



**THE EFFECT OF LESSON STUDY ON THE EFFECTIVE
IMPLEMENTATION OF DIFFERENTIATED INSTRUCTION:
RESULTS OF RESEARCH ON SECONDARY
SCHOOL STUDENTS IN GREECE**

Eurydice-Maria Kanellopoulouⁱ,

Maria Darra

Department of Primary Education,
University of the Aegean,
Dimokratias 1, 85132 Rhodes,
Greece

Abstract:

The main purpose of this paper is to present the results of the research, which aimed to investigate the effect of lesson study on the way teachers plan, implement, and understand differentiated instruction in the context of teaching the Modern Greek language course of 2nd class of the Lyceum. The research was qualitative and in the context of its implementation, grounded theory data collection and analysis techniques were used. The research was carried out in three schools in two municipalities of Eastern Attica, with the participation of four teachers and eighty students in a lesson study cycle. Data were collected before, during and after the lesson study cycle and included classroom observations, interviews of participating teachers, protocols for planning, observing, revising and reflecting on the research lesson as well as transcripts of teacher meetings and the teaching of the research lesson, diaries, which were kept during the implementation of the lesson study, students' assignments as well as their interviews after the teaching. The results of the research showed that lesson study helped teachers to develop flexibility in planning their teaching, encouraged them to implement new differentiation strategies and techniques, and pushed them to manage differentiation actively and successfully implement it, addressing the needs of students and the challenges of teaching, influencing their existing beliefs and practices. In addition, from the research, it emerged that the teachers' goals for the lesson study were realized, as well as the teachers planned the learning goals of the research lesson and created activities for formative assessment.

Keywords: lesson study, differentiated instruction, research lesson, secondary education

ⁱ Correspondence: email evikanell@gmail.com

1. Introduction

In the increasingly heterogeneous classrooms of the Greek educational system, teachers must teach effectively by revising teaching concepts and methods (Sfyroera, 2004), as their one-dimensional and standardized way of teaching cannot meet and cover the needs of students (Koutselini & Persianis, 2000). The traditional way of teaching is due to the isolation culture of teachers, who have become accustomed to the habit of closing the door as soon as they arrive in their classroom and feeling comfortable, autonomous and free due to isolation, without fear of criticism from their colleagues (Mon, 2009). Teachers who lack sufficient knowledge and skills do not wish to compare their teaching with that of other colleagues and to have the isolation of their classroom disturbed by their presence. Teachers with a culture of isolation reproduced their teachers' teaching when they themselves were students, using many of the traditional strategies that their teachers used and will themselves use with their students (Coe, 2010).

In contrast, teachers in a modern education system collaborate with each other and with their students to improve student learning and their professional development (De Jesus, 2012). Through cooperative learning, which is promoted by the implementation of lesson study and differentiated instruction, the successful treatment of increasing school diversity and new social data and demands can be achieved (Fykaris & Mitsi, 2012) and cannot be implemented with traditional teaching methods. More specifically, through the interaction between teachers and students, synergies are created that make the educational process more effective (Bandura, 2006). When teachers work together in the context of a collaborative effort, they improve teaching and learning, benefiting themselves and their students (Van Sickle, 2011).

Their collaboration focuses on the students by improving their teaching and promoting their professional development, making schools learning spaces for teachers and students (Desimone, 2009). This process is guided by the teachers themselves and not by various external experts who visit their classrooms to teach methods which may not be able to be effectively applied to all students (Birman, Desimone, Porter & Garet, 2000).

From the review of the international literature, only two studies were identified which examined the effect of lesson study in the context of the implementation of differentiated instruction in Mathematics in primary education (Harsono, 2016; Hockett, 2010). From the review of the Greek literature, no research was found that studies the effectiveness of lesson study in the context of the implementation of differentiated instruction. More specifically, most of the research in the international and Greek literature on lesson study was mainly concerned with the professional development of teachers and the improvement of student learning in minimal subjects (Howell, 2014; Loose, 2014; Panoutsos, 2015; Sirotic, 2015), while researches on differentiated instruction focused mainly on the conditions, procedures and difficulties for its effective implementation as well as its effect on student learning (Hogan, 2014; Maddox, 2015; Stone, 2012).

