



## Universal Design for Learning, Teachers' Self-Efficacy, and School Performance in Inclusive Classrooms

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### ABSTRACT

The aim of this study is to investigate the extent to which teachers apply the principles of UDL in classroom context and the current conditions existing in schools for the implementation of these principles. The relationships between implementation of UDL principles, teachers' self-efficacy and students' school performance were also analyzed. A number of 151 teachers from Braşov county, aged between 21 and 63,  $M = 44.75$ ,  $AS = 9.06$  participated in the present study, of which 138 women (91%) and 13 men (9%). The implementation of UDL principles was measured through a list of specific UDL activities, organized into four categories (use of technology, diversified teaching, cooperative teaching, individualized assessment). Current conditions in schools were measured by means of a list of situations, organized into three categories (material resources, teachers' concern, modern applications). Self-efficacy was measured with General Self-Efficacy Scale, GSE (Schwarzer & Jerusalem, 1995). Students' performance was measured by a computational algorithm. The results showed that teachers report high levels of application of UDL principles and that the main condition in schools that facilitate UDL is teachers' concern. Among the UDL principles, only the use of technology was positively associated with student performance, and among the current conditions in schools, only teachers' concern was positively associated with school performance. Teacher self-efficacy was positively associated with school performance and UDL principles. Practical implications are discussed and future research directions are established.

**Keywords:** *universal design for learning, current school conditions, teachers' self-efficacy, students' performance*

## 1. INTRODUCTION

### Understanding effective inclusion

The philosophy of inclusive education holds that every student has their own strengths and weaknesses, and education systems must appreciate and manage this diversity and ensure that they provide students with optimal conditions in mainstream schools (Booth & Ainscow, 2011). Inclusion is considered both a process, which involves identifying and removing barriers to access, learning and performance for all students, and an ideal outcome of these practices (Antoninis et al., 2020). To improve inclusion, substantial changes are required in formal and informal teaching practices, but also in school's material base, the necessary materials and relations with parents and the community in general (Dally et al. 2019; Subban et al., 2022). Booth and Ainscow (2011) believe that efforts for inclusion in education must be oriented towards three levels: the development of an inclusive policy, an inclusive culture and inclusive practices.

Inclusive policy provides the foundation for schools accessible to all students; facilitate student admission and remove barriers to accessibility and full participation in all aspects of the school environment. The inclusive policy also ensures adequate resources for both students and teachers. Inclusive education is regulated in Romania by National Education Law no. 1/2011. From the perspective of the legislation in force, at least at the declarative level, the access of all children to education is supported, in environments where they are not discriminated against and which support their security and well-being. For the successful implementation of the inclusive policy, schools must adopt an inclusive culture accompanied by inclusive practices.

An inclusive culture is one where diversity is accepted and valued, with all learning participants being treated fairly and with respect. Students need to feel that they belong to their class or educational community (Qvortrup & Qvortrup, 2018). Building an inclusive culture requires teachers to understand that any student can experience barriers to learning and participation, not just those with special education needs (SEN) (Booth & Ainscow, 2011) and that their role is to facilitate learning and reduce these barriers for all students with whom they interact (Florian & Spratt, 2013).

Inclusive practices refer to the fact that teaching-learning activities are adapted to the diversity of students and respond to their learning needs (Ainscow, 2020). Thus, learning experiences are designed based on students' strengths and needs, and special attention is paid to how all students can be engaged in active and meaningful participation in the learning process (Ainscow, 2020). Focusing on students' strengths, not deficits, should be a priority in teaching design and implementation. Student

differences and diversity must be approached positively (Finkelstein et al., 2021). When these principles are effectively implemented, effects on the self-esteem and social development of all students can be observed (Antoninis et al., 2020).

Inclusive practices can be supported through Universal Design for Learning (UDL) (Finkelstein et al., 2021) and differentiated instruction. UDL is considered a proactive approach, in which attention to students' diversity is implicitly planned regardless of their special needs, while differentiated instruction is considered a reactive approach, in which learning experiences are modified to shape the needs of students (Lidner & Schwab, 2020). The UDL approach involves the use of several means for students to access and perceive information (presentation of information in several, accessible and alternative forms), involvement in learning (offering opportunities to choose learning activities) and communication of what has been learned (facilitating different ways of expression). Differentiated instruction can include changing the learning environment, the actual instruction, the contents, the processes by which students engage and learn the contents, the way they express what they have learned, the assessment methods and the organization of time (Lidner & Schwab, 2020).

