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THE EFFECTIVENESS OF DIFFERENTIATED INSTRUCTION IN PRESCHOOL EDUCATION. A CASE STUDY

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Abstract:
In the context of the ever-increasing structural changes, high demands and pedagogical challenges of the modern educational reality, the need to search for innovative alternative teaching methods that will contribute to the dynamic exploration and redefinition of the concept of effective school learning becomes imperative. Based on this logic and given the multifaceted heterogeneity of the student population in terms of learning readiness, interests and learning profile, it seems that Differentiated Instruction constitutes a modern teaching perspective capable of responding to the complexity of the multi-level activation of the psycho-spiritual potential of each student, in the acquisition of skills, in their active involvement in the teaching process and in the development of motivation for the construction of new knowledge. The purpose of this research study is to briefly present the effectiveness of Differentiated Instruction when applied in preschool education during the 2023-2024 school year. In order to quantitatively investigate the didactic utilization of Differentiated Instruction in the educational process, an experimental application is presented in which an observation key was used as a research tool. The results of the research demonstrated the maximization of the all-round development of all students in mixed-ability classes and highlighted the dynamics of Differentiated Instruction in terms of activating interest and the ability to enhance cognitive and metacognitive skills. The research findings, although limited, constitute the impetus for strengthening scientific and pedagogical dialogue and reflection on the meaning-making of alternative and innovative teaching applications, as well as the further implementation and utilization of Differentiated Instruction in everyday school practice.

Keywords: differentiated instruction, preschool education, effectiveness

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1. Introduction

In the modern educational reality, the multi-complexity, differentiation and rapid redefinition of knowledge urgently call for distancing from established teaching practices as they seem unable to respond in a multifaceted and effective manner to the newly created needs of a heterogeneous student population and strongly raise the need to utilize multiple effective and alternative teaching approaches (Sakellariou, Mitsi & Strati, 2021; Sakellariou, Mitsi & Konsolas, 2018a; 2018b). The necessity and imperatives of pedagogical science propose Differentiated Instruction not as a panacea but as a channel connecting teaching with social justice and professional ethical commitment in order to achieve the elimination of student inequalities and the maximization of learning outcomes for all students (Valiandes & Neophytou, 2017). Differentiated Instruction is distinguished for its qualitative result as it is the culmination of pedagogical research while aiming to utilize the potential of each student in order to achieve maximum results and individual development (Tomlinson, 2017; Mitsi, 2020).

The term "Differentiated Instruction" refers to a systematic approach to the design of the entire teaching by adjusting the content, the processing of the content and the final product of the curriculum for students with different readiness, learning profile and interests. In this way, a qualitative learning outcome is ensured which is fully consistent with the student's level of readiness, interest and preferences regarding the learning process (Panteliadou & Antoniou, 2008). In the context of differentiation, the teacher plans teaching based on the diversity of students at all levels, aiming to maximize the learning outcomes for each student (Sakellariou *et al.*, 2024; Goddard *et al.*, 2015). Regarding the conceptual approach of the term "Differentiated Instruction", it is clear that it is a high-level process that requires flexibility in the teaching method, an alternative way of implementing the curriculum and an attractive presentation of new knowledge to students.

Differentiated Instruction is a conscious and deliberate method of design and teaching method that provides multiple possibilities for acquiring knowledge through clearly defined goals (Gregory, & Chapman, 2018; Anastasiadou, 2020). It is a demanding teaching strategy that is distinguished by its complexity as it is based on the teacher's utilization of multiple flexible and effective teaching methods (YPETH, 2017; Georgiou, 2019). The teacher's goal is to highlight both the student's personality as an acting subject and his own personal theory as it is projected through the role he plays in the teaching practice and the work he performs (Koutselini & Pyrgiotakis, 2015). It is undoubtedly a complex process that includes teaching for the whole class, teaching in groups and individualized teaching. The main concern for the implementation of Differentiated Instruction in practice is the recognition by representatives of the educational system of the existence of inter- and intra-individual differences among students (Tomlinson, 2017).

