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The Impact of Universal Design for Learning (UDL) on Inclusive Education: An Analysis of Participation and Academic Performance

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Abstract

This study analyzes the impact of Universal Design for Learning (UDL) in inclusive education contexts, focusing on student participation and academic achievement. Using a sequential explanatory mixed-methods approach, quantitative instruments (participation scales and standardized tests) and qualitative tools (interviews and classroom observations) were applied to teachers and students from three Ecuadorian educational institutions. The results show significant improvements in active student engagement and academic performance when UDL-based strategies are implemented. Additionally, key enabling conditions were identified, such as pedagogical leadership, teacher training, and the use of accessible technologies. The study concludes that UDL not only benefits students with special educational needs but also enhances the overall quality and equity of learning for the entire school community. The article ends with recommendations for teachers, school administrators, and education policymakers.

Keywords: *Universal Design for Learning, inclusive education, participation, academic achievement, curricular accessibility.*

Introduction

In recent decades, education has undergone a significant transformation in its conception and practice, driven by a growing concern for equity, diversity, and inclusion. This evolution has led to the consolidation of an inclusive paradigm that recognizes heterogeneity as a value rather than an obstacle, and that demands flexible forms of organization, teaching, and assessment (UNESCO, 2020). However, despite normative and discursive progress, many educational systems still face difficulties in translating the ideal of inclusion into sustainable pedagogical practices that ensure the active participation and learning of all students, especially those with special educational needs.

In response to this challenge, Universal Design for Learning (UDL) emerges as an innovative pedagogical approach aimed at eliminating learning barriers through curriculum planning. Developed by the Center for Applied Special Technology (CAST), UDL proposes three fundamental principles: providing multiple means of content representation, multiple means of learning expression, and multiple means of engagement or motivation (CAST, 2018). Through this structure, UDL recognizes the neuronal and cultural variability of students and presents a flexible, anticipatory, and inclusive framework.

Several studies have shown that the application of UDL improves student engagement, supports academic performance, and fosters more accessible and equitable learning environments (Meyer, Rose & Gordon, 2014; Schreffler et al., 2019). However, in Latin American contexts—and particularly in Ecuador—empirical evidence on its impact remains limited and fragmented. It is necessary to investigate how this model is translated into concrete practices, what effects it has on the participation

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and performance of students with and without disabilities, and what conditions facilitate or hinder its implementation.

In this context, the present study aims to analyze the impact of Universal Design for Learning on inclusive education, using student participation and academic achievement in functionally diverse school settings as the primary variables of analysis. The research seeks to answer the following questions:

- What differences are observed in participation levels and academic achievement between students learning in UDL-based environments and those in traditional settings?
- What are the perceptions of teachers and coordinators regarding the impact of UDL on inclusive learning?
- What are the facilitators and barriers identified in the implementation of UDL?

The relevance of this study lies in its contribution of contextualized and up-to-date evidence on the effectiveness of UDL as a tool for educational inclusion, offering guidance for public policy design, teacher training, and sustainable pedagogical practices.

Fundamentals of Universal Design for Learning (UDL)

Universal Design for Learning (UDL) is a pedagogical approach based on advances in neuroscience, educational technology, and learning psychology. It was developed by the Center for Applied Special Technology (CAST) and proposes that teaching should be designed from the outset with student variability in mind, rather than relying on subsequent adaptations.

According to CAST (2018), UDL is founded on three core principles:

1. Provide multiple means of representation (the "what" of learning).
2. Offer multiple means of action and expression (the "how" of learning).
3. Foster multiple means of engagement (the "why" of learning).

These principles are linked to three brain networks: the affective, the strategic, and the recognition networks. As Meyer, Rose, and Gordon (2014) point out, “each student processes information differently; therefore, learning environments must be designed with enough flexibility to accommodate that variability” (p. 38).

A longer quotation illustrates the depth of this perspective:

“Universal Design for Learning is not a one-size-fits-all solution, but rather a blueprint for creating flexible learning environments that can accommodate individual learning differences. It is a proactive strategy that seeks to anticipate barriers before they arise, enabling educators to plan instruction that is inherently inclusive” (CAST, 2018, p. 6).

From this perspective, curriculum design becomes a tool for equity by eliminating physical, sensory, cognitive, or emotional barriers before they materialize.

Inclusive Education and Pedagogical Accessibility

The movement for inclusive education promotes the right of all individuals, without discrimination, to access, participate in, and progress through the general education system. UNESCO (2020) emphasizes that inclusion is not merely the physical presence of diverse students in the classroom, but rather their full participation and effective learning under equal conditions.