The misunderstanding of inclusion can arise when it is considered that students only need to be physically present at school or integrated into mainstream education to be effectively included. In such cases, essential aspects of inclusion, such as equitable student participation and a sense of belonging to the student group, can be circumvented (Qvortrup & Qvortrup, 2018). Students with SEN may be present in the classroom, but only conditionally involved in common classroom activities (Slee, 2013). Differentiation of learning activities, if not done effectively and with great care, can in turn unintentionally undermine students' feelings of belonging and self-worth and implicitly fair inclusion (Dixon et al., 2017). All these situations are essentially examples of micro-exclusion, where, under the name of inclusive practices, students in mainstream schools can experience exclusion (Faustino et al., 2018). Therefore, inclusion means much more than placing initially marginalized students in mainstream classes. Inclusion implies the existence of teachers who apply innovative and inclusive practices to counter the barriers that students face in the classroom and teaching methods that overcome these barriers (Sanger, 2020). They must make learning accessible, meaningful and well-received by all students by approaching models such as UDL (Sanger, 2020).

### Applying UDL principles in inclusive classrooms

The principles on which UDL operates have remained unchanged since their formulation until today (CAST, 2018),

providing a strong model for practical application. They are as follows: i) providing multiple means of involvement (the why of learning); ii) providing multiple means of representation (the what of learning) - presenting information and contents in different ways; iii) providing multiple means of action and expression (the how of learning) – differentiating the ways in which students express what they know.

Effective teaching requires that all students' learning needs are met so that they reach their full potential (Fullan, Hill, & Crevola, 2006), which is why many schools in more developed countries have chosen the UDL model. By incorporating the UDL model, it is intended to cover the increasingly diverse needs of increasingly diverse students and create increasingly appropriate learning conditions for students to achieve success (CAST, 2015). Studies on the implementation of UDL principles in teaching have obtained promising results regarding the academic success of students (Browder et al., 2008; Coyne et al., 2012; Niedo et al., 2014).

However, the process of implementing UDL is not sufficiently explored, which has attracted a number of problems in terms of measuring the effects of UDL in learning contexts (King-Sears, 2014). For this reason, the present study aims to portray the current image of the implementation of UDL principles in Romania, measuring the level of implementation of these principles, as well as the current conditions in schools regarding the openness towards a truly inclusive education.

Incorporating UDL principles requires teachers to take a proactive attitude toward planning instruction so that it covers the needs of all students and the social aspects of the classroom (Meyer, Rose, & Gordon, 2014). The principles of UDL are accompanied by clear "instructions" for implementation, although the latter are developed as recommendations, as a set of strategies that can be used to counter the barriers inherent in most existing curricula. CAST (2015) emphasizes that these guidelines should be used to evaluate and plan methods, materials, goals, and assessments so as to achieve a maximally accessible learning environment for all students. The guidelines are important because they help identify the extent to which UDL principles are actually being applied in the classroom.

Another condition for the successful implementation of UDL is the use of technology. Although, theoretically speaking, the principles can also be applied through traditional teaching methods and materials, in the absence of technology, UDL practices become less feasible (Rose, 2000). Digital multimedia equipment allows greater flexibility and versatility that cannot be achieved with traditional means (Edyburn, 2010). For example, a computer can be used as an audio device, a book, a video game, a phone, a system of tables and texts, an exam.

Instructional design is another condition for the implementation of UDL principles in education, it represents an arrangement of the organization and planning of lessons and assessments in such a way as to determine as accurately as possible the actual state of the student and identify his real needs in order to achieve predetermined learning objectives, with external support or intervention where appropriate (Merrill et al., 1996). Currently, in Romania, although there are schools that use the principles of UDL, there is no organized system of teacher training in this regard, and the way in which these principles are implemented is rather intuitive and not based on recommended instructions. We therefore aim to investigate the extent to which teachers apply the principles of UDL, namely the use of technology, diversified teaching, cooperative teaching and individualized assessment, thus we establish one of the study's research questions:

Q1. *To what extent do teachers currently adopt the principles of UDL?*

### **Effective implementation of UDL principles in schools. Current conditions**

Implementing any type of innovation in schools requires effort. Innovation in this context refers to a set of changes that are necessary to cover certain needs within the school (Fullan, 2007). The UDL model can be an innovation, which means that it is not simple to implement, namely, it is difficult for schools to adapt quickly and make the necessary changes for a correct and complete implementation.