2. Effectiveness of Differentiated Instruction in its applied functionality in preschool age

The effectiveness of Differentiated Instruction, as well as its superiority over traditional teaching, is confirmed by the findings of other research (Sakellariou, Mitsi & Strati, 2021; Mitsi, 2020; Mavidou, 2019; Valianti, 2015). According to scientific data, teachers assess the level of readiness of students and adjust their educational goals, aiming to ensure that all students will be able to achieve them and develop to their fullest potential (Vassala, 2018; Erotokritou-Stavrou, 2015). In the classroom where differentiation is utilized, activities are designed in such a way as to promote collaborative skills with flexible grouping, and even in the cases of students who have difficulty meeting the demands of the group, they do not give up but seek to be continuously involved in tasks implemented in groups so that they become familiar while at the same time ensuring a disciplined and orderly learning environment (Wormeli, 2018; Tomlinson & McTighe, 2019).

The opportunity given to students to choose the work they will undertake, as well as the connection of the tasks to their interests and learning style, contributes to maximizing learning outcomes and increasing motivation for learning (Vassiliou, 2021; Wormeli, 2018). In the context of Differentiated Instruction, students had the opportunity to choose the way in which they would present their work. They have the opportunity to choose materials and media that seem appropriate and interesting to them, as well as various forms of expression of the final result. Research has observed that the ability to choose materials and media by students during teaching is an important factor for more effective learning and maintaining their interest (Kambeza, 2015; Karelou, 2016).

The implementation of Differentiated Instruction in mixed-ability classrooms in preschool age, according to research, results in the maximization of learning outcomes and the achievement of learning objectives, a fact that is linked to previous research (Sakellariou *et al.*, 2021; Mitsis, 2020; Mavidou, 2019; Valiandes, 2015; Nasi, 2019; Erotokritou-Stavrou, 2015). In low-performing students, a significant improvement in learning outcomes and in the acquisition of interest in school learning is demonstrated (Kamarudina *et al.*, 2017; Vassiliki *et al.*, 2019). Correspondingly, research on students with high academic performance as well as on students with special educational needs (Karageorgou, 2020; Matsagouras, 2018) highlights the effectiveness of Differentiated Instruction. In mixed-ability classrooms, research indicates that the implementation of Differentiated Instruction has significant benefits for all students (Mitsi, 2020; Elaldı & Batdı, 2016; Karip, 2016).

3. Differentiated Instruction in Teaching Practice

Differentiated Instruction is an organizational and pedagogical strategy that addresses the diverse needs of students in mixed-ability classrooms. Pedagogical differentiation refers to the instructional aspect of teaching with the teacher playing a significant role, while its success also depends on organizational differentiation, which concerns the

organization of the learning environment, materials, alternative teaching, learning and assessment methods (Tomlinson, 2017; Panteliadou, Papa, & Sandravelis, 2020).

Differentiation is distinguished by its flexible design and adaptation to the needs, demands and interests of students, but it requires from the teacher deep knowledge and understanding of both the theoretical and applied framework for its design, planning and practical implementation. The design includes the basic work routines but also the utilization of strategies that provide the possibility of differentiating teaching in terms of process, content, final product and learning environment depending on the learning profile, readiness and interests of the students (Valiandes & Neophytou, 2017).

The main axes that constitute the starting point for the course of differentiation are the students (who will I teach?) and the curriculum (what will I teach?). The type of differentiation, the choice of activities and the organization of the classroom are in absolute relation to the needs of the student population. In mixed-ability classes with a focus on the selection and formation of tasks and the construction of knowledge, differentiation is structured in the analysis of undifferentiated material into core knowledge and their prioritization into basic, prerequisite and transformative (Koutselini & Pyrgiotakis, 2015). Teachers should initially identify the basic concepts, skills, ideas or knowledge of the cognitive subject they will teach and connect them to the pre-existing ones (Tomlinson, 2017).

