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UNIVERSAL DESIGN IN LEARNING AND RESPONSE TO INTERVENTION: ESSENTIAL ELEMENTS IN INCLUSIVE EDUCATION

Abstract: Routines and processes in the classroom should be designed in a way that all students are able to have access and a level of success. In order to have effective inclusive education we need to build a scientifically valid framework for guiding educational practice that will provide flexibility in the presentation of information, flexibility in the engagement of students, reduction of barriers in instruction and provision of appropriate accommodations for all students, including students with learning disabilities.

The main focus of this qualitative research was determining the essential elements for such a framework. For this purpose, an extensive systematic review was conducted with which we summarized all empirical evidence that fitted the pre-determined criteria for eligibility.

One approach to designing inclusive instruction is the utilization of the principles of Universal Design for Learning (UDL). UDL is characterized by three major principles: multiple means of representation, multiple means of expression, and multiple means of engagement. This approach to teaching and learning allows individuals to draw upon and utilize their particular learning strengths, while acknowledging that not all students learn in the same manner.

Another essential element is Response to Intervention (RTI). This is a systematic decision-making process designed to allow for early and effective responses to children's learning and behavioral difficulties, provide children with a level of instructional intensity matched to their level of need, and then provide a data-based method for evaluating the effectiveness of instructional approaches.

Keywords: Universal Design in Learning, Response to Intervention, Inclusive education

Introduction

As the core principles of inclusive education consider taking into account all the different needs of students and diversity in learning, as well as quality education through appropriate teaching (Odarich, Sofronov, Shickiyakh, 2021) the Universal Design in Learning and Response to Intervention can be used as approaches to enhance the inclusion process of all children.

Universal Design in Learning (UDL) is a framework to improve and optimize teaching and learning for all people based on scientific insights into how humans learn (CAST, n.d.). This approach to education strives to remove discriminatory practices, as the learning needs of most students are taken into account (Dalton et al. 2019). According to Meyer, Rose and, Gordon (2014, as cited in Garcia-Capmos, Canabal & Alba-Pastor, 2018), the UDL approach promotes attractive and flexible teaching environments that proactively start at the acknowledgment of student diversity and highlights the need to maximize learning opportunities for all students.

The origins of UDL stem from the earlier concept of Universal Design (UD) that emerged in the field of architecture in the 1980s (Fovet, 2021; Hamraie, 2017) when it became a concept for including all people in the design process. UD quickly became revolutionary and its impact spread beyond architecture. That is how it found its place in education as well.

The UDL is based on three main principles developed by the Center for Applied Special Technology (CAST, n.d.): multiple means of engagement, multiple means of representation, and

multiple means of action and expression. The three principles are then broken down into 9 guidelines, and the guidelines into checkpoints. A simplified table of the principles and guidelines of the UDL design is presented below.

Picture 1
UDL principles and guidelines (Baumann & Melle, 2019)

Principles		Provide multiple means of engagement	Provide multiple means of representation	Provide multiple means of action & expression
Guidelines	Access	1. Recruiting interest	4. Perception	7. Physical action
	Build	2. Sustaining effort and persistence	5. Language & symbols	8. Expression & communication
	Internalize	3. Self-regulation	6. Comprehension	9. Executive functions
Goals		**Purposeful & motivated**	**Resourceful & knowledgeable**	**Strategic & goal directed**

The principles of UDL are in the same scope of inclusive education that allows for a time frame that accommodates human differences (Florian & Black-Hawkins, 2011).