In the context of any change, the participants must first change (Saunders, 2012). At the same time, change does not occur immediately, but in phases or stages: the initiation phase, prior to implementation, the implementation phase, in which the new ideas are implemented, and the follow-up phase, in which the changes are sustained. This entire process can take between three and ten years (Fullan, 2007). School culture can play an important role in how an innovation is implemented (Hall & Hord, 2001). Katz (2013) and Abell et al. (2011) mention a number of factors that are necessary in implementing UDL principles, including the need for collaborative time planning, the creation of professional learning communities and the provision of training opportunities for teachers.

The Universal Design for Learning Implementation Research Network (UDLIRN) developed an UDL implementation scheme (Nelson & Basham, 2014). From the perspective of instructional practices, the researchers recommend that the implementation process be divided into four essential dimensions: setting goals, planning purposefully according to student variability, using flexible methods and materials, and maintaining a time-based monitoring of progress. The implementation stages include: the exploration stage - which focuses on the attitudes and capabilities of the staff; the preparation stage – in which the

programs, initiatives, resources and processes applied to verify alignment with the UDL are investigated; the launch stage – where schools and the community implement the UDL model; the support/extension stage – which investigates the monitoring and feedback of the systems associated with the UDL model.

Currently, in Romania, there are no schools that officially implement the UDL model. There are teachers who apply some of the principles, but the model is not as strongly established as in other states. Taking into account the fact that Romanian education underwent numerous reforms after 1989, any change proposed to schools brings additional stress. We aim to identify the current conditions of some of the Romanian schools in terms of preparation for the application of the UDL model, more specifically the existence of material resources, the concern of teachers and the existence of technological means. We formulate the second research question as follows:

Q2. *To what extent do schools have the material resources, concerned teachers and modern applications to implement the UDL model?*

### **Teachers' self-efficacy in relation to the implementation of UDL**

Self-efficacy is defined as an important psychological construct that describes individuals' belief in their own abilities to organize and perform sets of actions to achieve certain goals (Bandura, 1997). The individuals' self-efficacy in a certain field can influence their setting of goals and objectives, the amount of effort invested, the level of resilience and perseverance when facing difficult situations (Pajares & Schunk, 2001). Levels of self-efficacy differ from one field of activity to another, and teacher self-efficacy refers to the belief in one's abilities to facilitate positive student outcomes, such as learning and engagement, or building belief in one's own abilities to take the necessary actions to perform school tasks successfully (Tschannen-Moran et al., 1998). Teacher self-efficacy has been operationalized in various ways, but it is generally considered to represent the belief in personal abilities specific to instructional strategies, classroom management, and student engagement.

Teachers' beliefs in their teaching capabilities may be associated with attitudes toward inclusion and the level of implementation of inclusive practices. A number of studies have shown significant positive relationships between the level of teachers' self-efficacy and certain variables related to school inclusion, such as the general attitude towards inclusion and towards student diversity or the reduced likelihood of excluding students with CES from classroom activities (Savolainen et al., 2020; Woodcock & Jones, 2020). Also, teachers with high levels of self-efficacy are more willing to work with children with SEN and welcome them into their classrooms, adopt specific strategies for

differentiated instruction and enthusiastically adopt these strategies (Zee & Koomen, 2016).

Teacher self-efficacy has been shown to be an important predictor of inclusion behaviors for students with intellectual disabilities, such as modifying curriculum content, using resources, and adapting the pace of instruction (Wilson et al., 2016). The authors concluded that in the absence of self-efficacy, these behaviors would not have been able to manifest because self-efficacy triggers both teachers' motivation and the skills of practical application of inclusive educational activities. Teachers with high levels of self-efficacy use strategies that incorporate the philosophical principles of inclusive education, centered on student success, accessibility, and the development of confidence. The learning objectives set by such teachers are specific to the students' profile, and the curriculum is modified based on this profile to support each student's learning (Woodcock et al., 2022). Among the practices implemented by self-efficacious teachers are the development of lessons adapted to the objectives set by the students, the encouragement of self-monitoring and self-regulation among students, differentiated instruction and flexibility, the involvement of all students in the class in common cooperative learning activities.

