https://doi.org/10.14393/ER-v32e2025-18

Perception of undergraduate students in Natural Sciences about Inclusive Education and Universal Design for Learning in Colombia[1]

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ABSTRACT

To address inclusive education in Colombia, the Ministry of National Education takes proposals such as the Universal Design for Learning (UDL), which is based on diversity to enrich teaching; in this, teachers and their ideas are key; therefore, the perceptions of students of the degree in the area of natural sciences on inclusive education and the UDL had to be analyzed. The research was descriptive, with a total of thirty participants. The data was collected through Google Forms with a closed questionnaire; the analysis was quantitative through the graphs that were generated and qualitative through four categories that encompassed the central ideas; it is concluded that the participants indicate a low knowledge of the topics discussed, as well as about the UDL and the possibilities it has in the area, stating that they do not know how to apply it within the area.

KEYWORDS: Teacher Training; Universal Design for Learning (UDL); Including Education; Inclusion; Perception.

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Percepção de estudantes de licenciatura em Ciências Naturais sobre a Educação Inclusiva e o Desenho Universal para Aprendizagem na Colômbia

RESUMO

Para abordar a educação inclusiva na Colômbia, o Ministério da Educação Nacional adota propostas como o Desenho Universal para Aprendizagem (DUA), que se baseia na diversidade para enriquecer o ensino; os professores e suas ideias são fundamentais para isso. Assim, o presente estudo teve como objetivo analisar as percepções dos estudantes da licenciatura na área de Ciências Naturais sobre a Educação Inclusiva e o Desenho Universal para Aprendizagem (DUA). A pesquisa foi descritiva, com um total de trinta participantes e os dados foram coletados de forma virtual por meio do *google forms* com um questionário estruturado. A análise foi quantitativa por meio dos dados apresentados em gráficos que foram gerados e qualitativa com a apresentação de quatro categorias que englobaram as ideias centrais do estudo. Conclui-se que os participantes indicam um baixo conhecimento nos temas abordados, bem como sobre o DUA e as possibilidades que este tem na área, alegando não saber como aplicá-lo dentro da mesma.

PALAVRAS-CHAVE: Formação de Professores; Educação Inclusiva; Desenho Universal para Aprendizagem (DUA); Inclusão; Percepção.

Percepción de estudiantes de pregrado en Ciencias Naturales sobre la Educación Inclusiva y el Diseño Universal para el Aprendizaje en Colombia

RESUMEN

Para abordar la educación inclusiva en Colombia, el Ministerio de Educación Nacional adopta propuestas como el Diseño Universal para el Aprendizaje (DUA), que se basa en la diversidad para enriquecer la enseñanza; Los profesores y sus ideas son fundamentales para esto. Así, el presente estudio tuvo como objetivo analizar las percepciones de estudiantes universitarios del área de Ciencias Naturales sobre la Educación Inclusiva y el Diseño Universal para el Aprendizaje (DUA). La investigación fue descriptiva, con un total de treinta participantes

y los datos fueron recolectados de forma virtual a través de Google Forms con un cuestionario estructurado. El análisis fue cuantitativo a través de los datos presentados en gráficos que se generaron y cualitativo con la presentación de cuatro categorías que englobaron las ideas centrales del estudio. Se concluye que los participantes indican un bajo nivel de conocimiento sobre los temas tratados, así como sobre la DUA y las posibilidades que tiene en el área, manifestando no saber cómo aplicarla dentro de ella.

PALABRAS CLAVE: Formación del profesorado; Educación inclusiva; Diseño Universal para el Aprendizaje (DUA); Inclusión; Percepción.

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Introduction

How students participating in the educational process have been treated in Colombia has had various approaches over the years, which have accompanied the evolution of society. According to Camargo (2018), these approaches have included exclusion, segregation, integration and, finally, inclusion, which assumes the role of developing an education that responds to the needs of all students since inclusive education is recognized as the most appropriate modality for States to guarantee the universality of the same right and, as such, requires responding to the diverse needs of all, respecting human diversity. In Colombia, inclusion is a process of acceptance, without any discrimination, implying the recognition of its actors, especially students with disabilities, exceptional abilities and talents, with different disorders and others who face barriers that prevent participation in the process (Camargo, 2018).

The search for the implementation of Inclusive Education by the Ministry of National Education (MEN) in the country has led to different processes accompanied by regulations that seek to have an effect, as the State is aware of the difficulties encountered by participants in the system; that, according to Conpes, “Colombia ranks first in prevalence of disability”

(CONPES, 2013, p. 19). This has led to the need for decrees, such as 1075 (Colombia, 2015), which for now governs the process and has allowed the strategy of the Ten-Year Education Plan (PDE, 2016) to demand equity and quality, however other factors, such as social inequality, classism, the large gaps between rich and poor, the lack of opportunities for broad sectors limit progress, as indicated by Camargo (2018).

For the year 2017, and in addition to the Ten-Year Education Plan (PDE, 2016), Decree 1421 (Colombia, 2017) was launched, which complements the parameters for work in the educational area with the population that presents some disability, thus confirming something that has always been requested, adequate human resources to work in different classrooms, with teachers being one of the main axes for improving the conditions of the population.

Due to these demands placed on participants in the educational process, including teachers, the entities responsible for training play an important role. However, according to Molina (2018) and the Colombian Ministry of National Education (MEN, 2017), teachers express a lack of knowledge (in their training), experience and training on the subject and, sometimes, even a lack of interest in making changes to improve diverse environments, in some cases, due to misconceptions anchored in popular belief. The same Ministry (MEN, 2017) indicates that only 4% of undergraduate courses present content on inclusion processes in their academic curricula, which is worrying and leads to the search for possible solutions.

The Colombian education system organizes teacher training mainly by areas of concentration that fulfill a specific role in the teaching and learning of students. One of the areas in Natural Sciences, which aims to promote autonomy and the ability to analyze reality and the environment, is something close to what Inclusive Education proposes, since no participant can be excluded from these objectives due to limitations of the environment or society. Moreover, the science teacher is responsible for developing these ideas, including involving other teachers and families that comprise the

school community. However, for this to happen, they must be the first to have this perception, as pointed out by Álzate and Ruiz (2014).

However, it is important to remember that the teacher is not solely responsible for the process and that the State and territorial entities are obligated to provide tools and support. Therefore, among the strategies proposed by the Ministry of National Education of Colombia for the development of inclusive education in classrooms is the work with Universal Design for Learning (UDL), which allows acting from diversity as a starting point for enriching the teaching and learning process, according to Universal Design for Learning (Cast, 2018):

> UDL helps to account for learner variability by suggesting flexibility in objectives, methods, materials, and assessments to enable educators to meet these varying needs. A curriculum created according to the UDL framework is designed from the outset to meet the needs of all learners, making subsequent changes and the cost and time associated with them unnecessary (CAST, 2018, p. 3).