In the design of Differentiated Instruction, the purpose of teaching is initially determined, that is, the basic core knowledge that all students should acquire should be clear. Then, the basic core knowledge and skills that all students should acquire based on the Curriculum are determined, as well as the transformative knowledge and skills that concern those students who will quickly and effectively acquire the basic core knowledge and skills. Along the way, the teacher decides which teaching strategies, techniques, media and activities to apply. Finally, continuous, participatory and reflective evaluation is necessary for the effectiveness of Differentiated Instruction and its dynamic adaptation according to needs; therefore, the design is flexible for readjustment and modifications. Planning is short-term or long-term and goes beyond daily or weekly planning (Valiandes & Neophytou, 2017).

4. This research

The present study aims to investigate the effectiveness of Differentiated Instruction in its applied functionality in kindergarten. Specifically, the aim of the research through the experimental application of differentiation was to examine whether the maximization of the learning outcomes of all students in mixed-ability classes was achieved and to highlight the dynamics of Differentiated Instruction in terms of activating interest and the ability to enhance cognitive and metacognitive skills.

The research was conducted during the 2023-2024 school year. Four kindergartens participated, two as control groups and two as experimental groups. The kindergartens belong to an urban area in the Epirus region. The total number of students was 48 students in the experimental groups and 51 in the control groups. The kindergartens that

participated in the research had common characteristics. More specifically, the age groups were almost equal, the classes were mixed abilities, the number of teachers was equal and the teachers had almost the same formal qualifications. In all four kindergartens, the teachers negotiated the same topics and applied Differentiated Instruction with the same frequency and in all learning areas.

The Observation Key is a useful tool that includes qualitative and quantitative criteria examining the basic teaching actions that the teacher should implement in order to meet the conditions for implementing Differentiated Instruction. The theoretical framework on which it is based has been validated using the Rasch model. The tool allows us to record the data that interests us in order to answer our questions and formulate suggestions for possible improvement of our practice and actions.

The Key followed the five-point scale, an isosceles Likert-type scale of positions with ratings from 1 Not at all to 5 Very much, as well as, there were positions-questions in which the observer had to mark Yes, No or Not needed. While in the last question, the observer had to choose one of the proposed answers for each question, and there was the possibility to record some comments that concerned the teaching and would provide additional information.

The structure of the Observation Key includes in the initial information the following data: the name of the observer, the date, the group registration, whether it is experimental or control, the class, the school and finally the lesson. The Key was structured on the basis of the following seven (7) categories:

1) Content Differentiation,
2) Process and Activities Differentiation,
3) Outcome Differentiation,
4) Differentiated Instruction Environment,
5) Assessment Differentiation,
6) Differentiated Instruction and Student, and
7) Differentiated Instruction and Teacher.

In the first category, Content Differentiation, observers record data regarding the degree of differentiation of the teaching content, i.e. what the student needs to learn and how he/she will be able to access basic information in the teaching of the subject.

In the second category, which concerns Process and Activity Differentiation, the observer records the extent to which the activities and processes in which students will be involved were differentiated in order to understand the content and acquire new knowledge.

In Outcome Differentiation, the observer will capture the ways in which students present the final product of their work and the ways in which students express what they gained from the teaching.

In the next category, Differentiated Instruction and the Learning Environment, the observer explores the way in which the classroom is arranged and organized so as to offer possibilities for choosing ways of working, to provide the appropriate materials and means as well as feelings of safety and a friendly and pleasant learning environment.

In Differentiated Assessment, the observer examines the ways in which the learning outcomes of the students are assessed the time at which the assessment takes place in the teaching process, i.e. whether an assessment is carried out before, after and during the teaching process.

In the sixth category, Differentiated Instruction and the Student, the observer records data concerning the role that the student plays during the teaching process, the possibilities of choice that he has and the way in which he acquires knowledge.