From the review of the research, it follows:

- a) a relatively small number of researches on the implementation of lesson study and differentiated instruction in secondary education as well as on the evaluation of their effectiveness on the learning outcomes of students in the Modern Greek Language course in Greece
- b) a small number of researches focusing on the conditions, processes and difficulties of lesson study and effective differentiation in the Modern Greek language course and
- c) lack of experimental researches to evaluate the effectiveness of lesson study in the context of the implementation of differentiated instruction in Greece and internationally.

The present research is implemented with the aim of covering these gaps. More specifically, it aims to investigate the effect of lesson study on the way the teacher plans, implements and understands differentiated teaching in secondary education in the Modern Greek Language course of the 2nd class of the Lyceum, a cognitive field in which students often face particular learning difficulties, which make it difficult for them to achieve their learning goals. It is also investigated whether these two pedagogical approaches combined can bring about better learning results, and the perceptions and opinions of the participating teachers and students are analyzed.

2. Lesson study and differentiated instruction: Theoretical approach

2.1. Lesson study

Lesson study, acting as a continuous cycle of professional development, allows teachers to create a learning community (Penderi, Karadimitriou & Rekalidou, 2013) in which they collaboratively design a teaching unit based on the intended learning objectives. By designing the research lesson according to the detailed curriculum, they choose a teaching unit, and by evaluating the advantages and disadvantages of traditional teaching methods, they promote the implementation of new teaching methods with the gradual and progressive change of their educational practices (Coe, 2010). Then, by teaching the lesson, which is characterized as a research lesson, they collect data on student learning. Immediately after teaching and observing the lesson, the teachers exchange views, revise and reteach the lesson, adding the modifications resulting from the results of the research lesson (Fernandez, 2002; Van Sickle, 2011).

In the context of lesson study, differentiated instruction can be directly studied by observing the effect of research lesson design and certain elements of instruction on students' motivation, discovery, dialogue, and acquisition of knowledge. Fruitful dialogue between teachers facilitates understanding and improvement of teaching, actively engages teachers to explore, observe and revise their teaching, and promotes their professional development, which is directly linked to their teaching in their own classroom. Therefore, teachers' professional development is implemented by themselves, learning through their daily teaching (Nauerth, 2015).

The environment of dialogue and cooperation formed in the context of lesson study promotes and strengthens the teachers in the exchange of ideas and opinions, who, as a group of colleagues, through creative dialogue and with respect for the different points of view, adopt innovative approaches (Lewis & Hurd, 2011). Through continuous, honest, two-way and effective communication, they collectively support student learning by improving their teaching. Therefore, lesson study is based on collaboration between teachers, is directed by them, and takes place in the classroom, focusing simultaneously on improving their teaching and on the learning of their students (Hamzeh, 2014).

The lesson study is implemented by a small group of teachers of the same speciality, usually 3 to 6 people, who, devoting approximately 10 to 15 hours over a period of 3 to 4 weeks, collaboratively plan and implement the teaching of a teaching unit (Fernandez, 2002; Hockett, 2010).

The frequency of their meetings is determined based on the degree of difficulty of the unit chosen for teaching and of the cognitive object, the time required for planning the teaching and the time available in the teachers' daily timetable (Hamzeh, 2014).

Figure 1 shows a lesson study cycle.