According to Cast (2018), which presents the three principles of UDL: providing multiple forms of motivation and commitment, providing multiple forms of representation, and providing multiple forms of action and expression, it seeks to support inclusion processes. Thus, this type of information and UDL proposal must reach teachers and be made available in the initial and continuing training process, so training, territorial entities, and support teams must always be present.

Thus, this article analyzes undergraduate students' perceptions of inclusive education in Natural Sciences.[4] and Universal Design for Learning (UDL).

[4]This article is the result of adaptations of parts of the dissertation, entitled " Perceptions of Undergraduate Students in Natural Sciences About Inclusive Education and Universal Design for Learning (DUA): Preparation of a Guidance Guide", defended at the Postgraduate Program in Special Education - PPGEEs, at the Federal University of São Carlos - UFSCar - São Carlos-Brazil.

Methodological Design

The research has a descriptive design, and students from three Colombian universities participated. Participants were recruited by emailing the Higher Education Centers in the country that offered at least one undergraduate course in Natural Sciences. Thus, two universities were located in Cali (Valle del Cauca) and one in Medellín (Antioquia). The entire process was virtual, and contacts were made through the secretariats of the undergraduate courses, who sent out invitations with links to the Google *Forms questionnaire* so that students could participate in the study.

The participants were thirty students from the last semester who had already completed the supervised internship subjects (teaching practice), this being a practice space in an educational institution, guided by a professor in the area of Natural Sciences, or were already in professional practice.

For data collection, a closed questionnaire with seventeen questions was applied, which were validated by the research group registered in the CNPq Research Groups Directory entitled "Center for Studies and Research in Inclusive Education, Educational Technology and Professional Training in Different Contexts," which assessed the relevance of the questions concerning the objective of the study. This allowed us to identify undergraduate students' perceptions of natural sciences courses at universities in Colombia regarding inclusive education, work in diverse classrooms, and the use of UDL in these contexts.

The information was collected through *Google Forms*, where the responses were kept for academic purposes only, ethically protecting the identity of the participants. Participants were given thirty days to respond voluntarily, meaning some questions could be omitted at their discretion. Next, a quantitative analysis of the responses obtained was performed, creating graphs that allowed the extraction of numerical data. From this data, a qualitative analysis was performed by classifying the responses into four categories:

• Category one: Subjects related to Inclusive Education in the curricular matrices;

• Category two: Knowledge of inclusive education policies, disability and exceptional skills and/or talents;

• Category three: Perception of future teachers about pedagogical practice with students who have disabilities or exceptional abilities and/or talents;

• Category four: Knowledge about Universal Design for Learning (UDL).

Results and discussion

The responses obtained through the questionnaire were organized based on the numerical analysis of the graphs made with the same information and then classified, which allowed identification of the participants' perceptions of the issues addressed.

Category one: Subjects related to Inclusive Education in the curricular matrices

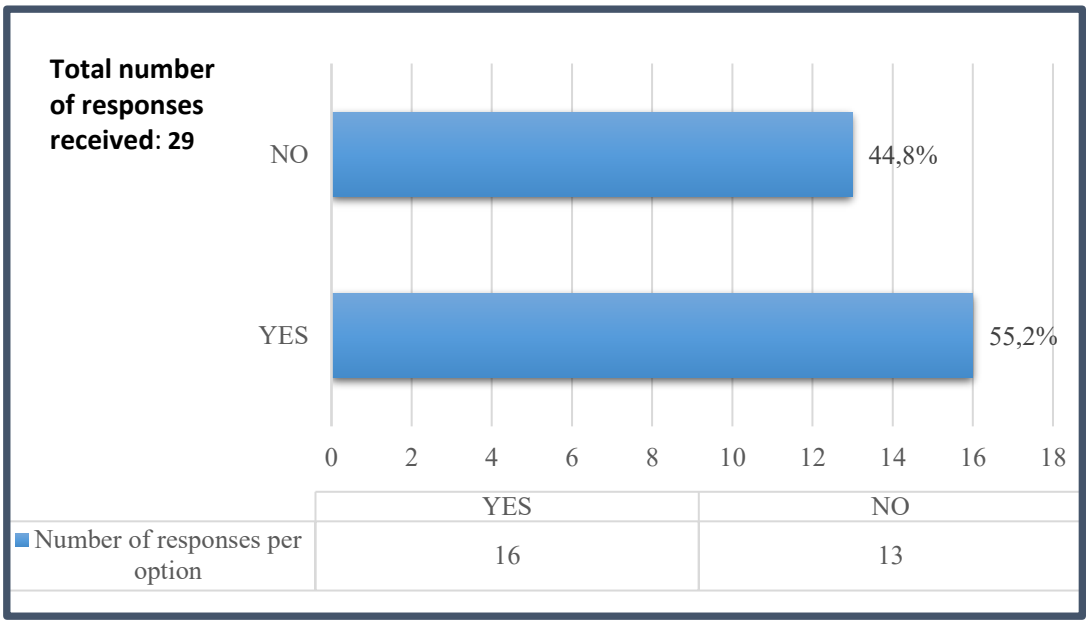
The category included questions related to the curricular part of the training programs, in which the objective is to analyze the presence of these types of subjects or courses in the science course, in addition to identifying whether they are mandatory or whether participants take them voluntarily due to their interest in the subject.

This category includes questions related to the curricular part of the undergraduate programs in Natural Sciences, in which we sought to analyze the extent to which the subjects were present in the curricular matrices. We also sought to identify whether these subjects are part of the mandatory matrix or whether the participants took them voluntarily out of interest in the subject.

Four questions were grouped, from which it is possible to show (Chart 1) that 55.2% (16 participants) indicated that they had received training

related to Inclusive Education, while 13 participants, representing 44.8%, stated that they had not. This result shows that some basic requirements established by the State concerning training on the subject may not be met, as indicated by the MEN (Colombia, 2019).

CHART 1 - Students trained in Inclusive Education processes



Source: Own elaboration (2023)

The Colombian Ministry of National Education (MEN) indicates that 96% of teacher training courses do not provide what is necessary concerning a problem that has been recognized and that demands attention and action. It also emphasizes that, according to the agency itself, this is not optional and is justified and provided for by law in the most recent documents, which require professionals trained specifically in Inclusive Education.

To complement the question, participants who stated that they had received this training were asked whether the subject was mandatory or optional. It was found that 52.6% indicated that it is part of the curriculum and is mandatory, while 36.8% said that some subjects are optional and, therefore, they do not choose to take them. Other participants said they combine mandatory and optional subjects to improve their knowledge.

