UNIVERSAL DESIGN FOR E-LEARNING: AN EXPERIENCE IN THE MANUELA BELTRAN UNIVERSITY TO SUPPORT A LEARNER WITH ADHD

DISEÑO UNIVERSAL PARA EL E-LEARNING: UNA EXPERIENCIA EN LA UNIVERSIDAD MANUELA BELTRAN PARA APOYAR A UN APRENDIZADO CON ADHD

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ABSTRACT.

Colombian government through the 1816 law from 2013, and attending the calls from UNESCO of promoting education for all, established rules to ensure the full exercise of the rights of people with educational needs in diversity. This paper presents the application of the Universal Design for Learning (UDL) guidelines to support an e-learning course of the Manuela Beltrán University with one student with ADHD symptoms. Results show a positive impact in the perception and learning outcomes of the student.

KEYBOARDS ADHD, education, e-learning, inclusion, UDL.

RESUMEN.

Colombia a través de la ley de 1816 a partir de 2013 y atendiendo a los llamamientos de la UNESCO para promover la educación para todos, estableció reglas para asegurar el pleno ejercicio de los derechos de las personas con necesidades educativas en la diversidad. Este artículo presenta la aplicación de las pautas del Diseño Universal para el Aprendizaje (UDL) para apoyar un curso de e-learning de la Universidad Manuela Beltrán con un alumno con síntomas de TDAH. Los resultados muestran un impacto positivo en la percepción y los resultados de aprendizaje del estudiante.

PALABRAS CLAVES: ADHD, education, e-learning, inclusion, UDL.

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1. INTRODUCTION

Individuals differ from one to another for many reasons: social, cultural, geographic, economic, ethnic, religious, sexual, intellectual, motor or sensory. Throughout history, although there is some equity in the strict sense of entitlement, in the educational context, this diversity has led to exclusion. However, it is important to stand out the several efforts promoted throughout the world for an inclusive education as the education for all policy framework geared by the UNESCO Salamanca Statement (UNESCO, 1994) which stipulates that education is a right for everyone. The challenge posed by greater diversity is to enable students with divergent needs, skills, and interests to attain the same high academic standard; it means to transform diversity in an enriching element for people and their education.

E-Learning has become an essential tool for the teaching of a large numbers of diverse students. This is because e-Learning enables to provide and integrate a wide range of teaching resources and materials (e.g. using video, audio, text, expressions), that can be adapted to suit a variety of learning needs and preferences. Nevertheless, the didactic and strategy used in this context, need to be carefully designed in order to achieve good results in the learning process more specifically when a student has a specific need.

Based on the above mentioned, the objective of this paper is show an experience done in the Virtual Unit of the Manuela Beltrán University in the context of inclusive education. Specially, this experience uses the guidelines of the Universal Design for Learning (UDL) (Meyer, A, Rose, D & Gordon, D. 2014), a framework that support the challenge to attend diversity in the classroom through the advances on neuroscience on individual learning differences and the power and versatility of technological tools.

The remainder of the paper is structure as follows: in section 2 the theoretical foundations relevant for this study are outlined, these are: inclusive education, the UDL framework and ADHD disorder; in section 3 the UDL templates are applied; and finally in section 4 the paper is concluded.

2. THEOTERICAL FUNDATIONS

2.1. Inclusive Education

Historically, the term inclusion born from the field of special education and disabilities where people with disabilities condition were considered abnormal human beings (Mkonongwa, 2014). However, from the mid-18th century, some instructors began to question the educational system because it denied access to people with disabilities and in the 20th century emerged special schools to provide education for children and young people who were excluded from education. Based on such background, inclusion began as an approach that focused primarily on people with disabilities and learning difficulties. However, today, the concept of inclusion in education takes a wider perspective considered not only as a need but also as a right of every individual towards the realization of her full life potentials. A long the way toward this concept, education have pass through different movements, Figure 1 and Table 1 summarize them.