Figure 1: Presentation of a lesson study cycle



Adapted from Stepanek *et al.*, 2007

The views of the researchers differ in defining the stages of the lesson study process (Coe, 2010), the number of which ranges from four (Lewis, 2002) to eight stages (Stigler & Hiebert, 1999). The present research, according to the opinions of most researchers, distinguishes the lesson study in the following stages (Stepanek *et al.*, 2007):

- I. Research theme, choose a unit and setting learning goals.
- II. Planning the research lesson.
- III. Teaching, observing and collecting data of the research lesson.
- IV. Assessment – feedback, revising and reteaching.
- V. Reflecting - formulating and sharing final results.

2.2. Differentiated instruction

Differentiated instruction is a didactic approach to alleviate inequalities between students and improve their performance, offering the possibility for the teacher to intervene in important axes of the learning process to facilitate the participation of all students in learning (Argyropoulos, 2013). Differentiated instruction is based on two important axes, the student and the curriculum (Padeliadu, 2008). The first axis, focusing on the special needs of students, is distinguished in learning readiness, interests and learning profile (Tomlinson, 2001). Knowing these parameters in depth, the teacher can obtain important information to plan and organize his teaching effectively (Valiandes & Neophytou, 2017). The second axis, focusing on teaching, is distinguished into content, process and final product (Levy, 2008; Tomlinson & Imbeau, 2010).

Figure 2 shows the axes of differentiated instruction.

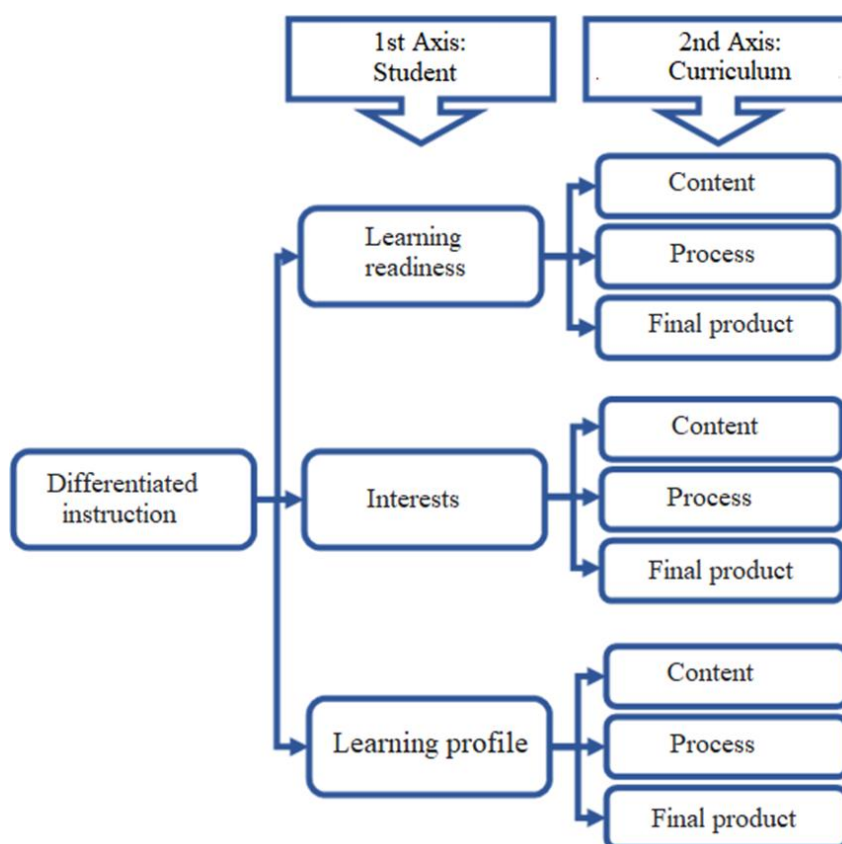


Figure 2: Axes of differentiated instruction (Padeliadu, 2008).