Therefore, it is observed that, in some cases, it is still optional for undergraduate students in Natural Sciences to have or not have knowledge of the subject during their initial training, which is worrying since diversity in the classroom is a reality and a right guaranteed to all involved. An example is Decree 1421 (Colombia, 2017), which determines that teachers must be trained in Inclusive Education. Therefore, if this training were mandatory within the curricular matrix of training institutions, future teachers would have at least a basic understanding of the subject, which highlights the need to work on these courses, as Herrera (2015) states:

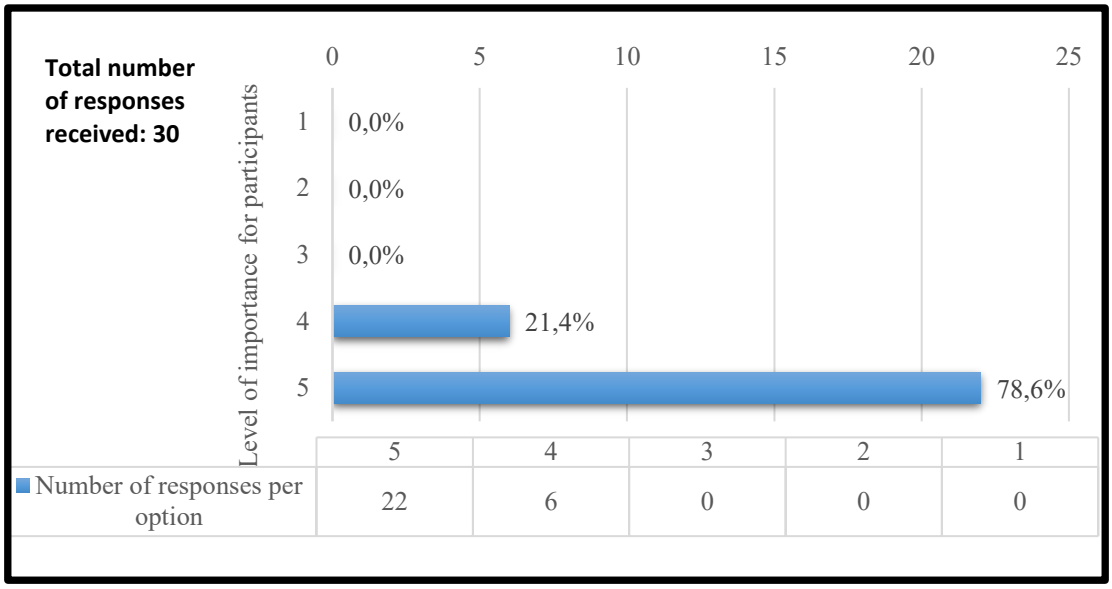
> Public policies for education require intervention in the factors that improve the work of schools and teachers. However, what are these factors? We could simplify things by saying they strengthen schools and improve teachers' initial training and working conditions. Of course, these two factors have room for everything (Herrera, 2015, p. 1). (own translation).

According to the Colombian Ministry of National Education (MEN, 2017), this gap in initial training increases one of the main barriers, which is the lack of knowledge of the needs and requirements of students in schools. This is related to the difficulties that teachers have in teaching students with disabilities, as they are not familiar with the subject or know how to support the learning processes of this group (MEN, 2017). For this reason, it is necessary to seek solutions, not only for the benefit of the group mentioned above but for the diversity of the community participating in the educational process. Thus, future teachers need training to offer these possibilities (MEN, 2013).

Another question assessed the level of importance that participants attributed to the topic. They could assign a value from 1 to 5, with 1 being unimportant and 5 being the most important subjects related to Inclusive Education. All those who answered the question considered these subjects

important (Chart 2), not only because they are mandatory, but because the lack of this training generates a demand already identified and perceived by the teachers.

CHART 2- Level of importance of content about Inclusive Education in the curriculum



Source: Own elaboration (2023)

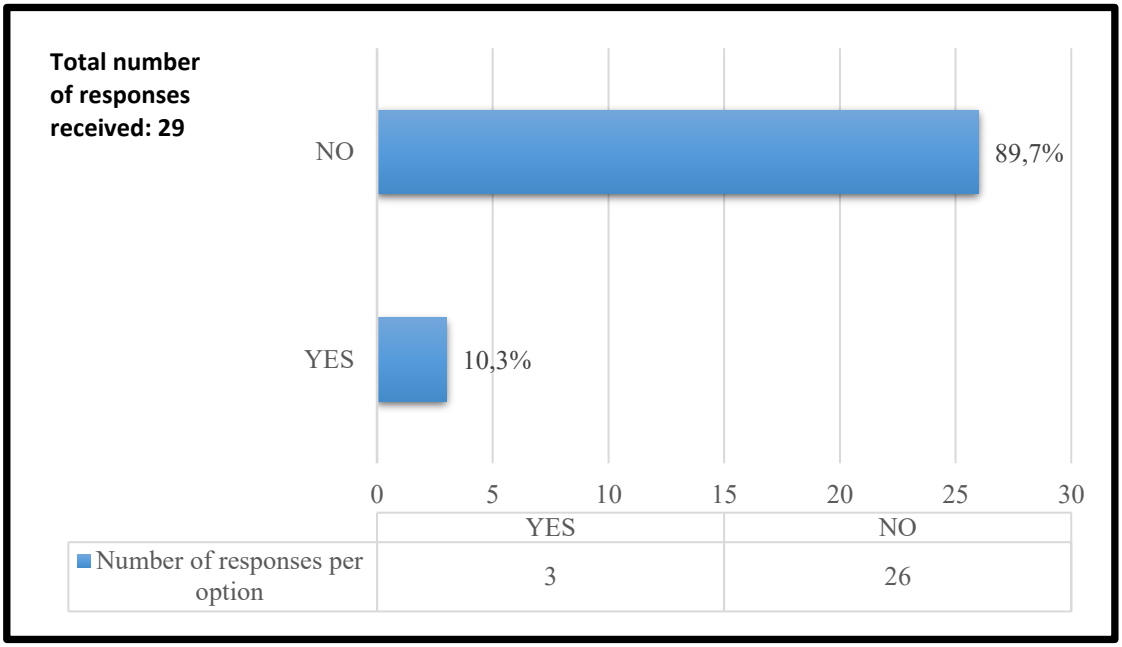
Category Two: Knowledge of policies on inclusive education, disability and exceptional abilities and/or talents

This category grouped questions that sought to identify participants' knowledge level about laws, decrees, resolutions, or standards related to the Inclusive Education process, especially regarding students with disabilities or exceptional abilities and/or talents. Knowing the current legislation can allow for better guidance of the educational process, using the mechanisms offered by the State, avoiding non-compliance with the standard and seeking to comply appropriately.