Finally, in the Differentiated Instruction and Educator category, the observer notes observations regarding the role of the teacher in the educational process, the teaching climate he creates, the way he treats students, that is, in general, the way he acts and behaves during the teaching of each learning subject.

In this observational key, our purpose was to examine most of the parameters related to the pedagogical and organizational differentiation of teaching and to record the frequency and degree to which elements of Differentiated Instruction are utilized in the teaching of a particular learning subject, both in experimental and control classes.

The recordings in the observation key were made at the beginning (pre-test) and upon completion (post-test) of teaching, initially in the traditional classical way and later with the implementation of Differentiated Instruction.

For the analysis of quantitative data, the statistical package SPSS 25.0 for Windows was used. The normality of quantitative variables was checked using the Kolmogorov - Smirnov test. Quantitative variables with a normal distribution were expressed as mean ± standard deviation (mean ± standard deviation). To calculate the differences before and after the intervention, the paired sample t-test was used with a statistical significance level of $p<0.001$.

Key limitations of the research were the small sample size and the fact that the sample comes from only one region of Greece.

4. Presentation of the research results

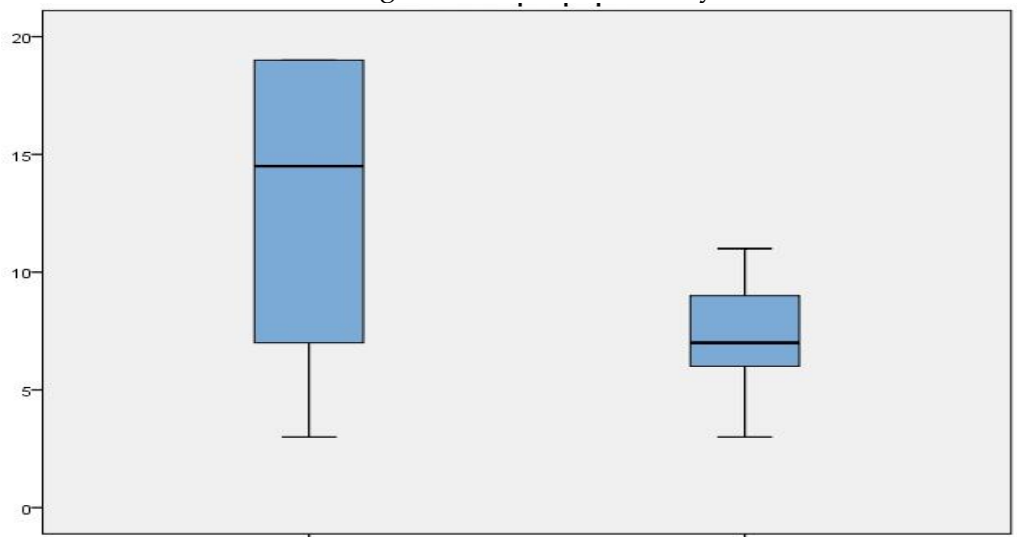
In the measurements at the beginning and end of the experimental intervention, statistically significant differences are presented in all 8 dimensions of the Observation Key, with higher values being presented in the experimental classes with the intervention. In all dimensions, the significance index $p <0.001$ indicates notable differences. Overall, the records per category of the key are presented in the table below:

Table 1: Comparison of experimental groups with and without intervention based on the Observation Key