### **UDL and school performance**

One of the reasons why different intervention methods are implemented in educational field is to improve student performance (Edyburn, 2010). Regarding the association between UDL and school performance, a number of studies have shown positive links. Browder et al. (2008) showed that students with multiple disabilities can improve their performance in tasks based on UDL principles. Following a computer-based intervention, students with special intellectual abilities showed significant increases in understanding complex texts (Coyne et al., 2012). These results led the authors to consider that the same method, namely the use of e-books and letter and word recognition software, may also be useful for students with intellectual disabilities. In a study related to mathematics classes, significant increases in the level of performance of students (with and without SEN) were observed following an intervention that included several means of representation, expression and involvement, giving students the possibility to also choose to incorporate digital media into teaching and learning activities (Friesen et al., 2008). Dolan et al. (2015) showed that students achieved significant improvements in reading texts after using educational read-aloud software programmed according to UDL principles. Lieber et al. (2008) showed that students achieved increased performance in mathematics and language and communication after implementing a curriculum based on UDL principles. The curriculum was developed by researchers to increase the academic achievement of

students at risk of school failure, including students from disadvantaged backgrounds or with disabilities. The authors suggested that incorporating UDL principles can provide all students with easier access to learning content, which can lead to improved school outcomes.

As these studies show, it seems that using the UDL model in the teaching-learning process can be positively associated with increasing student academic performance. This fact is also highlighted in a meta-analysis by King-Sears et al. (2022), in which 20 studies were included (50 individual effects). The study revealed a moderate effect size ( $g = .43$ ) regarding the effects of UDL programs on student academic achievement. Among the factors that differentiate between students trained according to the UDL model and those trained according to traditional models are: the area of learning contents, the size of the group in which the UDL model was implemented, the duration of the intervention, and the skills targeted.

## 2. METHODOLOGY

### Participants and procedure

A number of 151 teachers from Braşov county, aged between 21 and 63,  $M = 44.75$ ,  $AS = 9.06$  participated in this

Taking into account the above, we aim to verify whether the implementation of UDL principles and existing conditions in schools are positively associated with students' academic performance. We formulate the hypotheses of the present study as follows:

H1. *The implementation of UDL principles (use of technology, differentiated teaching, cooperative teaching, individualized assessment) is positively associated with students' school performance.*

H2. *Current conditions in schools (material resources, concerned teachers, modern applications), which favor the implementation of UDL, are positively associated with students' school performance.*

H3. *Implementation of UDL principles mediates the relationship between teachers' self-efficacy and students' performance.*

study. The sociodemographic characteristics of the participants are shown in Table 1.

Table 1  
*Participants' sociodemographic data*

	n	(%)
Gender		
Female	138	(91)
Male	13	(9)
Position		
Full-time	7	(5)
Part-time	144	(95)
Profession		
Primary school teacher	22	(15)
Secondary school teacher	93	(62)
Special education teacher	25	(17)
Support teacher	11	(6)
Work experience		
< 1 year	7	(5)
1-4 years	15	(10)
5-9 years	16	(11)
10-14 years	29	(19)
15-19 years	19	(13)
20-24 years	22	(15)
> 24 years	43	(26)
Didactic grade		
Substitute teacher	17	(11)
Beginner	6	(4)
Definitive teacher	30	(20)
Grade 2	22	(15)
Grade 1	76	(50)

To participate in the study, the teachers were invited through CJRAE Braşov, after being informed about the details of the study. Participation was voluntary and there were no rewards of any kind to the participants. The information and invitation to participate was sent to 1200 teachers, and data collection is ongoing. At the time of this report, only 151 teachers provided valid answers (13%). The questionnaires were distributed online, through Google Forms. The first section of the questionnaire included informed consent and agreement to the processing of personal data.

### Instruments

*Implementation of UDL principles* was measured through a list of specific UDL activities, organized into four categories. The total number of items is 48, 12 for each category. Item example for technology use category: "I use a special website for students to have access to learning materials (Google Classroom, Microsoft Teams, etc.)". Item example for diversified teaching category: "I reduce the total volume of reading materials for students with SEN, even if I do not do this for other students." Item example for cooperative teaching: "I organize groups of a maximum of four students, in which they discuss the main ideas of the taught topic." Item example for individualized assessment: "I use various ways of assessment, depending on students' possibilities and development level." Answers are given on a five-point Likert scale, where 1 – never and 5 – always.

*Current conditions in schools* were measured by means of a list of situations, organized into three categories. The total number of items is 30, 10 for each category. Item example for material resources category: "The school where I teach has the necessary materials to facilitate and adapt the learning of students with SEN". Item example for teachers' concern category: "I work closely with support teachers so that we provide students with SEN with the best

learning experience." Item example for modern applications category: "The school where I teach uses augmentative reading and writing programs." Answers are given on a five-point Likert scale, where 1 – to a very small extent and 5 – to a very large extent.

*Teachers' self-efficacy* was measured with General Self-Efficacy Scale (GSE) (Schwarzer & Jerusalem, 1995), translated into Romanian by Dimache and Sulea (2020). The scale includes 10 items, and the answers are given on a four-point Likert scale, where 1 – not at all true and 4 – completely true. Item example: "I know how to effectively manage unexpected situations."