Based on the information collected, 26 participants indicated they were unfamiliar with the legislation or legal aspects of the topic (Chart 3). This represents 89.7% of the 29 who answered this question, evidencing low knowledge about national policies. Of the 3 participants who stated that they were familiar

with them, the question was confirmed by asking them to indicate which laws, decrees, or resolutions they were familiar with, and only 2 could answer.

CHART 3 - Knowledge of national policies related to Inclusive Education

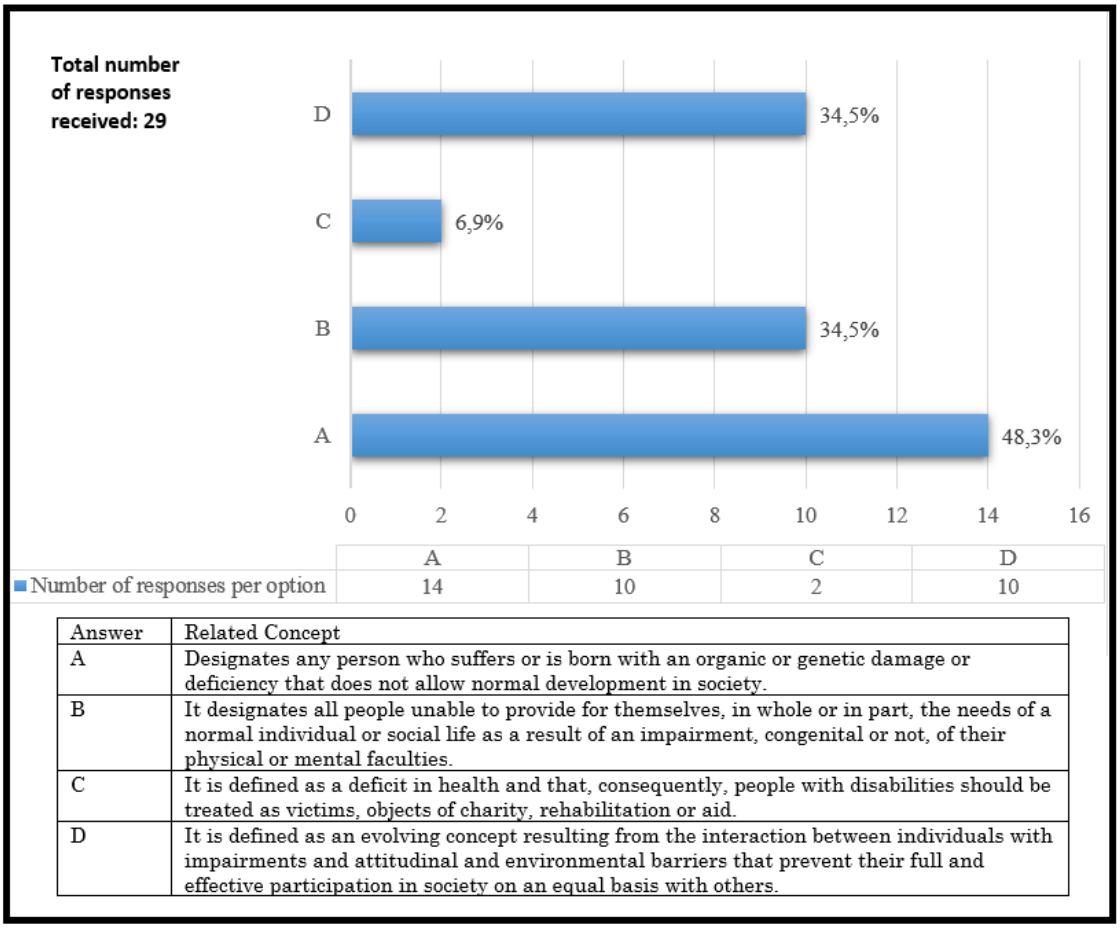


Source: Own elaboration (2023)

This demonstrates part of what is stated by the Ministry of National Education of Colombia (MEN, 2017), when indicating that many teachers are not aware of the legislation they must comply with and, consequently, are unaware of the support offered by the Ministry to help comply with each of the established standards.

Considering that most participants are unfamiliar with the regulations, we also sought to identify which concept of disability the participants most agreed with (Chart 4). It was found that 48.3% of participants associated disability with the idea of "normality," understanding that it impedes social development. Furthermore, 34.5% and 6.9%, respectively, relate disability to a precarious state of health or a limitation. Only 34.5% state that the external environment does not adapt to people's needs and that this environment is, therefore, the true limiting factor.

CHART 4- Concepts of disability for participants



Answer	Related Concept
A	Designates any person who suffers or is born with an organic or genetic damage or deficiency that does not allow normal development in society.
B	It designates all people unable to provide for themselves, in whole or in part, the needs of a normal individual or social life as a result of an impairment, congenital or not, of their physical or mental faculties.
C	It is defined as a deficit in health and that, consequently, people with disabilities should be treated as victims, objects of charity, rehabilitation or aid.
D	It is defined as an evolving concept resulting from the interaction between individuals with impairments and attitudinal and environmental barriers that prevent their full and effective participation in society on an equal basis with others.

Source: Own elaboration (2023)

The concept that participants have about disability is important, as it can generate misconceptions about what it means to work with people with disabilities in an inclusion process. This can lead to rejection based on teachers' myths or prejudices (MEN, 2017), further hindering the Inclusive Education process within the classrooms.

Category three: Perception of future teachers about pedagogical practice with students who have disabilities or exceptional abilities and/or talents