Observation Key		Mean	Std. Deviation	Std. Error Mean	p-value
Differentiation of Content and Material	With intervention	3.0978	,79141	,11669	,000
	Without intervention	2.3913	,22914	,03379	
Process and Activity Differentiation	With intervention	12.8913	6.33589	,93418	,000
	Without intervention	7.4565	1.76013	,25952	
Result Differentiation	With intervention	10.7933	6.03569	,82318	,000
	Without intervention	6.4325	1.52368	,22679	
Differentiated Instruction Environment	With intervention	31.6957	1.60374	,23646	,000
	Without intervention	3.6739	,63436	,09353	
Evaluation Differentiation	With intervention	9.0115	,63459	,09357	,001
	Without intervention	8.7967	,15325	,02259	
Teacher Speaking Time	With intervention	1.9130	1.31362	,19368	,000
	Without intervention	2.8174	,29762	,04388	
Differentiated Instruction and Student	With intervention	3.8678	,59876	,08828	,000
	Without intervention	1.6522	,94792	,13976	
Differentiated Instruction and Teacher	With intervention	3.3116	,15334	,02261	,000
	Without intervention	2.0739	,79371	,11703	

Research has shown that in kindergarten, in the experimental classes, in the *"Differentiation of Process and Activities"*, there was a significant increase in the mean values, where initially it was M.t: 7.4565 while after the experimental intervention, the mean value was M.t.: 12.8913. Below is a diagrammatic representation of the distributions of the mean values of this specific category of the questionnaire (Figure 1).

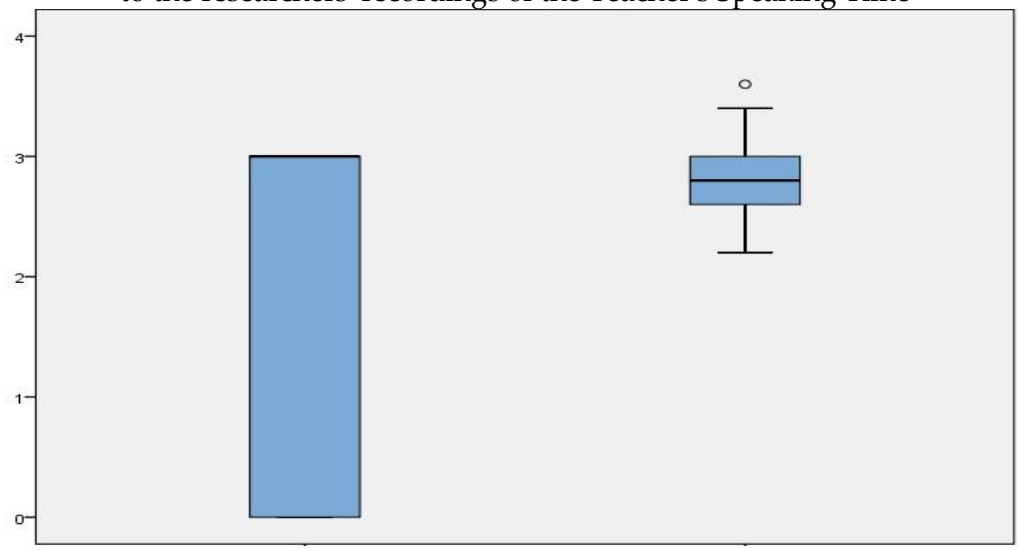
Figure 1: Distribution of the two groups according to the researchers' recordings of Process and Activity Differentiation



Process and Activity Differentiation (post) Process and Activity Differentiation (pre)