The differentiation of teaching by teachers according to the needs of all students provides them with the possibility to explore basic concepts and skills, according to the

students' mental capabilities, through creative and enjoyable activities, as avoiding the one-dimensional way of teaching contributes to their progress (Tomlinson & Imbeau, 2010). Differentiated instruction is a modern teaching practice according to which teachers do not carry out their teaching on the basis of a strictly predetermined framework in a one-dimensional and one-sided way but implement it successfully following specific principles and values of differentiation (Lagadinou, 2014; Tomlinson & Imbeau, 2010).

Differentiated instruction is a pedagogical approach which requires detailed planning as well as the use of many means and strategies (Valiandes & Neophytou, 2017). Strategies, which are grounded in the theoretical background of differentiation are necessary to achieve the effective planning and successful implementation of differentiated instruction in the classroom. The strategies aim to meet the different needs of students during instruction while forming an appropriate learning environment through activities that motivate students to actively participate in their learning (McLean, 2010). The strategies can be implemented with various means/techniques, according to the subject, the groups of students or the teaching preferences of the teachers (Padeliadu, 2020)

3. Purpose and research question

The main purpose of this research is to investigate the effect of lesson study on the way teachers plan, implement and understand differentiated instruction in the context of teaching the Modern Greek Language course of the 2nd class of Lyceum.

From the review of the Greek and international literature, the need to investigate a basic research question emerged, which is the following: "How does the participation of teachers in a lesson study cycle affect the planning, implementation and understanding of differentiation?"

4. Method

The analysis of the qualitative data was based on the grounded theory methodology. For the analysis of the qualitative data in this particular research, the procedure described in the constructivist strand of Charmaz's grounded theory (2006) was used, which proposes the following three stages of coding: a) initial, b) focused coding and finally, c) the theoretical coding.

The research was carried out in three Lyceums of two municipalities of Eastern Attica, with the participation of four teachers and eighty students. The teachers from the three Lyceums who participated in the research and taught the Modern Greek language course in the 2nd grade of a Lyceum, before the teaching intervention in their school units were invited to attend a three-day educational training on differentiated instruction and a corresponding one of the same duration, for the lesson study, which started on 09-22-

2022 and ended on 10-05-2022. Immediately after, the research was conducted and completed in the three school units of Eastern Attica.

The researcher, who was the leader of the group, informed the members about the purpose of the research and trained them in lesson study and differentiated instruction. Data collection tools of the specific research were interviews of the participating teachers, protocols of planning, observation, revision and reflection of the research lesson, transcripts of the teachers' meetings, diaries kept during the implementation of the lesson study, student assignments as well as interviews of students who participated in the research.

The research was carried out in three phases. In the first phase of the research implementation (from 10-13-2023 to 10-21-2022), the researcher first observed the teaching of each teacher separately in his class before the implementation of the lesson study cycle. In this phase, the researcher had the opportunity to observe each member of the lesson study group teaching a didactic unit of the Modern Greek Language course of the 2nd grade of the Lyceum, implementing differentiated instruction. This observation provided the researcher with basic data on the way in which each teacher conceives, plans and implements differentiation, as well as if this way changes during and after the implementation process of the lesson study. The observation of the teachers during the lesson study contributed to the understanding of the context in which the teachers carry out their daily teaching. Each participating teacher in the lesson study group chose an observation date within a specific time frame and produced a brief lesson plan, along with any explanatory notes, comments or questions. After the teachers participating in the research implemented the specific teaching methods, the researcher conducted interviews with them.

Using the teacher's lesson plan, observation notes, the tape recording of the lesson, and the post-lesson interview, the researcher assessed the degree of differentiation of the lesson in its basic elements based on a qualitative rubric.

In this phase, the researcher was able to gather useful information about the experience, beliefs, goals and practices of the teachers, helping to build a framework necessary for collaboration between them during the lesson study cycle, as some did not know each other and had not worked together before.