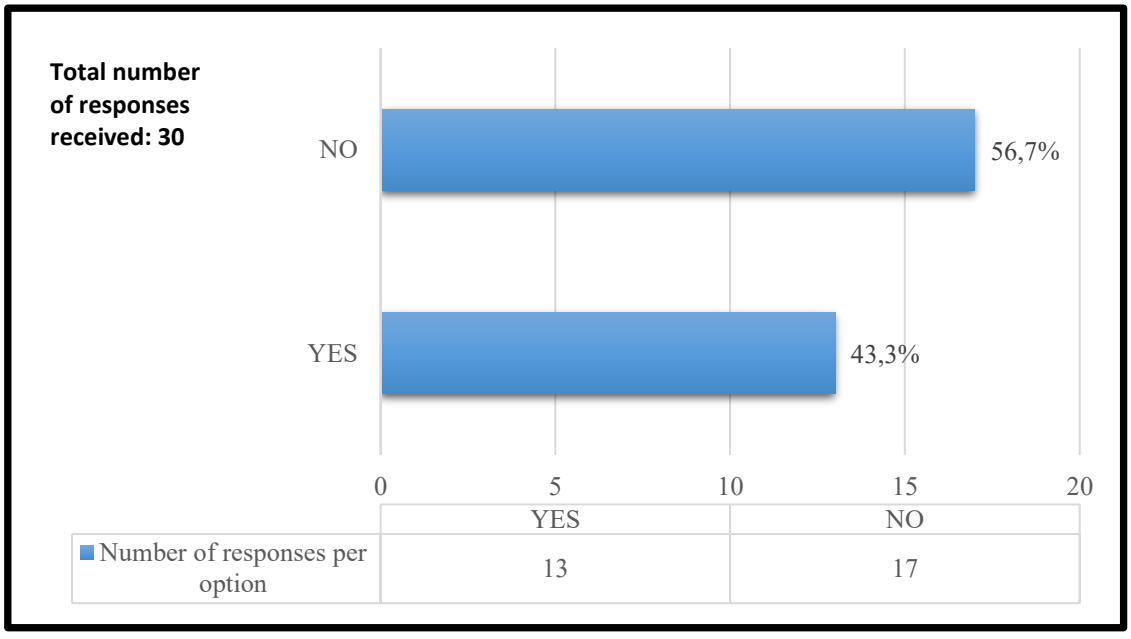
This category brings together questions that allow us to identify what ideas participants have about Inclusive Education, whether they have

already experienced this process, how they deal with students with disabilities in the classroom, as well as with exceptional talents, and how they would serve a diverse audience.

It was found that 17 participants, or 57%, stated they had no contact with students with disabilities or exceptional talents during their practice (Chart 5). It is important to highlight that, in general, there is a lack of awareness about the presence of these students in the classrooms, as pointed out by MEN (2015), possibly due to the lack of training and knowledge on the part of teachers in this area.

It is important to note that it is not the teacher's responsibility to carry out the diagnosis, as this is the responsibility of specialized professionals. However, the teacher may be the first to identify the student's academic adaptation needs.

CHART 5- Interaction with classroom diversity and with students with disabilities or with exceptional abilities and/or talents



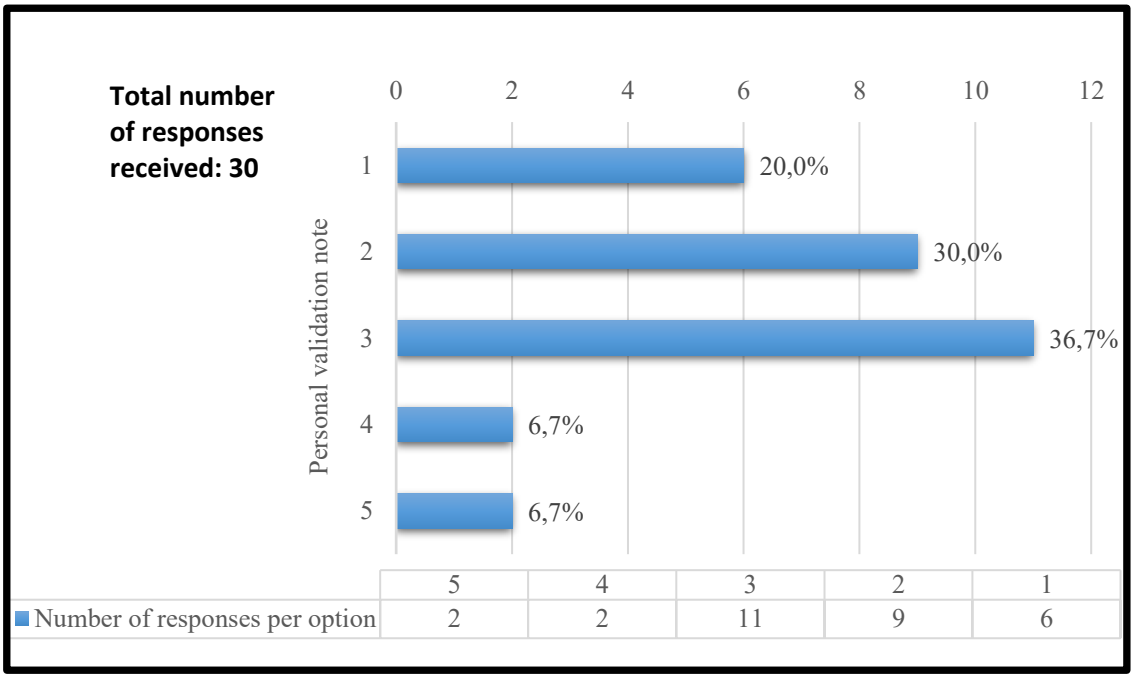
Source: Own elaboration (2023)

Of the 17 participants who indicated that they had no prior experience, when this information was related to the answers about their initial training, it was observed that seven had also not taken any courses or training focused

on Inclusive Education. This indicates that these participants had no contact with the topic, neither in its theoretical dimension nor in its practical application, which makes the inclusion process even more difficult when faced with heterogeneous classrooms.

They were also asked to perform a self-assessment (Chart 6) regarding the level of preparation they perceived themselves to have to work in different educational contexts. The scale ranged from 1 (not very prepared) to 5 (very well prepared). The data revealed that 50% of the participants considered themselves unprepared to face this challenge, 36.7% considered themselves well prepared and only 13%, corresponding to four participants, said they felt prepared to work in inclusive contexts.