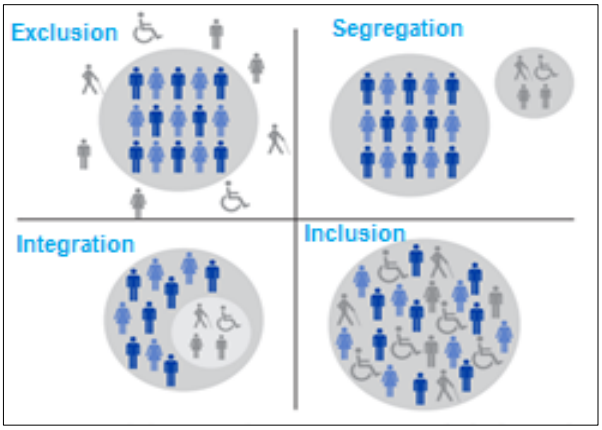

Figure 1. Different movements towards the inclusion concept.

Table 1. Description of the different movement towards inclusion

Exclusion	Segregation	Integration	Inclusion

People with disability were considered abnormal human beings.	Medical model: only specialist can teach to students with disabilities. Specialized places. Students with disabilities are marginalize and excluded. Students with special needs are required to be educated separated	People are defined only by their special educational needs. Disabled students need to be adapted to the rest of the community, to the existing education and school system. Students with disabilities still have the expertise and individualized attention in regular classrooms. The role of the teachers and support staff is to ensure that a child fits in the existing school structure regardless of his/her condition.	Diversity is a great educative value. Embrace those who are at risk of marginalizatio n or exclusion for whatever reason. It is not just the placement of students with disabilities into regular classrooms. An inclusive classroom allows students to experience and accept the differences and commonalities that make up our diverse society. Focuses on transforming education systems and schools so that they can cater to diverse students' learning needs.

Based on the information of table 1, in this paper we assume the position that inclusion is no only refers to people with disabilities but it is about support diversity. As the UNESCO (2005) stated "inclusive education is a process intended to respond to students' diversity by increasing their participation and reducing exclusion within and from education".

However, the response to diverse needs of students to achieve high quality education involves substantive change in the existing notions, attitudes, curricular, pedagogical practices, teacher training, assessment, and evaluation systems. It is a long-term, costly process. Nevertheless, it is important awareness that personal contributions represent a significate progress in achieving an inclusive education system. This implies the development of a universal education design in which the teaching and learning process and the curriculum consider the diversity of students' needs.

2.2. Universal Design for Learning (UDL)

UDL is a framework that stated the challenge posed by diversity in the classroom can be supported through the advances on neuroscience on individual learning differences and the power and versatility of t echnological tools (Rose, D & Meyer, A, 2002). According to (Rose, D & Meyer, A, 2002, p. 8) "the task for educators is to understand how students learn and use technology available in this digital age to provide selected supports where they are needed and position the challenge appropriately for each learner".

The basis on brain research in which UDL support their framework is that there are three networks of the brain which have been identified to be essential to learning: 1) recognition (The "what" of learning), 2) strategic (The "how" of learning), and 3) affective (The "why" of learning). The recognition network enables the identification and understanding of information, ideas and concepts. The strategic network allows planning, executing and monitoring actions and skills. And the affective network enables the engagement with task, learning and the world around. According to Rose and Meyer, although these three neural networks work together to coordinate le arning any task, individual brains differ substantially in the way they perceive and comprehend information, the way they can navigate a learning environment and express what they know and the influence sources that affect individuals to learning.

Consequently, the UDL framework consist of three principles: 1) to provide multiple means of representation; 2) to provide multiple means of action and expression; and 3) to provide multiple means of engagement which means to stimulate interest and motivation for learning, to support affective learning (Meyer, A., Rose, D. H., & Gordon, D., 2014).

In conclusion, the UDL principles suggest that to accommodate a broad spectrum of learners, universally designed curricula require a range of options for accessing, using, and engaging with learning materials and states that new digital media and assistive technology offer the opportunity to do it considering their qualities, versatility and

transformability (Rose, D & Meyer A, 2002). In this context, curriculum is referred to the set of core competencies, objectives, contents, methodology and evaluation criteria that students must achieve in a certain level of education.