Response to Intervention (RTI) is a relatively new term for a very commonsensical approach to understanding and addressing students' school difficulties, which consists of two main features: response – the act of responding; and intervention – the act of intervening. The term *intervention* can also be changed with the term *instruction* (Brown-Chidsey & Steege, 2010). It is a multi-tier approach of early identification and support of students with learning and behavior needs (RTI action network, n.d.). According to Sailor (2009) RTI is best understood as a model used to guide efforts to teach (intervention) based on measures of student progress (response) and grounded in the idea of prevention. The same author (Sailor, 2009) describes the key features of the approach to be the following:
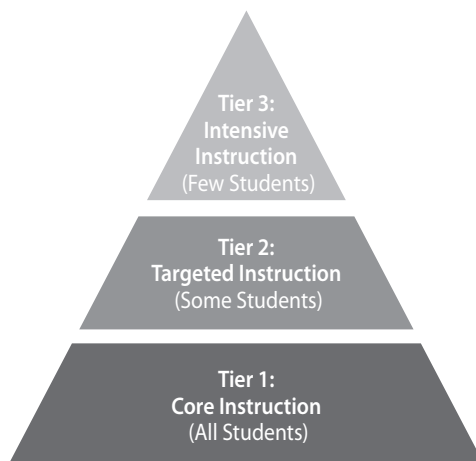
- A three-tier system of matching interventions to assessed student academic and behavioral needs;
- Systematic screening of young children using scientifically acceptable measuring instruments;
- Interventions that have solid grounding in research and for which there is scientific evidence that they improve behavior or academic achievement, or both;
- Progress monitoring of students identified as being at risk for low academic achievement, again using scientific measures;
- Decision rules concerning levels of support provided through intervention.

The RTI approach begins with a screening of all children for academic and behavior problems, then the progress of those at risk for difficulties in these areas is monitored and in the end, intense intervention is implemented based on the progress monitoring assessment (Vaughn &

Fuchs, 2003 as cited in Fletcher & Vaughn, 2009). In the following picture can be seen the purpose of each tier of the RTI approach.

Picture 2
RTI pyramid model (Listenwise, 2021)

Tier 3:
Intensive
Instruction
(Few Students)

Tier 2:
Targeted Instruction
(Some Students)

Tier 1:
Core Instruction
(All Students)

Method

The main research goal of this paper was to determine the effects of UDL and RTI usage in the inclusive classroom. Due to the fact that none of these approaches are used in the classrooms in our country, in order to see the effects for future implementation, we conducted a systematic review. A systematic review collects secondary data and is a synthesis of all available, relevant evidence that brings together all existing primary studies for review (Cochrane, 2016 as cited in Phillips & Barker, 2021). With this qualitative approach, we wanted to gain information on what has already been done in the field, and what are the experiences so far.

To form the sample, a thorough search of two databases was conducted: Google Scholar and Wiley Online Library. Because there is no empirical research that examines the effects of both UDL and RTI approaches at the same time, the search words that we used were divided in two parts: *UDL and inclusive education* (first part), and *RTI and inclusive education* (second part).

Giving that the main difference between the narrative and systematic review is that the second one starts with the development of a protocol detailing the plan of the review (Misra & Agarwal, 2018), eligibility criteria were set for our study in order to determine the inclusion or exclusion of the research found by the search keywords. The 4 eligibility criteria we set were:
- The study to represent an empirical research;
- To be published in a scientific journal;
- Not to be older than 2013;
- To be published in English.

First, the abstracts of the studies were analyzed if they met all the above criteria. Then, the analysis moved towards the content of the whole studies that were selected. The studies were analyzed through the following research questions:
- RQ1 – What are the effects of UDL and RTI on the academic performance of students with disabilities?
- RQ2 – How are the principles of UDL met in the inclusive classroom?
- RQ3 – At what level of education are the approaches mostly used?

After checking the fulfillment of the criteria, it was concluded that 15 studies were eligible to create the research sample.

Results and Discussion

As mentioned before, in this systematic review 15 empirical studies regarding the use of UDL and RTI in the classroom were analyzed. The number of studies about the use of UDL is higher, 9 in total, and the rest 6 are empirical studies for the RTI approach. In table no. 1 are presented the data regarding the methodological framework of the sample studies.

Table 1
Methodological framework of sample studies

Methodology	UDL	RTI
Quantitative	3	5
Qualitative	4	1
Mixed method	2	/
Total	9	6

What is evident from the table is the number of studies that use the qualitative approach for the examination of the UDL approach (4 in total). The situation with the RTI approach studies is the exact opposite. We cannot say that these results are unexpected. The research of the UDL application requires a systematic approach that usually takes longer in order for the effects to be seen. Also, the focus on flexibility, proactive, and iterative design inherent to UDL makes it difficult to consistently measure (Basham, Gardner, & Smith, 2020). Another thing is that both practitioners and researchers operationalize UDL in a variety of ways and most of the time, only a snapshot of the observed learning environment is observed (Bryk et al., 2015; Lewis, 2015). All of these reasons make it clearer why researchers find the qualitative approach to be more suitable when the effects of UDL in the classroom need to be analyzed and why most of the qualitative research designs were presented as case studies.