According to Echeita (2020), “inclusive education should not be confused with mere physical integration; it is about transforming school cultures, policies, and practices to respond to diversity” (p. 19). In this regard, UDL presents itself as a methodological framework consistent with the principles of inclusion, as it offers options and supports that benefit all students without the need to label or separate them.

Furthermore, Booth and Ainscow (2011) point out that:

“Truly inclusive school systems do not expect the student to adapt to the classroom; instead, they modify their structure and culture to ensure everyone’s participation. This involves rethinking what is taught, how it is taught, and how it is assessed” (p. 52).

From this perspective, UDL is not a supplement but an essential component of the contemporary inclusive school.

Student Participation and Academic Achievement in Diverse Contexts

Participation is one of the key indicators of inclusion. It does not merely refer to being physically present in the classroom, but rather to being actively engaged in the learning process, making decisions, collaborating with others, and feeling part of the school community (Ainscow, 2020). UDL supports this type of participation by allowing students to choose the means, forms, and pace of work that best suit their learning styles and individual needs.

Florian (2015) argues that "inclusive pedagogy requires designing opportunities for all students, not merely allowing some to access the general curriculum while others are segregated with parallel accommodations" (p. 16). This open and flexible design directly impacts academic performance by enabling more students to meaningfully access learning content.

Various studies have documented the impact of UDL on academic achievement. For instance, Schreffler et al. (2019), in a study involving university students in STEM programs, found that "the implementation of UDL improved not only content retention, but also students' intrinsic motivation and perceived self-efficacy" (p. 304).

In the Latin American context, González and Ruiz (2021) demonstrate that UDL has enabled teachers to plan more intentionally and in a way that is sensitive to diversity: "the progressive implementation of UDL in the classroom has led to visible improvements in the participation of students with visual, hearing, and learning disabilities" (p. 91).

Factors Influencing the Implementation of UDL

Although UDL offers multiple benefits, its implementation is not without challenges. Teacher training, planning time, access to technological resources, and institutional support are key factors in its success. As noted by Cabrera and Mendoza (2022), "one of the most common obstacles to implementing UDL is the perception that it requires more time and effort than usual, especially in contexts with limited technical support" (p. 47).

Therefore, it is essential to promote public policies and ongoing professional development programs that incorporate UDL not as an optional component, but as a cross-cutting axis of the curriculum.

Methodology

Research Approach

This study adopts a mixed-method sequential explanatory approach, which allows for the integration and complementarity of quantitative and qualitative results in order to comprehensively understand the impact of Universal Design for Learning (UDL) on inclusive education. According to Creswell and Plano Clark (2018), the mixed-method approach is particularly relevant when the goal is not only to identify statistical patterns but also to explore the perceptions and experiences underlying those patterns.

Methodological Design

A non-experimental correlational-descriptive design was employed in the quantitative phase, followed by an interpretive qualitative design in the exploratory phase. This approach allows for the identification of relationships between the main variables—student participation and academic achievement—and the implementation of UDL, as well as a deeper understanding of the phenomenon through the perspectives of educational stakeholders.

Participants

The sample consisted of 230 students from Basic General Education and High School levels, including students with and without special educational needs, and 18 teachers from three public educational institutions in Ecuador that have progressively incorporated the UDL approach into their pedagogical practices.

A purposive and convenience sampling method was applied, selecting institutions actively engaged in inclusion programs and equipped with pedagogical support teams.

Table 1. Description of Participants

Type of Participant	N	Educational Level	Remarks
Students	230	Basic Education and High School	20% with diagnosed Special Educational Needs
Teachers	18	All levels	Trained in UDL and inclusion

Data Collection Techniques and Instruments

Quantitative phase:

- A student participation scale adapted from Fielding et al. (2011) was applied. This scale had been previously validated in inclusive education contexts and evaluates three dimensions: engagement, interaction, and agency, through 5-point Likert-type items.
- To measure academic performance, standardized tests in reading comprehension and mathematical problem-solving were administered at two points: before and after the UDL-based intervention.
- The reliability of the participation instrument was verified using Cronbach's alpha coefficient, yielding a value of $\alpha = 0.91$.

Qualitative Phase:

- Semi-structured interviews were conducted with 10 teachers and 4 institutional coordinators. The questions focused on the implementation of UDL, encountered barriers, observed changes in student participation, and perceptions of learning.
- Structured non-participant classroom observations were also carried out using a category guide based on the core UDL principles: multiple means of representation, action and expression, and engagement.