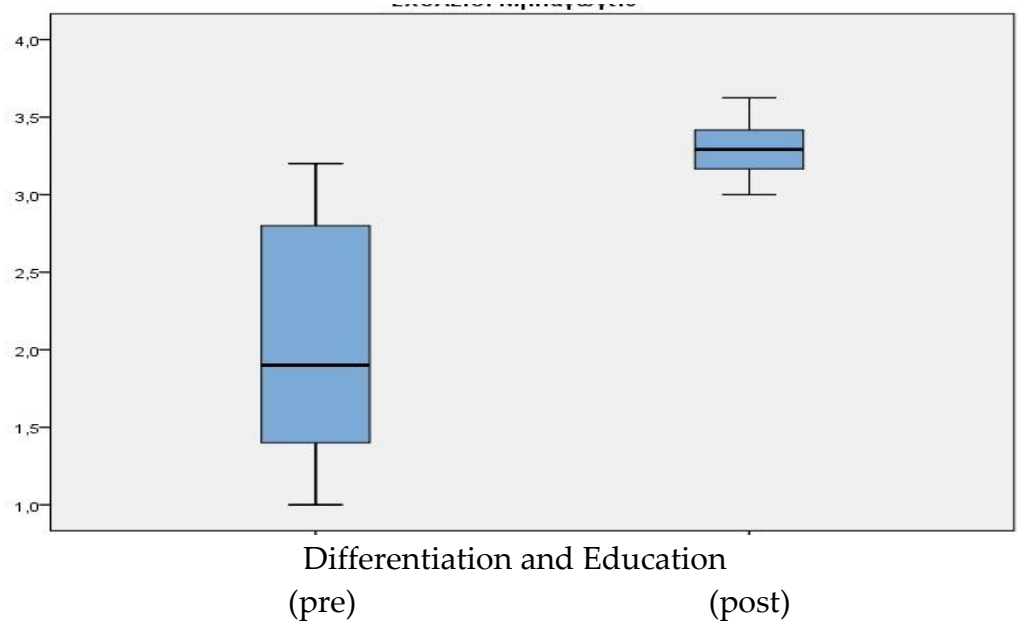
From the researchers' observations and recordings in the observation key, it was found that the *"Teacher's speaking time"* during teaching, in the experimental classes was significantly reduced, with the average values demonstrating the differentiation between them [M.t .: 2.8174 (pre)- M.t .: 1.9130 (post)], which is schematically depicted below.

Figure 2: Distribution of the two groups according to the researchers' recordings of the Teacher's Speaking Time



Also, through the researchers' recordings, a statistically significant difference emerged in the average values of the experimental classes in the category *"Differentiation and Educational" with* the average values initially being M.t.: 2.0739 and after the experimental intervention M.t: 3.3116.

Figure 3: Distribution of the two groups according to the researchers' records on Differentiation and the role of the Educator



In the records of the observation key, before and after the implementation of the educational intervention in the control classes, statistically significant differences are presented in all 8 of its dimensions, with higher values being presented in the control classes at the end of the school year. In all dimensions, the significance index $p < 0.005$

indicates notable differences. However, the values compared to the experimental classes after the intervention are lower in the control classes.

Table 2: Comparison of control groups before and after the intervention based on the Observation Key

Observation Key		Mean	Std. Deviation	Std. Error Mean	p-value
Differentiation of Content and Material	Before	2.2324	,23156	,02365	,000
	After	2.5354	,12365	,02153	
Process and Activity Differentiation	Before	8.5032	1.2064	,21578	,000
	After	9.3256	5.2135	,20139	
Result Differentiation	Before	7.2312	1.7369	,23546	,000
	After	8.9874	5.6159	,86491	
Differentiated Instruction Environment	Before	3.4632	, 56984	,24466	,000
	After	6.2315	1.53698	,19342	
Evaluation Differentiation	Before	8.5627	,63164	,09642	,000
	After	8.8635	,36195	,03124	
Teacher Speaking Time	Before	2.9349	,23664	,04312	,000
	After	2.4362	,71456	,04325	
Differentiated Instruction and Student	Before	2.9632	,31534	,04657	,000
	After	3.6932	,51662	,08465	
Differentiated Instruction and Teacher	Before	2.0109	,73126	,12470	,000
	After	2.7236	,23548	,10390	

5. Conclusions-Suggestions

In the experimental classes with the implementation of the intervention, students worked in groups considerably compared to their work before the intervention and that of the students in the control classes, where it was mainly individual. This fact contributed to the strengthening of the students' sociability and the development of collaborative skills, while the children's effort to achieve a common goal and the success of their group was observed. Research has recorded a positive correlation between the implementation of Differentiated Instruction and the social interaction of students (Vygotsky, 1978; Tomlinson, 2017; Mitsi, 2020).