In order to help and guide teachers in this process of curriculum design, the UDL framework suggests four templates:

1) The class learning profile template (table 2) which helps teachers to identify learners 'strengths, weakness, and preferences:

Table2. The class learning profile template

Grade: **Teacher:** **Subject:** **Goal:** **Date:**			
Network	Students Strengths	Students Weaknesses	Student Preferences/ Interests
Recognition			
Strategy			
Affect			

The idea is to highlight the particular student talents, weaknesses, or interests that could facilitate or hinder the effectiveness of the teaching process written the names of the students whose particular qualities may affect their ability to make use of the curriculum as originally planned.

2) The curriculum barriers template (table 3) which helps teachers to identify the potential barriers inherent in the planned curriculum materials and methods:

Table 3. The curriculum barriers template

Grade: **Teacher:** **Subject:** **Goal:** **Date:**		
Materials and Methods	Students Qualities	Potential Barriers/Missed Opportunities

In the left column must be listed each method or material that could be used in the teaching process and this is aligned with the student qualities defined in the class learning profile. Thus, this template permits to highlights barriers created by the interaction between materials, methods, and student weaknesses and points out missed opportunities created in the intersection between materials, methods, and student strengths or interests.

3) The UDL solutions template (table 4) which helps teachers to consider the previously barriers identify and in this way select, assemble or create flexible learning materials and methods including tools, digital content and Web-based materials to minimize barriers for students:

TABLE IV
THE UDL SOLUTIONS TEMPLATE

Materials and Methods	Potential Barriers/Missed Opportunities	UDL solutions

4) The creating systemic change template (table 5) which helps teachers apply the relevant parts of the concord model to the school o district to build new instructional approaches for reaching every learner (Rose et al, 2002).

Table 4. The creating systemic change template

Concord Model Component	Implementation Examples
1. Technology infrastructure 2. Administrative support	

This work is centered on young adults with Attention Deficit Hyperactivity Disorder (ADHD) who are included in e-learning processes. Specifically, the aim of this study is to improve the curricula design so that to address weakness but also strengths and preferences of students with ADHD by implementing the UDL guides. Next section outlined the ADHD disorder.

2.3. Attention Deficit Hyperactivity Disorder (ADHD)

According to the National Institute of Mental Health (NIMH), ADHD is a neuro-biologically and neuro-psychologically heterogeneous disorder most common in children and adolescents, with a persistence of about 50% into adulthood. The condition entails impairment of executive functions of the brain, influencing an individual's ability to manage and organize her/his thought processes.

Individuals diagnosed with ADHD typically exhibit long-term and pervasive: 1) distractibility (low degree of sustained focus) and 2) impulsivity (poor control over impulses and low tolerance for delayed gratification). Two-thirds of those diagnosed with ADHD also demonstrate 3) hyperactivity (high degree of restlessness or continuous activity).

Based on ADHD characteristics, several studies have demonstrated that individuals with this disorder have difficulties and let-downs, such as school and job failures

(Biederman, 2005), and several studies have reported that most students with deficits such as those that compose the ADHD, who take online courses, drop them in few days because they find the courses hard to follow (Grabinger, 2009).

Common symptoms of ADHD young adults, grouped into categories and their implication in academy performance are described in table 6.