Purpose: To enhance methodological transparency.

Example Table:

Table 3. Sample Items from the Student Participation Scale

Assessed Dimension	Example Item	Response Type
Participation – Engagement	I feel motivated to participate actively in class.	Likert Scale (1–5)
Participation – Interaction	I communicate with my classmates during activities.	Likert Scale (1–5)
Participation – Agency	I take part in decisions about how to learn.	Likert Scale (1–5)

Procedure

Data collection was carried out during the 2024–2025 academic year in two phases. First, quantitative instruments were administered to students and teachers. Then, based on the results, significant cases were selected for the qualitative phase. The study was approved by the ethics committees of the participating institutions, and informed consent was obtained from all participants, in accordance with principles of confidentiality and voluntary participation.

Data Analysis

Quantitative Phase

Statistical analysis was conducted using SPSS v.26. Descriptive statistics (means, standard deviations) and inferential tests (repeated measures ANOVA and Pearson correlation) were applied to assess significant differences in participation and academic achievement between students exposed to the UDL approach and those who were not.

Qualitative Phase

Interview and observation data were analyzed using NVivo 12 software, following a thematic coding process. Common patterns were identified regarding the impact of UDL, highlighting both strengths and

challenges in its implementation. Data triangulation and double inter-rater coding ensured the reliability of the analysis.

Results

Quantitative Results

Statistical analysis revealed significant differences in levels of participation and academic achievement between students exposed to pedagogical strategies based on Universal Design for Learning (UDL) and those in traditional settings.

Student Participation

The overall mean on the participation scale was significantly higher in classrooms implementing UDL ($M = 4.35$, $SD = 0.42$) compared to those using traditional approaches ($M = 3.41$, $SD = 0.61$). The ANOVA test showed statistically significant differences ($F = 11.76$, $p < 0.001$), indicating that UDL considerably increases student engagement.

Academic Achievement

In reading comprehension tests, students who learned under the UDL approach improved their scores by an average of 18.6%, while in mathematical problem-solving the improvement was 14.2%. Repeated measures analysis confirmed that these differences were statistically significant ($p < 0.01$) in both cases.

Suggested Chart (Figure 1):

Figure 1. Comparison of Student Participation and Academic Achievement by Learning Environment Type.

A significant difference is observed in favor of the UDL-based environment, both in terms of active participation levels and average student achievement.

Comparison of mean participation and performance scores before and after UDL implementation.

Table 4. Correlation Between UDL Implementation Frequency and Key Academic Variables

Variable 1	Variable 2	Correlation Coefficient (r)	p-value
Frequency of UDL Use	Student Participation	0.67	< 0.01
Frequency of UDL Use	Academic Achievement	0.59	< 0.01

Interpretation:

The table shows a strong positive correlation between the frequency of UDL strategy implementation and both student participation and academic achievement. These results reinforce the statistical significance of the impact of UDL in inclusive learning environments.

Qualitative Results

The interviews and classroom observations revealed common perceptions among teachers, coordinators, and students regarding the impact of UDL. Below is a summary of the most relevant emerging categories:

Accessibility and Content Comprehension

"By applying UDL principles, especially the use of multiple means of representation, students with cognitive or visual difficulties began to participate more and better understand the content." (Teacher E4)

Greater Autonomy and Self-Regulation

"Students are not just responding to tasks; they are making decisions about how they want to learn or demonstrate what they have learned." (Pedagogical Coordinator C2)

c) Classroom Climate and Group Cohesion

"I've noticed more collaboration among students, especially with those who were previously excluded or didn't participate. Now everyone feels they have something to contribute." (Teacher E7)

d) Implementation Challenges

"The biggest obstacle has been the planning time and the lack of initial training in UDL. However, the benefits have been evident." (Teacher E1)

Triangulation of Results

The comparison between quantitative and qualitative data reveals a clear convergence: the UDL approach promotes more inclusive, autonomous, and meaningful participation, while also improving academic performance across various subjects. The improvements observed quantitatively were interpreted and reinforced by the narratives of teachers, who reported changes in pedagogical dynamics and greater student engagement.

In addition, the impact of UDL was found to be more significant when it was aligned with:

- Inclusive pedagogical leadership.
- Intentional use of accessible ICT tools.
- Support from multidisciplinary teams.

