo is an important educational space to promote greater development and learning in students with ASD, however, aspects associated with time, lighting and noise should be avoided as much as possible to reduce the effects caused by stress in students, especially those with ASD, seeing that this visitation may cause crises and stress. Thus, more in-depth studies should be conducted, using other locations and tools to serve this clientele better.

4. CONCLUSION

This study applied Grounded Theory from a constructivist perspective to build a processual and situated explanation of the experience of three students with ASD in a non-formal educational environment, the CIGS Zoo, in Manaus, Amazonas. The methodological choice proved adequate because it enabled traceable monitoring of the construction of meaning in the interaction among participants, mediators, and the setting, rather than imposing pre-existing categories on the phenomenon.

The constructivist Grounded Theory made it possible to understand that students' experiences with ASD at the CIGS Zoo are not reduced to isolated preferences or a single measure of learning. It presents itself as a process of mediated exploration and meaning-making: the environment provides stimuli and events (perceived animal activation, heat, sounds), the students select anchors of attention and emotion, and the relational security offered by teachers and families sustains participation and transforms observations into situated learning. This understanding reinforces the value of the zoo as a non-formal space with inclusive potential when mediation, self-regulation, and accessibility are treated as structural dimensions of the journey.

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