On the other hand, the effects of the RTI approach are simpler to be analyzed because the outcomes are easily measured. In its nature, the RTI models tend to measure growth in achievement over time in response to effective instruction or intervention (Schatschneider, Wagner, Crawford, 2008). In this case, researchers considered the quantitative methods to be used in their studies (5 out of 6).

Regarding the first research question (RQ1), the sample studies indicate positive effects on the academic performance of students when UDL or RTI approaches were implemented. Katz (2013) shows a statistically significant difference in students' academic engagement. Since this is quantitative research modeled as a quasi-experiment, the author states that the students from the classes where the UDL approach was implemented were significantly more active (socially and academically) than their peers from the other classes.

The results of Almumen (2020) are compatible with the previous results of Katz. In this study, UDL seemed to be effective in engaging all students, including those with disabilities. Besides the improvement of engagement in the learning process, students' showed greater expression of their learning. Significant positive outcomes in the motivation to learn and demonstration of understanding of learned concepts (science concepts) are noted in the study of Yu et al. (2021). The main positive UDL outcomes from the sample research are presented in table no.2.

Table 2
Main UDL outcomes

Authors	Title	Outcomes of UDL
Katz (2013)	The Three Block Model of Universal Design for Learning (UDL): Engaging students in inclusive education	Better social and academic engagement
Almumen (2020)	Universal Design for Learning (UDL) Across Cultures: The Application of UDL in Kuwaiti Inclusive Classrooms	Increased engagement and expression of learning.
Yu et al. (2021)	Findings From a Two-Year Effectiveness Trial of the Science Notebook in a Universal Design for Learning Environment	Significant positive outcomes in tstudents' motivation to learn.
Baumann & Melle (2019)	*Evaluation of a digital UDL-based learning environment in inclusive chemistry education. Chemistry Teacher International*	Using a specifically designed software students with and without special educational needs learn in an individualized and differentiated way on a common learning object.
Kumar & Wideman (2014)	Accessible by design: Applying UDL principles in a first year undergraduate course	Students found the design of the course, based on UDL principles, to be highly effective in their ability to access materials.
Dean, Lee-Post & Hapke (2016)	Universal Design for Learning in Teaching Large Lecture Classes	UDL environment has significant impact on perceived and actual learning
Black, Weinberg, Brodwin (2015)	Universal Design for Learning and Instruction: Perspectives of Students with Disabilities in Higher Education	When professors used approaches followed by the UDL principles, students expressed these were conducive to their learning, since it allowed them to succeed in higher education.
Hansen et al., (2021)	Making Computer Science Accessible	UDL framework for differentiation opportunities that were necessary for the diverse students studying computer science in elementary school.
Hall et al., (2015)	Addressing Learning Disabilities With UDL and Technology: Strategic Reader	Students using the online tool experience significant growth in comprehension scores.

When it comes to the RTI approach, the sample research indicates positive outcomes as well. The longitudinal study of O'Connor et al., (2013) analyzed the results of the students who participated in tier 2 intervention in a Response to Intervention model focused on reading across Grades 1–4. In the end, one-third of the students who were identified for special services due to

learning disabilities were not identified until the 4th grade. In similar context are the conclusions of the study made by Coyne et al. (2018). Tier 2 intervention implemented within a response to intervention can impact key reading outcomes when intervention significantly increases instructional intensity.