CHART 6 - Self-assessment of inclusive education processes

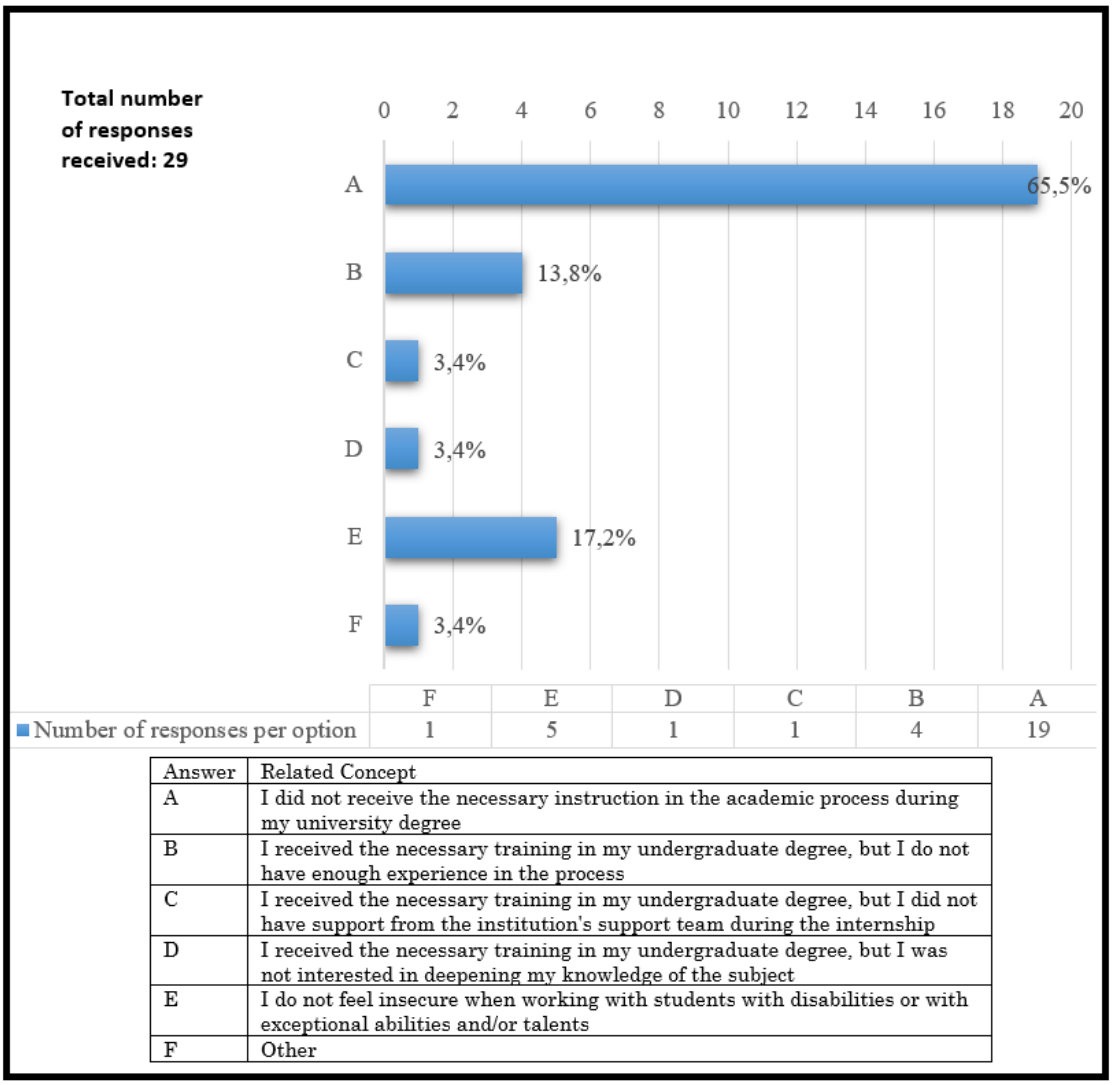


Source: Own elaboration (2023)

The data presented above demonstrate that the participants recognize and perceive a weakness concerning Inclusive Education and its processes. When asked about what they consider to be the cause of this difficulty, 65.5% attributed the problem to their initial training (Chart 7).

The other data obtained reinforce, in some cases, the lack of interest and practical experience as contributing factors to this perception of unpreparedness.

CHART 7 - Reason attributed to the lack of preparation of participants



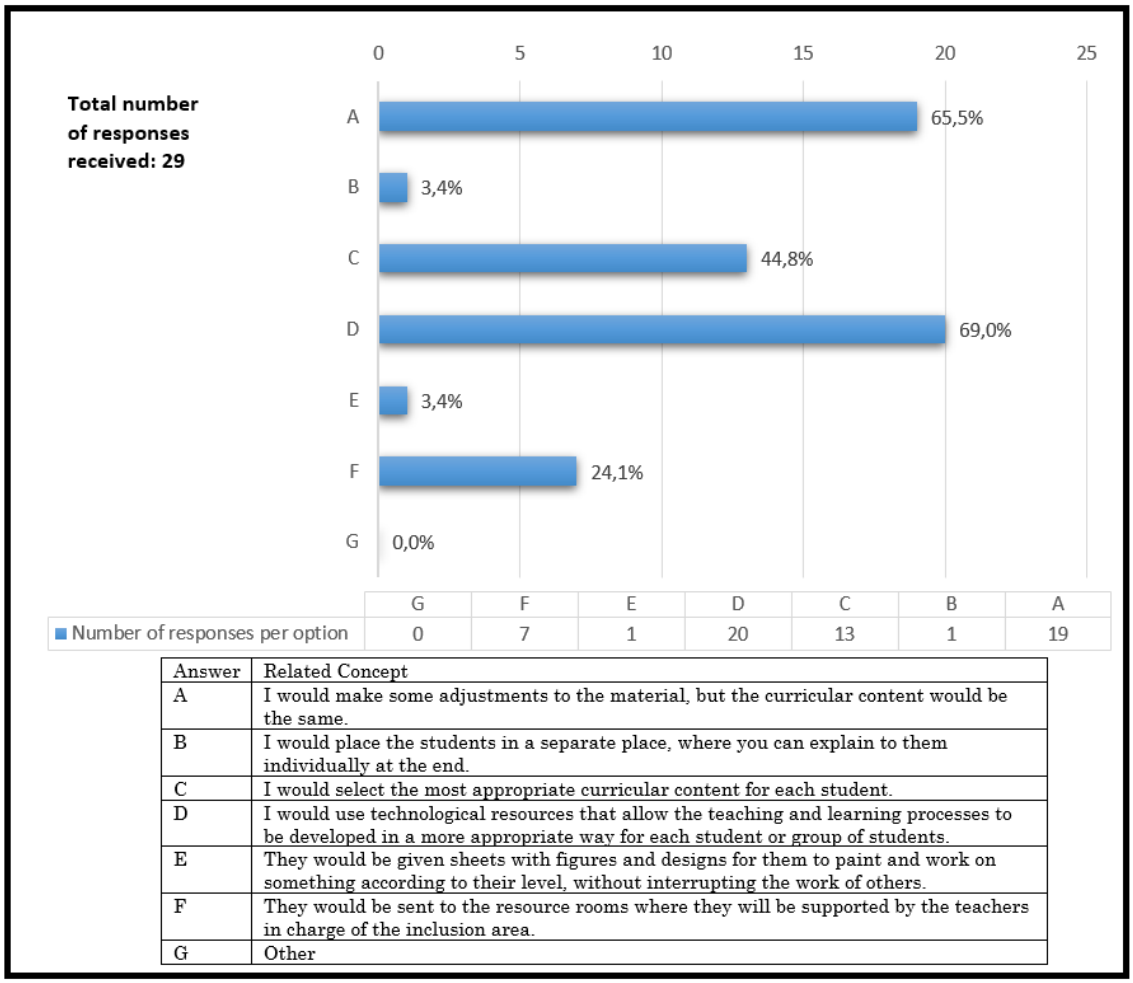
Answer	Related Concept
A	I did not receive the necessary instruction in the academic process during my university degree
B	I received the necessary training in my undergraduate degree, but I do not have enough experience in the process
C	I received the necessary training in my undergraduate degree, but I did not have support from the institution's support team during the internship
D	I received the necessary training in my undergraduate degree, but I was not interested in deepening my knowledge of the subject
E	I do not feel insecure when working with students with disabilities or with exceptional abilities and/or talents
F	Other

Source: Own elaboration (2023)

Participants were also asked how they would conduct classroom inclusion processes (Chart 8). It was found that some of them perceived the presence of students with diverse profiles as an obstacle to the teaching-learning process, even indicating that these students should be removed from the school environment (3.4%) or that they would use

completely different materials that were unrelated to the activities carried out by the rest of the class. On the other hand, it is important to highlight that 69% of the participants, that is, 20 of them, recognize technological resources as an important support for developing effective pedagogical practices in inclusive contexts.