In the second phase of the research (from 10-25-2022 to 11-08-2022) all the stages of the lesson study cycle were carried out, which included the online meetings of the teachers to discuss the research theme, the choice of unit and its goals of the research lesson. This was followed by a discussion on the development of the detailed teaching plan and student assessment. Subsequently, the teaching of the research lesson was carried out, and immediately after that, the discussion on the revision of the teaching of the research lesson and its re-teaching by another teacher of the group took place. The final stage of the lesson study cycle involved the teachers' discussion after reteaching of the research lesson.

In the third phase of the research implementation (11-16-2023 to 11-28-2023), the researcher observed each teacher's teaching separately in his class. The teachers who had

not taught the research lesson were asked to implement it in their classrooms, and the teachers who had taught the research lesson and its re-teaching were asked to implement the differentiation in their classroom in another unit of the Modern Greek Language course of 2nd Lyceum class, after the completion of the lesson study cycle.

5. Results of the research

5.1. Main findings

The main findings of the present research, which aimed to investigate the effect of lesson study on the way teachers plan, implement and understand differentiated instruction in the context of the teaching of the Modern Greek language course of the 2nd Lyceum class, resulted from the implementation of both three phases of research.

First, it was found that lesson study supported teachers in developing flexibility in their instructional planning. All participating teachers (teachers A, B, C and D) took part in the lesson study process as teachers who recognized the value and implemented their detailed lesson planning in the classroom. During the lesson planning of the unit "The organization of the news" in the Modern Greek Language of the 2nd Lyceum, each teacher tried to take into account the different needs of his students. Together, they had created a clear framework for planning and teaching the research lesson, which they implemented with precision. Possibly, the particular way they were taught might have hindered their thinking about how to differentiate. However, after implementing the lesson study, each teacher included elements in their planning that made them more flexible and receptive to change than they were before. Characteristically, teacher A pointed out that he proceeded to differentiate his teaching after the research lesson: *"To meet the needs of the students, so that everyone participates in the lesson, given their learning peculiarities, in the context of a more attractive lesson for everyone, as it offers more choices for students"* (Research Lesson Planning Form, p. 2).

The second finding is that the lesson study strengthened all the participating teachers in using new strategies and techniques of differentiation in their teaching, as they wanted to learn new methods of implementing differentiation, adopting different kinds of techniques and strategies that were taught and implemented in their lessons. During the implementation of the research lesson, the teachers proceeded to implement the strategies of flexible grouping and the prioritization and grading of the activities. Regarding the techniques, all the teachers preferred the implementation of the "entry card" and the "Think-Tac-Toe", while teacher B, during her third teaching, proceeded to implement the "Frayer model" as well. When teachers were asked to state their new knowledge about differentiation that they gained from the experience of their participation in the lesson study, teacher A characteristically mentioned: *"Experience in innovative methods, such as cooperative teaching and the "Think-Tac-Toe" choice of exercises"* (Interview of teacher A after the teaching of the research lesson, 11/16/ 2022, p. 3). Teacher B stated that by participating in the lesson study, she gained new knowledge regarding the differentiation *"in the way the lesson is presented in general, theory, types of exercises"*

(Interview of teacher B after the teaching of the research lesson, 11/28/2022, p. 3). Teacher C clearly emphasized: "*The contribution of the other participants in the program was important because the perspective and development of the teaching was improved by including proposals for differentiation*" (Interview of teacher C after the teaching of the research lesson, 11/25/2022, p. 3) and teacher D: "*My teaching improved by implementing differentiation strategies and techniques*" (Interview of teacher D after the teaching of the research lesson, 11/18/2022, p. 3).