Lesson planning based on Differentiated Instruction provides the opportunity for students to freely express themselves, highlight their interests, and shape their values, creating the conditions for the production of intrinsic motivation. As research shows, there is a strong positive correlation between motivation and academic performance of students of all age groups in those cases where teachers promoted the free and creative expression of students without hindrance (Schunk & Zimmerman, 2019; Niemann & Möller, 2020; López & Fernández, 2021).

During the experimental implementation, a differentiation of the learning environment was observed with better and greater utilization of the available spaces by enriching the learning environment with materials and means appropriate for the activities, needs and interests of the students. The climate was shaped so as to provide peace, tranquillity and security to the students but also to be enriched with motivation for action. The creation of a supportive and safe environment where children can freely express their emotions is of crucial importance (Denham & Burton, 2015).

Assessment in Differentiated Instruction is continuous, enhances the learning process and helps teachers understand the real needs of students while recognizing their strengths and weaknesses (Subban & Round, 2015). Differentiation requires a detailed, clear and continuous assessment that will come from a variety of sources of information (Tomlinson, 2017; Koutselinis & Pyrgiotakis, 2015). Differentiated Instruction also allows students to cultivate and develop cognitive and metacognitive learning skills (Neofytou & Valiandes, 2017; Valiandes, 2015; Mitsi, 2020).

By utilizing Differentiated Instruction, students actively participated in the learning process and had the opportunity to express their thoughts, question and discuss, and develop their critical thinking and problem-solving skills. Modern educational reality recognizes the need to shift the center of gravity from the teacher to the student. This means that the teacher is called upon to limit the time of his own speech in the classroom and create more opportunities for active participation and self-activity of students. Active participation in learning enhances the autonomy and self-confidence of students as when students feel that they have control over their learning, they are more likely to develop internal motivation and achieve (Hatzigeorgiou, 2018; Koutsoyiannis, 2019; Papadopoulou, 2020).

Teachers in the context of differentiation have the opportunity to utilize various strategies, which increase students' motivation to learn, improve learning outcomes and promote their active participation in the learning process (Gregory & Chapman, 2018; Mavidou, 2019). In a study conducted on the effectiveness of the implementation of Differentiated Instruction in mixed-ability classes, teachers reported that by implementing Differentiated Instruction they found that they further developed and cultivated their analytical planning skills (Valiandes, 2015; Mitsi, 2020; 2017; Stavrou Erotokritou, & Koutselini, 2016).

In the experimental classes that utilized Differentiated Instruction, the activities that the kindergarten students participated in and were involved in were mostly of a playful nature, which contributed significantly to the enhancement of social-emotional development. Based on research, teachers in the early stages of education consider the development of children's social and emotional skills to be more important than academic performance (Sverdlov & Aram, 2016). Recent research has shown that preschool education and kindergarten focus on the development of children's social and emotional skills, preparing them for the first grades of elementary school (Briggs, Russell, & Wanless, 2018). In conclusion, researchers support the importance of keeping these skills at the center of education for children's successful academic careers and smooth integration into society when they grow up (Graziano *et al.*, 2016). Play also plays a critical role in creating a world where children can explore and develop their abilities, confronting their fears and taking on adult roles. Play helps children develop new skills that lead to increased confidence and the resilience they will need to face future challenges (Najmonnisa & Saad, 2017).

The research data of this study, although limited, highlighted the maximization of learning outcomes for all students and documented the potential of Differentiated Instruction in terms of enhancing interest in responding to the learning profile, needs,

talents and readiness of students. In conclusion, further investigation of the issue is necessary in order to have data that will lead to proposals regarding the implementation of alternative and innovative teaching applications as well as the further implementation and utilization of Differentiated Instruction in everyday school practice.

Conflict of Interest Statement
The authors declare no conflicts of interest.

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