Table 5. ADHD common symptoms

CATEGORIES	DESCRIPTION AND EDUCATIONAL IMPLICATIONS
Trouble concentrating and staying focus	It difficulty listening in class; spaces out and misses lecture content or homework assignments; lack of attention to detail, makes careless mistakes in work, doesn't notice errors in grammar, punctuation, capitalization, spelling, or changes in signs (+,-) in math; difficulty staying on task and finishing school work; distractible, moves from one uncompleted task to another; lack of awareness of time and grades, may not know if passing or failing class.
Hyperfocus	A tendency to become absorbed in tasks that are stimulating and rewarding. Hyperfocus on a certain subject can cause sidetracking away from assigned or important tasks.
Disorganization and forgetfulness	Poor organizational skills; trouble starting and finishing projects (difficulty getting started on tasks); frequently forgetting appointments, commitments, and deadlines; constantly losing or misplacing things (homework, keys, wallet, phone, documents, bills); difficulty knowing what steps should be taken first; difficulty organizing thoughts, sequencing ideas, writing essays, and planning ahead.
Impulsivity	Frequently interrupt others or talk over them; have poor self-control; blurt out thoughts that are rude or inappropriate without thinking; have addictive tendencies; act recklessly or spontaneously without regard for consequences; have trouble behaving in socially appropriate ways (such as sitting still during a long meeting). Rushes through work; does not double check work; doesn't read directions; takes short cuts in written work especially math (does it in his head); difficulty delaying gratification, hates waiting.
Emotional difficulties	Sense of underachievement; doesn't deal well with frustration; easily flustered and stressed out; irritability or mood swings; trouble staying motivated; hypersensitivity to criticism; short, often explosive, temper; low self-esteem and sense of insecurity. Those with ADHD find it difficult to activate or arouse themselves to initiate work that must be done, often complain of being unable to stay alert or even awake in boring situations, and frequently seem to be daydreamy or "in a fog" when they shoud be more alert, focused, and actively engaged in a task.
Hyperactivity or restlessness	Feelings of inner restlessness, agitation; tendency to take risks; getting bored easily; racing thoughts; trouble sitting still; constant fidgeting; craving for excitement; talking excessively; doing a million things at once. They display excessive movement not required to complete a task.

3. UDL For An Inclusive Classroom Supporting E-Learning Learners With Adhd: An Experience In The Virtual Unit Of The Manuela Beltran University

Based on Table 6, our interest is to offer a solution to the students from the Manuela Beltran University diagnosed with ADHD who has shown some low academic outcomes in their e-Learning processes. Specifically, we proposed to redesign the curriculum of a curse in which a student with ADHD was involved. All of this with the clear intention of analyzing how it might influence the student´ learning process. This redesign consists in apply three of the four UDL framework templates: 1) the class learning profile template, 2) the curriculum barriers template and 3) the UDL solutions template, in order to identify if we can make changes in the course methodology that allows us to assist the student to perform better.

3.1. Sample

The study was carried with four students of the course Research Methodology I, one of the curse of the e-learning administration program of the Manuela Beltran University. The group of students who composed the curse included a young adult student with ADHD (student 1), who had previously been diagnosed and whose consent was obtained to conduct the research, and three students without this disorder (student 2, student 3 and student 4).

3.2. Study procedure

3.2.1. *The class learning profile template*

First, the class learning profile template indicated in table 2, was filled with the help of the students themselves once the curse was opened. A synchronous meeting was held with each student to guide him or her during the process. This task was proposed through a forum as the first activity of the curse and took three days to be completed. The student with ADHD was more unconfident about his strengths and weaknesses so that we assist him with a general template we completed according to usual strengths, weakness and preferences of people with ADHD in terms of learning processes. The resulted class learning profile of the curse is presented in Table 7.

Table 6. The Research Methodology I class learning profile

GRADE: FIRST SEMESTER OF SPECIALIZATION SUBJECT: RESEARCH METHODOLOGY I			
Network	Student Strengths	Students Weaknesses	Students Preferences/ Interests
Recognition (Learning "what")	**Student 4**: Excellent observer, extensive vocabulary.		
Strategy (Learning "how")	**Student 1**: Good at oral presentations. **Student 2**: Talented at drawing.	**Student 1**: Loses focus, distracted; Organizational problems; struggle with writing assignments. **Student 2**: Poor writing mechanics.	
Affect (Learning "why")	**Student 1:** Good use of constructive feedback. Attraction of novelty. **Student 3:** Collaboration skills.	**Student 1:** Moves from one uncompleted task to another.	**Student 1:** Loves videogames, collaborative work. **Student 2:** Like listening to music, works with graphics. **Student 3:** Likes computers: play guitar. **Student 4:** Likes reading and writing.