CHART 8 - Activities that participants select to work with students with disabilities or exceptional abilities and/or talents



Answer	Related Concept
A	I would make some adjustments to the material, but the curricular content would be the same.
B	I would place the students in a separate place, where you can explain to them individually at the end.
C	I would select the most appropriate curricular content for each student.
D	I would use technological resources that allow the teaching and learning processes to be developed in a more appropriate way for each student or group of students.
E	They would be given sheets with figures and designs for them to paint and work on something according to their level, without interrupting the work of others.
F	They would be sent to the resource rooms where they will be supported by the teachers in charge of the inclusion area.
G	Other

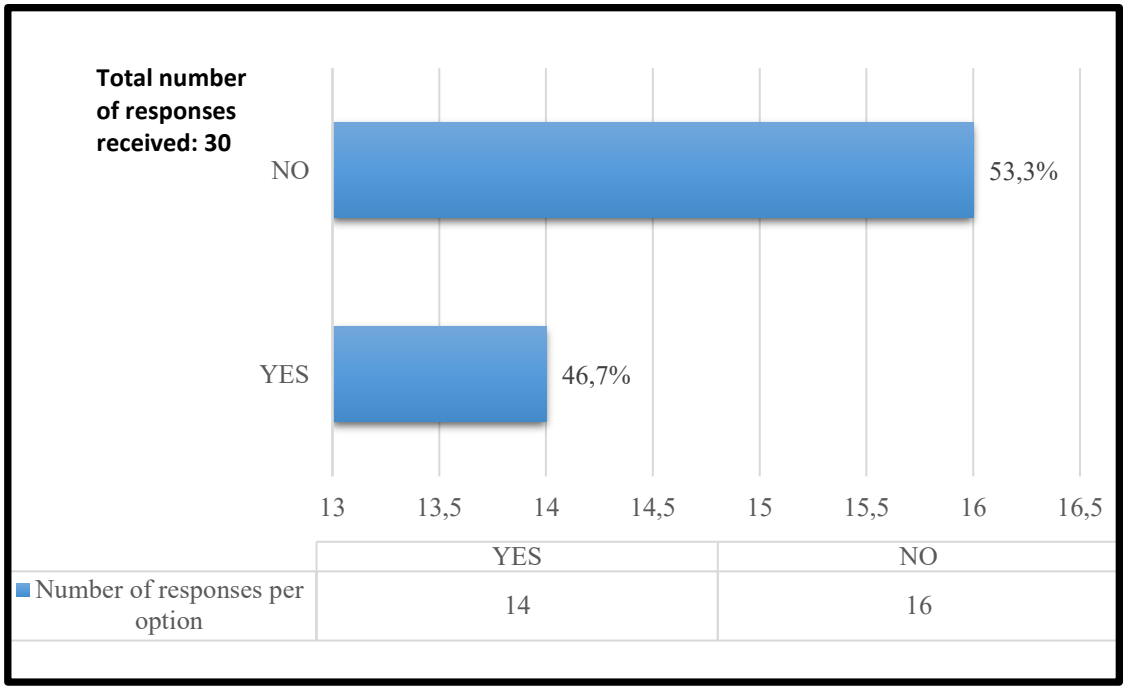
Source: Own elaboration (2023)

Category Four: Knowledge about Universal Design for Learning (UDL)

This category seeks to group questions that allow us to identify participants' knowledge level regarding the UDL, address its principles, guidelines, and checkpoints, and determine whether the knowledge is general or specific. The UDL is a proposal supported by the Ministry of National Education of Colombia as an alternative for improving inclusion processes.

Of the 30 participants, 53.3% (16 participants) stated that they were not familiar with the topic (Chart 9), while 46.7% (14 participants) reported having had some contact with it. Among those unfamiliar with the UDL, it was observed that the majority belonged to the group that had not received training on topics related to Inclusive Education, in addition to being unaware of the current legislation that supports this proposal.

CHART 9 - Do you know anything about DUA?



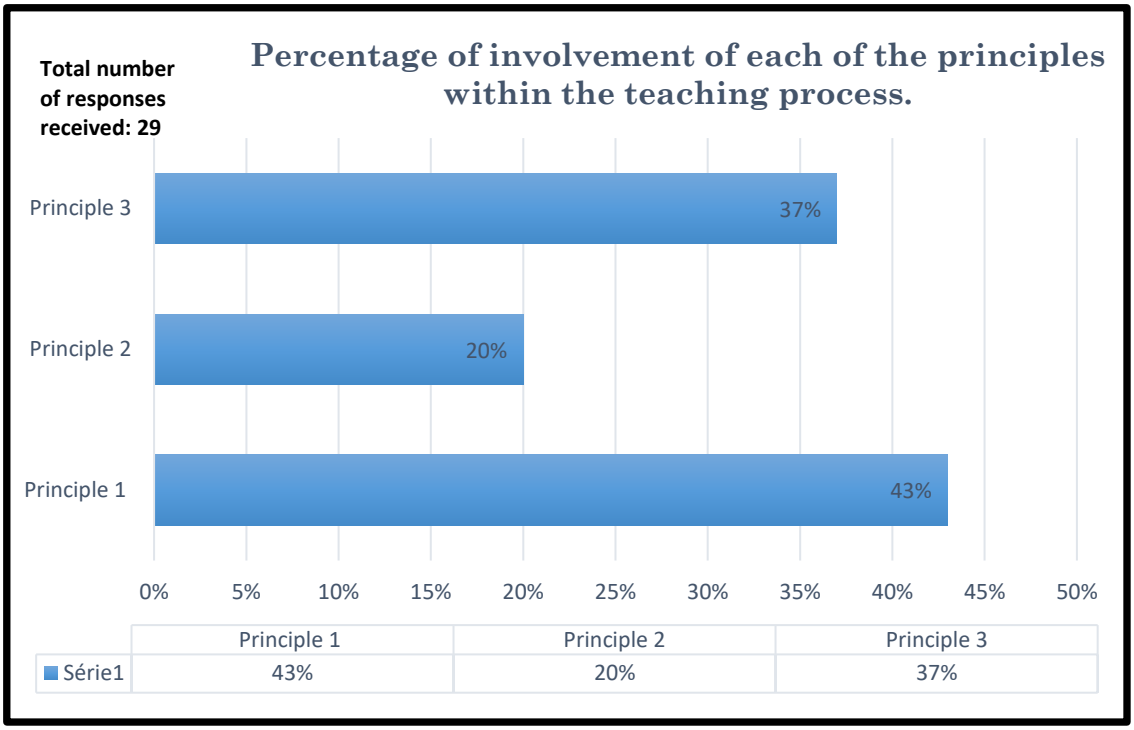
Source: Own elaboration (2023)