*Students' performance* was measured by means of a computational algorithm as follows: each teacher was asked to state the percentage of children with grades 9-10, 7-8, 5-6 and 1-4. These were quantified as follows: over 75% of students = 4; 50-75% of students = 3; 25-50% of students = 2 and below 25% of students = 1. The resulting numbers were multiplied by 10 for the first category, by 8 for the second category, by 6 for the third category and by 4 for the fourth category. Example: if a teacher reported having 50-75% of children with grades 9-10, under 25% of children with grades 1-4, 25-50% of children with grades 5-6, and over 75% of children with grade 7-8, the score is  $(4 \times 10) + (1 \times 4) + (2 \times 6) + (5 \times 8) = 76$ .

### Study design

This study has a cross-sectional, exploratory, correlational design. Data organization and statistical analyzes were performed using the statistical analysis program IBM.SPSS 25 (IBM Corp, 2016) and Jamovi's medmod GLM module (The jamovi project, 2023).

## 3. RESULTS

### Descriptive statistics

Table 2. *Descriptive statistics*

	M	AS	$\alpha$	UDLFT	UDLPD	UDLPC	UDLEI	CRSCM	CRSPP	CRSAM	AE	Perf
UDLFT	52.75	11.09	.87	1								
UDLPD	60.32	7.92	.82	.54**	1							
UDLPC	58.93	10.11	.93	.23**	.43**	1						
UDLEI	60.25	7.94	.81	.42**	.56**	.65**	1					
CRSCM	33.93	10.02	.89	.09	.10	.36**	.32**	1				
CRSPP	41.26	6.41	.83	.31**	.41**	.51**	.55**	.46**	1			
CRSAM	18.95	5.95	.81	.35**	.30**	.37**	.39**	.43**	.36**	1		
AE	34.23	4.71	.92	.68**	.63**	.40**	.51**	.18*	.42**	.31**	1	
Perf	55.28	11.51	-	.32**	.25**	.19*	.18*	.12	.23**	.18*	.42**	1

\*\* . p < .01, \* . p < .05.

UDLFT – use of technology, UDLPD – differentiated/diversified teaching, UDLPC – cooperative teaching, UDLEI – individualized assessment, CRSCM – material resources, CRSPP – teachers' concern, CRSAM – modern applications, Perf. – students' school performance

Q1. To what extent do teachers currently adopt the principles of UDL?

To answer the first research question, we analyzed the scores for implementation of UDL principles. The participants scored high in all four categories. Thus, for using technology,  $M = 52.75$ ,  $AS = 11.09$ , for diversified teaching,  $M = 60.32$ ,  $AS = 7.92$ , for cooperative teaching,  $M = 58.93$ ,  $AS = 10.11$ , and for individualized assessment,  $M = 60.25$ ,  $AS = 7.94$ . In the situation where the minimum possible score is 12 and the maximum possible score is 60, it seems that all participants have above-average scores, showing that they apply inclusive practices in the classroom to a large extent.

### Hypotheses testing

H1. *The implementation of UDL principles (use of technology, differentiated teaching, cooperative teaching, individualized assessment) is positively associated with students' school performance.*

Q2. Q2. To what extent do schools have the material resources, concerned teachers and modern applications to implement the UDL model?

To answer the second research question, we analyzed the scores for current conditions in schools. The participants reported high scores for the category of teacher concern,  $M = 41.26$ ,  $AS = 6.41$ , medium scores for the category of material resources,  $M = 33.93$ ,  $AS = 10.02$  and low scores for the category of modern applications,  $M = 18.95$ ,  $AS = 5.95$ . Regarding the current situation of the schools, the most important element seems to be the contribution of teachers, followed by the material resources and finally the technological endowment.

In order to test this hypothesis, a multiple linear regression analysis was performed, with the four UDL principles as predictors and students' performance as a dependent variable.

Table 3. Multiple linear regression analysis for UDL principles as predictors of school performance

	B	ES	$\beta$		
UDLFT	.28	.10	.27	2.89	.01
UDLPD	.12	.15	.08	.79	.43
UDLPC	.16	.12	.14	1.34	.18
UDLEI	-.10	.17	-.07	-.61	.54

$R^2 = .12$

UDLFT – use of technology, UDLPD – differentiated/diversified teaching, UDLPC – cooperative teaching, UDLEI – individualized assessment

The four UDL components are responsible for 12% of variation in students' school performance, the regression equation being statistically significant,  $F(4, 146) = 5.02$ ,  $t(151) = 2.89$ ,  $p < .01$ . Of these, only technology use is significantly and positively associated with performance,  $\beta = .27$ ,  $p < .01$ . Taking this result into account, we can say that hypothesis H1 is only slightly supported by the analyzed data.