3.2.2. The curriculum barriers template

As soon as we collected information about the class learning profile, the curriculum barriers template exposed in table 3 was filled according to the material and methods currently used in the Research Methodology I course (table 8).

Table 7. The Research Methodology I curriculum barriers template

MATERIALS AND METHODS		STUDENTS QUALITIES	POTENTIAL BARRIERS/MISSED OPPORTUNITIES
Video presentation explaining briefly the curse, how is the classroom organized and presenting the activities the students have to do in order to approve the curse (include value of each activity). Finally, the teacher recommends looking at the schedule of the curse. The video takes 20 minutes.		Student 1: Loses focus, distracted.	Distracted from listening; may have trouble keeping track of what he is going to learn. According to the statics tool of the Manuela Beltrán University e-learning platform (Virtualnet), the student 1 have watched the video three times and the other students once.
MODULE 1	Digital content in PDF (40 pages) and multimedia.	Student 1: Loves videogames. Student 2: Likes listening to music.	This kind of content does not tap into these interest and skill.
	Independent reading.	Student 1: Loses focus, distracted.	Difficulty working alone. May take more time than necessary to check and read the material. May not be able to abstract the important contents.
	Assessment activity 1: Writing report.	Student 1: Struggles with writing assignments, Organizational problems. Student 2: Talented at drawing, Poor writing mechanics.	Difficulty expressing her ideas effectively. Does not tap into Student´s 2 drawing skill. Difficulty organizing her ideas effectively.
MODULE 2	Digital content in PDF and multimedia.	Student 1: Loves videogames Student 2: Likes listening to music	This kind of content does not tap into these interest and skill.
	Independent reading 2	Student 1: Loses focus, distracted.	Difficulty working alone. May take more time than necessary to check and read the material. May not be able to abstract the important contents.
	Assessment activity 2: Oral video report posted in a forum.	Student 2: Talented at drawing.	This kind of content does not tap into this interest and skill.
	Digital content in PDF and multimedia.	Student 1: Loves videogames Student 2: Likes listening to music	This kind of content does not tap into these interest and skill.
	Independent reading 3	Student 1: Loses focus, distracted	Difficulty working alone. May take more time than necessary to check and read the material. May not be able to abstract

MODULE 3			the important contents.
	Assessment activity 3: Independent project.	Student 1: Loses focus, distracted, Organizational problems. Student 3: Collaboration skills.	Could have difficulty working alone. May have trouble keeping track of what he is learning and doing. Context won´t draw on his leadership and collaboration skills.

3.2.3. The UDL solutions template

Finally, we present solutions to the potential barriers identified in the curse through the UDL solutions template (table 8)

Table 8. The Research Methodology I UDL solutions templat

Materials and Methods		**Potential Barriers/Missed Opportunities**	**UDL solutions**
20-minutes video presentation		Distracted from listening; may have trouble keeping track of what he is going to learn.	Provide an abstract with the key points of the video in a sheet and suggest students to download and paste it in a visible place (Include the schedule). Related to the schedule, the teacher should send a notification at least a week ago before the expired of each activity.
Module 1	Digital content in PDF and multimedia.	Long texts does not tap into these interests and skills.	Divide the content into shorter readings into segments of 10-15 minutes. Improve the multimedia navigation avoiding the number of click the student have to press. Include the possibility of active Background music. Integrate the aTenDerAH videogame (Mancera, Baldiris & Fabregat, 2014) as a tool into the e-learning platform.
	Independent reading	Difficulty working alone. May take more time than necessary to check and read the material. May not be able to abstract the important contents.	Recommend the time for each reading. Propose question to solve during reading. Suggest having the study environment clean, organized and avoid distracters.
	Assessment activity 1: Writing report	Difficulty expressing her ideas effectively, Does not tap into Student´s 2 drawing skill	Suggest recording student´s speech about the report on a digital recorder in order they listen and write what they said. And assist them to edit, comprehend and organize it. Recommend students with drawing skill include a graphic of their report. Recommend names of graphics computer programs.
Module 2 Assessment activity 2: Oral video report posted in a forum		Student2: Talented at drawing	For Digital content in PDF and multimedia and Independent reading of module 2 the same solution of module 1 is proposed. Recommend student2 to use “movie maker” to present an animated video recording only his Voice and drawings made by him.
Module 3 Assessment activity 3: Independent project		Could have difficulty working alone. May have trouble keeping track of what he is learning and doing. Context won´t draw on his leadership and collaboration skills.	For Digital content in PDF and multimedia and Independent reading of module 2 the same solution of module 1 is proposed. Support student 1 in the selection of their research idea and check frequently the student 1´s progress by email or chat. Encourage student 3 to support other students during the process through a forum. Create a forum in which student 3 could provide support.