We also sought to identify which UDL principles the participants considered without addressing them directly. To this end, several checkpoints

were presented, corresponding to the actions recommended by the UDL to be implemented in the classroom, allowing the participants to select those they considered important for their teaching practice.

Based on the responses, it was found that the most recognized principle was number 1, representation (Chart 10), with 43% of the responses, which indicates an emphasis on "what is learned." Next, principle 3, motivation and engagement, stood out, with 37% related to the question "Why do we learn." Finally, principle 2, action and expression, associated with "how do we learn," was the least mentioned.

CHART 10 - Implication of each principle in the participants' teaching process.



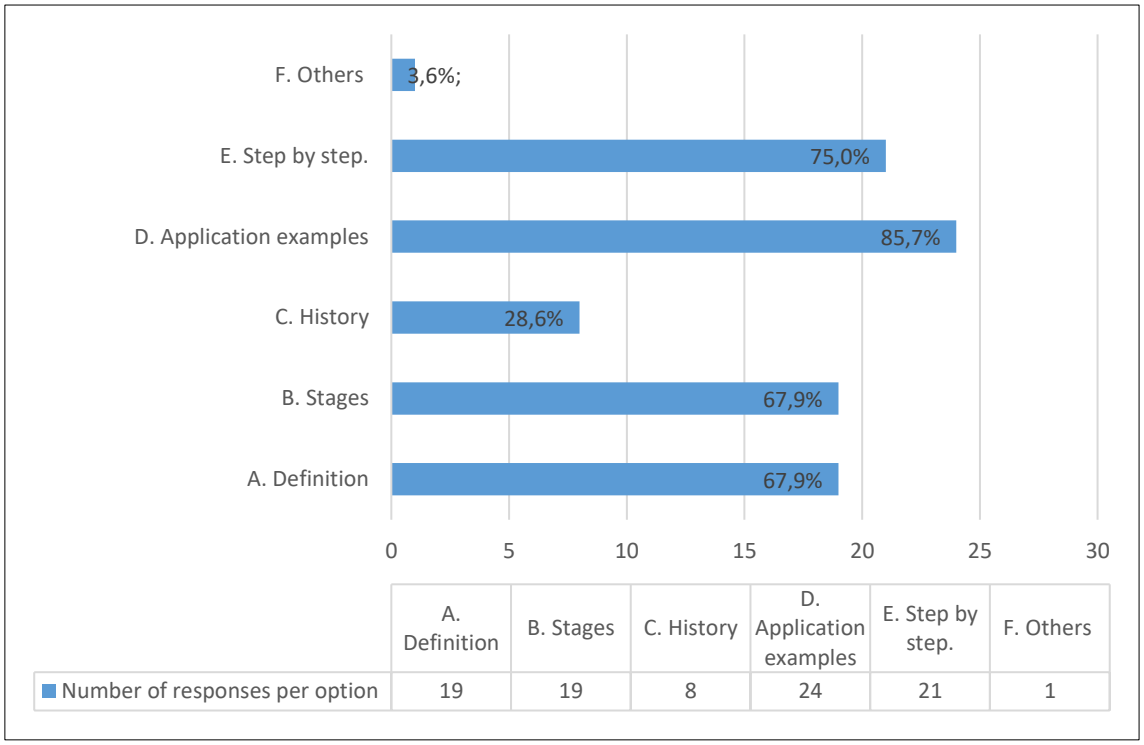
Source: Own elaboration (2023)

From this data, it is possible to analyze that the participants remain more focused on the question "what should be taught?". As Zambrano (2008) points out, it is more important for some teachers to transmit themes, concepts, and content that are often distant from the pedagogical practice.

Thus, it is observed that the principle with the least presence in the answers is the one related to "how to do it?".

Given this, the last question in the questionnaire was directed precisely at this gap, seeking to identify what teachers would like to know about UDL (Chart 11). It was found that the main demand is related to "how to apply UDL," with 85.7% of participants expressing interest in practical application examples, even requesting a step-by-step guide for its implementation in the classroom.

CHART 11 - Participants' DUA requirements



Source: Own elaboration (2023)

Conclusions

During the research development, it was observed that a large portion of the students in the Natural Sciences undergraduate course consider it necessary to include specific subjects or courses focused on the theme of Inclusive Education in the curricular structure of their undergraduate

courses, specifically in the undergraduate courses. This content should directly address the relevant legislation and offer an overview of the country's current situation concerning educational inclusion. In addition, the participants expressed the desire to experience the processes of inclusion through teaching practices, both those who already have some prior knowledge on the subject and those who have not received any training, recognizing that this is an undeniable reality that they will have to deal with in their future professional practice.

We also identified the persistence of misconceptions among some undergraduate students, who associate working with students with disabilities, disorders or exceptional talents with obstacles to developing school processes. This perception reveals a view centered on the individual as the source of limitation, disregarding the role of the environment and pedagogical interaction. This perspective sometimes leads to the proposal of exclusionary measures, such as the complete isolation of these students, which goes against the principles of inclusion.

Universal Design for Learning (UDL) is one of the approaches recognized and promoted by the Colombian Ministry of National Education as a strategy to improve inclusive education processes in schools. However, it was found that most participants were unaware of UDL and that current regulations support its adoption. Even among the few who claim to be familiar with this approach, there was difficulty in understanding its structure and its practical application in the classroom context.

When analyzing the principles and neural networks activated by UDL, it was found that participants attribute greater importance to the dimension "what to learn," demonstrating a tendency to value the content to be transmitted to the detriment of motivational or methodological aspects. UDL is a potential tool that can contribute to teaching practice, especially through its guidelines and checkpoints.

Finally, teachers in training indicate that to understand and apply UDL effectively, it is essential to have access to practical examples

demonstrating how to operationalize this approach in everyday school life. This demand represents a concrete training that needs to be considered in future teacher qualification proposals.

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Received in September 2024.

Approved in March 2025.