The third finding that emerged from the research is that lesson study helped teachers manage differentiation proactively. Although each teacher implemented his own ways of approaching teaching and student behavior, however, these were not sufficient to manage the differentiation. Through the group discussions that took place during the creation of the detailed teaching plan, the teachers dealt with the choice of differentiated activities as well as with the most effective way of implementing them. From these discussions, which were based on fruitful and constructive dialogue, teachers were helped to manage differentiation proactively by linking it directly to continuous assessment. In addition, with the discussions that followed the research lesson and its reteaching, the members of the lesson study group faced various management challenges related to the plan of the differentiated tasks, such as how to assign the differentiated activities, how to guide the students and how they will be monitored when they engage in these activities. All teachers successfully met some of these challenges in the observation lesson after the lesson study. In more detail, each teacher, by identifying and integrating the strategies and techniques that had been successfully implemented in the research lesson, managed to effectively incorporate the differentiated activities into his own teaching. Teacher C, in the interview she gave immediately after the teaching of the research lesson, stated the following: "*It was found that students who normally score average or low scores scored higher on the "entry card"... also in group work they all responded satisfactorily*" (Interview of teacher C, 11/07/2022, p. 2). With regard to the activity of "Think-Tac-Toe", teacher B emphasized the following: "*In the "Think-Tac-Toe" exercise, the four groups chose the same exercises, while one, with the weaker-average foreign students, chose a different and more demanding "Think-Tac-Toe" with positive results*" (Interview of teacher B, 11/08/2022, p. 2). Teacher A reported that "*all students worked energetically in groups but also individually*" (Interview of teacher A after the teaching of the research lesson, 11/16/2022, p. 2). In summary, the lesson study offered teachers the opportunity to discuss, think about and experiment with the challenges that arise from managing differentiation.

An additional finding concerns the successful implementation of differentiation. All the differentiated activities that the researcher observed in the classrooms of the lesson study group members during the third phase of the research were implementations that were formed for the specific research lesson of the group. Teachers B and C experimented more as they were the ones who taught the research lesson and its reteaching. By observing the implementation of differentiation, the teachers gained confidence in using an approach they had not tried before, either because of concerns

about its effective implementation or because they had not thought about it. In addition, their different perspectives on the research lesson could give teachers a perspective on what they would implement in their classrooms. Teacher C, after the realization of the research lesson, clearly emphasized: *"Differentiated instruction will henceforth be a priority in completing the teaching process. I was satisfied with the result and look forward to more creative teaching as a whole in the future"* (Interview of teacher C, 11/07/2022, p. 2). Furthermore, teacher B said: *"In making my assessment, I think that the average students were more motivated and responded quite well to group work, which made me especially happy"* (Interview of teacher B, 11/08/2022, p. 2).

The next finding relates to addressing classroom or teaching needs and challenges. The opinions of the participating teachers regarding whether and how they will implement some differentiation strategies and techniques appeared to be directly related to their abilities to effectively manage the existing needs or challenges they had identified before or during the implementation of the lesson study cycle. In her interview after the implementation of the re-teaching of the research lesson, teacher B pointed out the following about the differentiation of the lesson: *"I took into account the multiculturalism of my class. Due to the fact that in my class half of the students are foreigners, which means that there is a degree of difficulty in understanding some texts, I adapted the exercise book"* (Interview of teacher B, 11/08/2022, p. 1). In his interview after his first teaching before the implementation of the lesson study cycle, teacher A, regarding the differentiation of his teaching, emphasized that he implemented the strategy of grouping in order to understand the new unit by his students and to improve the climate in the classroom. Characteristically, he said: *"I was hoping that cooperative teaching ... would also help to make the lesson better. It was a new unit for the kids to understand before we even got into the text and feel familiar with it. And to improve the climate in the classroom"* (Interview of teacher A, 10/13/2022, p. 1). Additionally, all participating teachers jointly decided to implement flexible grouping when teaching the research lesson, and grouping was based not only on readiness but also on the interests and learning profiles of their students. However, they still thought that grouping based on readiness was more important for student development and fostering cooperation as the most important purpose of grouping. Regarding the differentiation of tasks in the research lesson, the teachers ensured that all students had access and their decision to implement different techniques, such as the "Think-Tac-Toe" activity, served this goal.