In summary, the setting solutions coupled were:

- The abstract with the key points of the video in a sheet and suggest students to download and paste it in a visible place (Include the schedule).
- In module 2 and 3, the digital content in PDF was divided into shorter readings in segments of 10-15 minutes.
- In module 2 and 3 recommendation about the time, study environment and questions to solve during reading were added at the beginning of the content (Readings).
- For the assessment activity 1, we recommended to use the voice recorder tool of windows or use the online voice recorder https://online-voice-recorder.com/es/.
- For the assessment activity 3, the support forum was created. An email was send to student 3 to encourage him to support their classmates.
- We implement the strategy of use the Newsletter tool in order to remember the date of each activity.

3.3. Evaluation

3.3.1. Instrument

In order to evaluate qualitatively the effectiveness of the solutions implemented, a short interview via Skype was conducted. The interview consisted of 10 questions, the first five related to general aspects of the course: 1) Easy to follow, 2) Difference between this and other courses, 3) Appropriateness in the activities description, 4) Utility of the learning resources used and, 5) Appropriateness of the assessment activities. The last five questions inspected on the specific contribution of the proposed solutions: 6) Contributions of integrating a summary of the key aspects of the video presentation, 7) Contributions from shorter readings, 8) Contributions of the recommendations made about the time and space used in each activity, 9) Contributions on the support given or received by the student in the activity 3, and 10) Contributions of the information constantly published in the newsletter tool about the delivery dates for each activity. In the following section, the results of the interview are listed.

3.3.2. Results

The assessments made by the students about the curse were generally positive, agreeing that perceived it, unlike the others, easier to follow and were able to deliver all the assessment activities in the established time thank to the continued sources of information that reminded them when they should deliver it. In this context, it is important to mention that the student with ADHD only gave an activity outside the established time.

With regard to the description of the activities, the student with ADHD said that clearer language should be used. All other students said they had clearly understood what they should do in each deliverable activity.

With respect to the contributions of the key highlights of the video presentation, all students agreed that it was a good strategy because sometimes did not pay attention to the whole video. The student with ADHD said that after this he did not play the video any more.

With regard to the short readings, only one student, the student 4, expressed that it was not a good strategy.

With regard to the recommendations made about the time and space to study, only the student with ADHD said it was very helpful. All other students said they had not followed those recommendations.

The student who offered his support in Activity 3, declared to have enjoyed it. The student with ADHD contacted him twice, the student 2 and 4 once and the student 3 did not contact him.

Furthermore, doing a correlation of the ADHD student' performance in other courses, it put on notice that the student was most accomplished in the delivery of activities.

4. CONCLUSIONS AND RECOMMENDATIONS

After analyzing the results of the interview, we can conclude that the redesign made to the curse based on the guidelines proposed

by the UDL framework allowed to support the process of e-learning student with ADHD, whereas it was observed that the student was constant in the process, most of the time was prompt in delivering their duties and expressed that he perceived the curse easy to follow. This experience has market an important turning point in the virtual unit of the Manuela Beltran University promoting the application of the UDL methodology in other courses. However, in order to achieving an inclusive education, we need to open our horizons and to share the knowledge to everyone.

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