H2. *Current conditions in schools (material resources, concerned teachers, modern applications), which favor the implementation of UDL, are positively associated with students' school performance.*

In order to test this hypothesis, a multiple linear regression analysis was performed, with the three components of current conditions in schools as predictors and students' performance as a dependent variable.

Table 4. Multiple linear regression analysis for current conditions in schools as predictors of students' performance

	B	ES	$\beta$		
CRSCM	-.02	.11	-.02	-.16	.88
CRSPP	.34	.16	.19	2.06	.04
CRSAM	.24	.18	.12	1.35	.18

$R^2 = .06$

CRSCM – material resources, CRSPP – teachers' concern, CRSAM – modern applications

The three conditions existing in schools are responsible for 6% of the variance in students' performance, the regression equation being statistically significant,  $F(3, 147) = 3.29$ ,  $p < .05$ . Of these, only teacher concern is significantly

and positively associated with performance,  $\beta = .19$ ,  $t(151) = 2.06$ ,  $p < .05$ . Taking into account this result, we can say that hypothesis H2 is only slightly supported by the analyzed data.

H3. *Implementation of UDL principles mediates the relationship between teacher self-efficacy and student academic performance.*

In order to test this hypothesis, a multiple mediation analysis was performed, with teachers' self-efficacy as a

predictor, students' school performance as a dependent variable and the four UDL dimensions as simultaneously mediating variables.

Table 5

*Mediation analysis for UDL principles in the relationship between teachers' self-efficacy and students' performance*

Tip	Effect	Estimate	SE	95% C.I.		$\beta$	z	p
				Lower	Upper			
Indirect	AE $\Rightarrow$ UDLFT $\Rightarrow$ PERF	.15	.17	-.19	.49	.06	.84	.40
	AE $\Rightarrow$ UDLPD $\Rightarrow$ PERF	-.05	.16	-.36	.27	-.02	-.29	.77
	AE $\Rightarrow$ UDLPC $\Rightarrow$ PERF	.09	.10	-.10	.28	.04	.94	.35
	AE $\Rightarrow$ UDLEI $\Rightarrow$ PERF	-.12	.14	-.39	.14	-.05	-.90	.37
Component	AE $\Rightarrow$ UDLFT	1.60	.14	1.33	1.88	.68	11.44	.00
	UDLFT $\Rightarrow$ PERF	.09	.11	-.12	.30	.09	.84	.40
	AE $\Rightarrow$ UDLPD	1.06	.11	.85	1.27	.63	9.95	.00
	UDLPD $\Rightarrow$ PERF	-.04	.15	-.34	.25	-.03	-.29	.77
	AE $\Rightarrow$ UDLPC	.85	.16	.53	1.16	.39	5.28	.00
	UDLPC $\Rightarrow$ PERF	.11	.11	-.11	.33	.09	.95	.34
	AE $\Rightarrow$ UDLEI	.85	.12	.62	1.08	.51	7.21	.00
	UDLEI $\Rightarrow$ PERF	-.14	.16	-.45	.17	-.10	-.91	.37
Direct	AE $\Rightarrow$ PERF	.96	.28	.41	1.50	.39	3.45	.00
Total	AE $\Rightarrow$ PERF	1.03	.18	.67	1.38	.42	5.66	.00

UDLFT – use of technology, UDLPD – differentiated/diversified teaching, UDLPC – cooperative teaching, UDLEI – individualized assessment, CRSCM – material resources, CRSP – teachers' concern, CRSAM – modern applications, Perf. – students' school performance

There are no significant indirect effects, which shows that the four UDL dimensions do not mediate the relationship between teachers' self-efficacy and students' performance. In terms of direct effects, self-efficacy is significantly and positively associated with students' performance,  $b = .96$ ,  $CI95\%(.41, 1.50)$ ,  $\beta = .39$ ,  $Z = 3.45$ ,  $p < .01$  and with all four UDL principles: use of technology,  $b = 1.60$ ,  $CI95\%(1.33, 1.88)$ ,  $\beta = .68$ ,  $Z = 11.44$ ,  $p < .01$ , differentiated teaching,  $b = 1.06$ ,  $CI95\%(.85, 1.27)$ ,  $\beta = .63$ ,  $Z = 9.95$ ,  $p < .01$ ,

cooperative teaching,  $b = .85$ ,  $CI95\%(.53, 1.16)$ ,  $\beta = .39$ ,  $Z = 5.28$ ,  $p < .01$  and individualized assessment,  $b = .85$ ,  $CI95\%(.62, 1.08)$ ,  $\beta = .51$ ,  $Z = 7.21$ ,  $p < .01$ . However, the total effect of teachers' self-efficacy on students' school performance registers a slight increase after the introduction of UDL principles, this being  $b = 1.03$ ,  $CI95\%(.67, 1.38)$ ,  $\beta = .42$ ,  $Z = 5.66$ ,  $p < .01$ .