The sixth finding relates to the effect of lesson study on teachers' existing beliefs and practices. The research found that the differentiation applications implemented by the lesson study team members in the first phase of conducting the research before the lesson study cycle was implemented were aligned with their beliefs that they would be effective or could be relevant to their ideas about the teaching of the Modern Greek Language, but also with the way they often prepared and taught their lessons. Several examples are highlighted by observing lessons and teacher interview data. For example, members of the lesson study team in the first phase of the research used the grouping strategy without implementing flexible grouping, a strategy they implemented while

teaching the research lesson. Additionally, in the first phase of the research, when the teachers implemented the initial assessment, they chose to ask questions to the whole class and for the students to answer, while during the teaching of the research lesson, they chose to use an "entry card" to check the level of readiness of each student. Also, teachers focused more on differentiating content based on student readiness. Only teacher B differentiated her teaching, taking into account the interests of her students, and teacher A implemented differentiated instruction, wanting to satisfy the emotional needs of his students as well. However, in teaching the research lesson, the teachers of the lesson study group proceeded to differentiate the content, process, and product, taking into account the readiness, interests, and learning profiles of their students. The teachers gradually integrated the techniques and strategies of differentiation into their existing beliefs and practices, and this integration was not sudden and inexplicable as the teachers participated in all stages of the lesson study, which contributed to the improvement of their teaching.

The seventh finding is related to the realization of the objectives set by the teachers for the lesson study. The research showed that there was a direct correlation between the choices of implementation of various ideas and strategies that the teachers incorporated into their teaching and the realization of their own goals for the lesson study process.

Table 1 presents the goals set by the teachers regarding the lesson study during the first phase of the research and the results in their professional development from their participation in it.

Table 1: Comparison of teachers' goals for lesson study and related lesson study outcomes

Teacher A	
Lesson study goal	Relevant result
<ul style="list-style-type: none"> - To improve his teaching experience and to contribute to his individual professional development. - To contribute to the progress of all students and to build closer relationships with his students. 	<ul style="list-style-type: none"> - Improving the organization of his lessons. - Effective use of flexible grouping. - Better knowledge of the needs of his students by using the initial assessment. - Student participation in the lesson with courage and self-confidence.
Teacher B	
<ul style="list-style-type: none"> - Knowledge of different ways and means of approach for differentiated instruction. - Getting positive things to improve her teaching in the future. 	<ul style="list-style-type: none"> - Implementation of more strategies and techniques. - Differentiate content, process, and product based on students' readiness, interests, and learning profile. - Implemented continuous assessment in her teaching.
Teacher C	
<ul style="list-style-type: none"> - Willingness to participate in planning and replanning of a teaching unit collectively. - To consolidate knowledge and new stimuli/suggestions to improve teaching. 	<ul style="list-style-type: none"> - Implementation in her teaching of a lesson plan that was formed together with the teachers of the lesson study group. - Implemented more differentiation strategies and techniques in her teaching.

Teacher D	
- To consolidate the more effective implementation of differentiation in the context of the lesson.	- She differentiated content, process, and product based on her students' readiness, interests, and learning profile. - Implement more differentiation strategies and techniques.

In conclusion, the aim to change the planning and teaching demonstrated a variety of improvements and changes, which can be incorporated into everyday teaching practice. The eighth finding concerns the planning of learning objectives. The research found that the teachers in the lesson study group spent enough time setting the goals of the research lesson, which were related to the aims of the detailed curriculum and to ensure that the lesson study work focused on these objectives and more on understanding. Teachers A and D initially focused mainly on the cognitive goals, teacher C on the comprehension objectives and teachers A and B on the skill objectives to complete the planning of the learning objectives of the specific lesson. All four members of the lesson study team ensured their implementation during their teaching.