Discussion

The findings of this study support the hypothesis that Universal Design for Learning (UDL) has a positive impact on student participation and academic achievement in inclusive environments. This empirical evidence reinforces the assertion made by the Center for Applied Special Technology (CAST), which states that UDL provides a pedagogical framework that "anticipates diversity from the outset of design" (CAST, 2018), rather than as a retroactive adaptation to perceived deficits.

Student Participation: From Presence to Engagement

The significant increase in active participation levels observed in classrooms that implemented UDL aligns with what Rose, Meyer, and Gordon (2014) referred to as the shift "from physical accessibility to access to meaningful participation." Students are not merely present—they are involved in decision-making processes, self-regulation, and the collective construction of knowledge.

This result is consistent with previous studies such as that of Echeita (2020), who stated: *"Educational inclusion cannot be reduced to allowing access; it involves creating conditions that ensure full participation and meaningful learning for all."* (p. 37)

In this regard, the UDL principle of "providing multiple means of engagement" was crucial in achieving equitable participation, particularly among students with cognitive disabilities or attention disorders.

Academic Achievement: Impact on Comprehension and Expression

The significant improvement in academic performance in reading and mathematics is linked to the application of UDL principles related to multiple means of representation and expression. By offering alternatives to conventional text (videos, pictograms, audio recordings) and allowing various ways to demonstrate knowledge (presentations, dramatizations, mind maps), the approach addressed different learning styles and paces.

Schreffler et al. (2019) found similar results among high school students, demonstrating that systematic implementation of UDL can enhance overall academic performance, particularly among populations facing learning barriers.

Additionally, teacher perceptions collected in this study suggest that UDL not only improves the performance of students with special educational needs but also raises the overall level of learning by enriching instruction for the entire class.

Mediating Factors and Structural Challenges

The impact of UDL was most evident in contexts where there was committed pedagogical leadership, use of accessible ICT tools, and support from assistance teams. These factors acted as enabling conditions for effective implementation.

However, structural challenges were also identified: lack of initial training in UDL, limited time for collaborative planning, and insufficient institutional support. These barriers have already been highlighted by authors such as Booth and Ainscow (2011), who argue:

"Inclusion does not depend solely on teacher goodwill, but on a school system that supports, trains, and legitimizes innovative and equitable practices." (p. 52)

In this regard, the need for a strong institutional policy that promotes UDL as part of the formal curriculum—and not merely as an isolated initiative—is evident.

Conclusions and Recommendations

Conclusions

The results obtained in this study allow us to conclude that the systematic implementation of Universal Design for Learning (UDL) has a positive and significant impact on both student participation and academic achievement in inclusive education contexts.

1. UDL promotes more active, autonomous, and equitable student participation by offering multiple means of engagement, representation, and expression. This reduces learning barriers and enhances students' sense of self-efficacy and belonging in the classroom.
2. Regarding academic performance, a significant improvement was observed in reading and mathematical skills among students engaged in environments designed according to UDL principles, reinforcing its potential as an effective instructional tool for addressing diversity.
3. Qualitative evidence supports the quantitative findings, showing that teachers perceive improvements in student engagement, peer collaboration, and content comprehension when UDL-based strategies are implemented.
4. Despite its benefits, the study reveals important challenges for sustained implementation, such as lack of specific training, limited collaborative planning, and the need for ongoing institutional support.

In summary, UDL should not be understood solely as a support strategy for students with special educational needs, but rather as a transformative pedagogical model that enhances learning quality for all.

Recommendations

Based on the study's findings and limitations, the following recommendations are proposed for various stakeholders in the educational system:

a) For Teachers:

- Engage in training on the UDL approach from a pedagogical—not merely technical—perspective.
- Design lesson plans that incorporate diverse options for motivating students, presenting content, and assessing learning.
- Promote inclusive and collaborative peer teaching practices.

b) For Educational Institutions:

- Integrate UDL into institutional plans and improvement projects (PEIs) as part of inclusive education policies.
- Create spaces for joint planning and provide pedagogical support for teachers.
- Equip classrooms with accessible and technological resources that facilitate UDL implementation.

c) For Educational Policymakers:

- Include UDL as a cross-cutting axis in initial and ongoing teacher training.
- Promote regulations that support curriculum flexibility based on equity and accessibility principles.
- Fund pilot projects and the documentation of best practices that demonstrate the impact of UDL in various contexts.

d) For Future Research:

- Conduct longitudinal studies that analyze the sustainability of UDL over time.
- Expand samples to include rural contexts and specific populations (Indigenous peoples, students with multiple disabilities).
- Compare the effectiveness of UDL with other inclusive pedagogical models.

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