Considering this result, we can say that hypothesis H3 is not supported by the analyzed data.

#### 4. DISCUSSION

*Question Q1. Application of UDL principles.* Our results show, first of all, that teachers report high levels of application of UDL principles. These results are somewhat

inconsistent with the focus group sessions that the author of the study conducted with the participants. It is possible that there is confusion among teachers between the



understanding of the concepts related to UDL and their actual practical application.

Several authors report the existence of such a situation. Thus, Woodcock et al. (2022) show that although all teachers seem to understand what UDL is and how to apply it, in reality few actually implement the specific strategies. Moreover, the desire of teachers to focus on the special needs of students with SEN can lead to what is called micro-exclusion, which is in no way consistent with the principles of UDL.

*Question Q2. Current conditions in schools.* The results show that among the three investigated conditions, namely material resources, concerned teachers and modern applications, only concerned teachers seem to be a condition that really exists in schools. It is true that not all schools in Romania benefit from the material means necessary to provide all students with individualized learning conditions, and it is equally true that there is not enough technological input in the teaching-learning process. Following the COVID-19 pandemic, however, some of the schools switched to more modern teaching methods, using technology more intensively, but now they returned to some extent to the original state, with some teachers giving up entirely computer-assisted teaching or the use of other technological means of capturing students' interest and curiosity.

#### *Hypothesis H1*

Through the first hypothesis, we aimed to test the relationship between the implementation of UDL principles and students' performances. The results showed that only the use of technology is positively associated with performance. These results can be attributed to the same reason, namely that teachers only have the feeling that they are implementing UDL principles, but in fact they are implementing a hybrid model made up of traditional teaching aids and modern aids. The model implemented by teachers is not really UDL, but it is in any case more advanced than the pre-existing models in the Romanian education system, so it becomes explainable why only the use of technology is associated with students' school performance. By using technology in the classroom, the teacher manages to enter the children's world, to better understand the needs of a generation that was born and raised in a peak period of technological development, so that he can "build" more interesting and engaging learning contents that are delivered closer to students' usual language.

Regarding the relationships between implementation of UDL principles (use of technology) and school performance, similar results have been obtained by other authors. For example, Friesen et al. (2008) conducted an experiment in which they asked students to solve geometry problems from the PISA tests after they benefited from an UDL teaching model. The results showed a significant improvement in students' performance and therefore they subsequently

developed an entire curriculum for teaching geometry in this way.

Another experiment involving second grade children showed an improvement in reading performance after the children participated in a six-week intervention (Metcalf et al., 2009). The intervention included traditional and UDL principles, including offering the opportunity to choose one of three multisensory activity centers. Overall, the children made progress in reading new words, and the authors proposed the implementation of UDL principles in other subjects as well, not only to improve reading, but also to increase the level of students' involvement in learning activities.

#### *Hypothesis H2*

Through the second hypothesis, we aimed to test the relationship between current conditions in schools and students' school performance. The results showed that only the existence of concerned teachers is positively associated with performance. In this case, it can be a question of an overload of the teacher, of the large amount of responsibilities and duties that fall to him in his activity. Or we can talk about an overvaluation of teachers, who perceive themselves as the main pawns in educating and training students. In essence, the results show that students' school performance is not associated either with the material resources of the school or with the technological means, the credit being exclusively with the teachers. It is quite possible that in those schools with low resources the teachers' effort to be higher to compensate for the lack of materials. In this case, the teacher really becomes the basic element of instruction and teaches his subject with the few means he owns or constructs himself.

Studies in this area have yielded inconsistent results. Some authors believe that schools with richer resources do not necessarily facilitate student success (Hakkinen et al., 2003; Hanushek & Luque, 2003), while other authors believe that variation in school characteristics is responsible for student achievement (Card & Krueger, 1996). Parcel and Dufur (2001) showed that students enrolled in schools with better physical environments achieve higher mathematics results, and Willms and Somers (2001) showed that students achieve better academic results when the number of teachers in schools is sufficient, the size of the library is larger and the teachers receive continuous training. Among the most important school characteristics that contribute to student success is teacher engagement (Fetler, 2001; Rivkin et al., 2005).