Table 3
Main RTI Outcomes

Authors	Title	Outcomes of RTI
O'Connor et al., (2013)	Special Education in a 4-Year Response to Intervention (RtI) Environment: Characteristics of Students with Learning Disability and Grade of Identification	Improvements in reading, one-third of those identified were not identified until grade 4.
Coyne et al. (2018)	Evaluating the Effects of Supplemental Reading Intervention within an MTSS or RTI Reading Reform Initiative Using a Regression Discontinuity Design	Tier 2 intervention impacts key reading outcomes.
Grapin, Waldron & Joyce-Beaulieu (2019)	Longitudinal effects of RtI implementation on reading achievement outcomes	Students' long-term reading comprehension outcomes were measured. Students who experienced the early phases of RtI implementation during Grade 2 generally had higher mean comprehension scores in Grades 4 and 5
Sharp et al. (2016)	The Relationship Between RTI Implementation and Reading Achievement: A School-Level Analysis	Tier 3 implementation integrity significantly predicted student reading outcomes when controlling for significant demographic predictors
Noltemeyer, Boone & Sansosti (2014)	Assessing School-Level RTI Implementation for Reading: Development and Piloting of the RTIS-R	Not direct outcomes, but stresses the importance of instruments for implementation adherence, once the RTI model is applied in school.
Fisher & Frey (2013)	Implementing RTI in a High School: A Case Study	Students benefited from the instruction they received and, along the way, ensured that special education eligibility decisions were considered only after a student had access to quality instruction and a range of interventions

In the second research question, about the ways UDL principles are met in the inclusive classroom, the sample studies show a variety, and on another hand, creativity in meeting the three

main UDL principles. The principle of engagement is mostly accomplished through group discussions on a particular topic, and sometimes, depending on the age of the students, role play is used. Of course, in order to make students more engaged in the process of learning, teachers tend to use as many didactic materials as possible (pictures, real objects, and etc.). Including students in different activities for the same topic is another way the authors mentioned about actively engaging students in learning.

The second UDL principle, representation of learning content, according to the sample studies is mostly met through the use of multiple formats for material presentation. This includes videos, audio materials, pdf documents, presentations, and of course, printed materials. This was stated to be very useful when students receive the materials before class, especially when it comes to large lectures.

Often, in order to implement multiple means of representation in the process of teaching, technology is used. Specially created computer soft wares, or learning management system platforms (LMS) are mentioned in the analyzed studies for this review many times. Students there could find the formats that fit their needs best, including students with disabilities.

About the expression of students' knowledge (third UDL principle), students are most often given a possibility to choose how to answer an exam question: to give a description, draw a chart or perform a demonstration. Another possibility is multiple deadlines for task completion to be set. Students can choose the deadline.

What is noticeable when analyzing the studies chosen for the review is the level of education where the two approaches, UDL and RTI, were used in an inclusive setting (RQ no.3 and table no.4). Teachers were able to implement the principles of UDL through the whole education span. Elementary classes can be easily adjusted to fit diverse learners, but also the classes for much older students in higher education. Of course, there are age-appropriate adjustments, but UDL principles can be incorporated into every level of education.

Since one of the core terms the RTI consists of is *intervention*, it is understandable that at-risk students should be identified as soon as possible so that an intervention could take place. Both identification and intervention should take place early in the education process of the student and that is why almost every study analyzed in this review is measuring the effects of the RTI approach in elementary classes (5 out of 6). That is the key difference between the two approaches, the RTI is most effective early in schooling, and the effects of properly organized UDL can be noticed in any inclusive classroom, no matter the education level.

Table 4
Leve of education

Level of education	UDL	RTI
Elementary	5	5
Secondary	3	1
Higher	3	/
Total	11	6

According to the review of the sample studies, it is evident that the UDL approach has a wider use throughout education subjects and areas. UDL principles were used for chemistry teaching, science, computer science, marketing, biology, society, health sciences, and reading. On the other hand, the studies found for this review were conducted only in the field of reading, like most of the early research about RTI that focused on reading improvement (Brown-Chidsey & Steege, 2010). Besides learning, the RTI is supposed to support students with behavioral needs as well, but no such empirical research was found in accordance with the eligibility criteria.

Conclusion

The positive effects of both UDL and RTI approach in inclusive classrooms are apparent, seen through the analysis of previous research in the systematic review. There is a possibility the two approaches to be simultaneously implemented in order to gain the best effects, but it certainly requires a wide set of skills of teachers and organization of the school environment in general.

Regarding the UDL, it might look like it is a time-consuming approach for the teachers who need to do all the adaptations for the 3 principles to be met. But, because the time for additional task explanations for the students is decreased due to the previously prepared materials, the teachers actually gain some time back.

If the RTI approach is to be implemented in schools, standards in the field of learning and behavior need to be set so appropriate screening can be performed and the at-risk children to be identified. If implemented properly, both UDL and RTI can contribute to inclusive education that takes into account all the diversities learners might have.

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