#### *Hypothesis H3*

Through this hypothesis, we aimed to analyze the role of teachers' self-efficacy. The results showed that teachers' self-efficacy is strongly and positively associated with students' academic performance and with all four UDL dimensions. These results are congruent with those obtained by other authors. Thus, a recent study of 390

teachers from Australia, India, Canada and Hong Kong showed that the strongest predictor of inclusive practices is teacher self-efficacy, above attitudes towards inclusion (Sharma et al., 2021). Also, in a qualitative study, Woodcock et al. (2022) analyzed the relationships between self-efficacy and inclusive educational practices among 41 Australian teachers through thematic analysis. The results showed that both teachers with high levels of self-efficacy and those with low levels have a relatively similar conceptual understanding of inclusive education. However, actual practices differ. Teachers with increased levels of self-efficacy actually and correctly implement inclusive practices, including those specific to UDL.

### **Conclusions**

The present study aimed to create an overview of the analyzed schools in terms of UDL practices and current resources. The results showed that teachers apply the principles of UDL in the classroom or that they at least try to do so. In terms of student performance, this is only associated with the use of technology, which raises an alarm both about the need to equip schools with modern equipment to facilitate the implementation of new teaching methods, and about the way information is processed by students. Being part of an eminently digital generation, students need to relate to technology including in the school environment.

Regarding the current conditions in schools, students' performance was associated only with the existence of concerned teachers and not at all with the rest of the resources. Clearly, human resources are an important capital of schools, but the responsibility for teaching students is one that must be fairly shared between the teacher and the school itself. The school should provide teachers with the necessary materials to deliver quality teaching that ultimately leads not only to high achievement but also to greater engagement in learning.

Teachers' self-efficacy proved to be an important and strong predictor of students' performance, but also of the implementation of UDL specific practices. It is not very clear if teachers adequately apply the principles of UDL or if they only understand these principles, but at least at the declarative level they report a great openness to modern and inclusive teaching methods.

Bearing in mind the need for continuous training of teachers in order to improve the teaching-learning process, we recommend that they benefit from judiciously developed training modules that complement the information they already possess. The UDL model is an extremely complex one, with predefined principles and guidelines, which teachers must know and understand extremely well in order to apply them optimally.

The strategies we recommend refer to short courses, formal or informal, in which UDL principles and guidelines

are described and exemplified, and which teachers can practice and then implement as a general model of action in the inclusive classroom, for covering the learning needs of as many students as possible.

Teachers trained in this way can contribute to the change that is so necessary in current Romanian schools. The concept of targeted universalism will be taken into account, as an essential principle in bringing about systematic changes in schools. As described by the Haas Institute at the University of California, Berkeley, targeted universalism refers to the establishment of universal goals pursued through targeted processes. By means of such a model, objectives can be set for all groups of students. The strategies developed to achieve these objectives are targeted according to students' characteristics. Such an approach can support the integration of UDL in the educational system, covering a wide range of social, emotional and learning needs of students.

### **Limitations and future research directions**

One of the limitations of this study is the reduced number of participants and the composition of the sample, with one third of the teachers being in special education. This fact has definitely affected the quality of the results because the "special" teachers already apply a number of strategies similar to the UDL model. We aim to develop different research designs for inclusive and special education teachers in future studies.

Another limitation is the way in which student performance was measured. Although the algorithm we propose is mathematically correct, we are not sure that it fully explains the overall performance level of the students in question. In future studies, we will use the overall average of grades obtained by students in inclusive classes, and for students with SEN we will use school motivation and self-perceived competence level as dependent variables.

A third limitation of the study is the instruments used, two of them being much too voluminous, which could have caused the teachers to lose patience and interest during the completion. We will consider this aspect in our further studies.

### **Practical implications**

This study is a pilot form and a first step of a larger project. After the completion of the project, which aims to attract more than 1000 teachers from Braşov county, we intend to develop and offer a professional training course for teachers, with two distinct modules, one addressed to teachers from mainstream education, considered inclusive, and another addressed to special education teachers. This differentiation must be made because the specifics of teaching, the approach to learning contents and the materials used are different for these two categories of teachers.

With the delivery of this course, new data will be collected from teachers to identify the level of understanding

of UDL principles and guidelines, but also to use this data as a baseline for future experimental studies.

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