The ninth finding is related to the implementation of formative assessment. The teachers participating in the lesson study group spent sufficient time creating activities suitable for formative assessments. However, not all teachers used the results of recent formative assessments about their students' readiness, interests or learning profile to the same extent in making decisions about the planning of their differentiated assignments. Additionally, they were reluctant to use more assessment tools even though the lesson study provided opportunities for discussions and implementation of processes related to differentiation. However, the team members tried to incorporate some of them during the planning of the research lesson, but some teachers did not implement them in their teaching as expected due to lack of previous experience.

Table 2 below briefly presents the most important findings previously mentioned, as well as the research question that guided this study.

Table 2: Research question and related findings

<p>Research question: How does participation in a lesson study cycle affect how teachers plan, implement, and understand differentiation?</p>
<p>Related findings: The lesson study:</p> <ul style="list-style-type: none"> - Develop flexibility in teaching planning. - Implement new strategies and techniques for differentiation in teaching. - Manages differentiation proactively. - Contributes to the successful implementation of differentiation. - Addresses classroom or teaching needs and challenges. - It affects existing beliefs and practices. - Implements the goals set by the teachers for the lesson study process. - Plans the learning goals. - Implements formative assessment.

5.2. Limitations

The existence of certain limitations in this particular study makes it necessary to consider them when interpreting the findings. Initially, among the members of the lesson study group, there were also teachers working in the same school unit in which the researcher has been working for the last sixteen years, who participated in the research as a mediator, and her participation may have influenced her interactions with the participants, in the way she analyzed the data and in the way she interpreted the findings.

Also, the findings of this particular research may have been hindered by its multidimensional role in lesson study and research processes. Although she attempted to analyze and be reflective about her influence on the whole process, she is unable to interpret how the participating teachers may have assessed her or her role as a positive or negative influence on the lesson study process and what they learned from her.

In addition, the findings regarding how the lesson study affects teachers' understanding, planning and implementation of differentiation are related to a small number of classroom observations and interviews of the participating teachers before and after the implementation of the lesson study cycle.

Nevertheless, another limitation concerns the challenge of analyzing group conversations, which are complex and evolving and are the result of many internal and external factors, some of which are difficult to identify or quantify. The researcher's active participation in these conversations may have enhanced or hindered the recording of lesson study group members' beliefs and intentions in these conversations and the identification and framing of those interactions that most fully represent the important findings. She stands behind her interpretations of these conversations in relation to her research question but realizes that complexity may suggest other interpretations of what happened and why relative to the context through which these conversations are interpreted.

6. Discussion – interpretation of the research findings

Based on the findings of the research, the lesson study strengthened the teachers' ability to develop flexibility when planning their teaching by focusing on the diverse needs of their students in order to ensure the participation of all in the lesson (Angelini & Alvarez, 2018). All four teachers agreed to jointly form a clear framework for the planning and teaching of the research lesson, and with the addition of materials and other elements, this planning became more flexible and open to change than it had previously been, as their specific way of teaching might have limited their thinking regarding the ways of differentiation. Through this process, the lesson became more attractive for all students, giving them the possibility of more choices. This finding is recorded in other research in the international literature (Hix, 2008; Hockett, 2010).

Also, with the implementation of the lesson study, all team members were encouraged to jointly plan the learning goals of the research lesson, to implement new strategies and techniques of differentiation in their teaching, and admitted that by

participating in this specific process, they enriched their knowledge about differentiation. This finding is also observed in studies by other researchers, where lesson study significantly influenced teachers' teaching, enhancing their ability to choose the most appropriate strategies according to the varied learning needs of their students (Lee, 2008; Van Sickle, 2011).

In addition, with the lesson study, the participating teachers were helped to manage the differentiation actively through the group discussions, which took place during the formation of the teaching plan of the research lesson and were also related to the selection of the differentiated tasks and their more effective implementation. The implementation of various differentiation suggestions and continuous assessment improved their teaching. This result is recorded by other researchers (Hockett, 2010; Jackson & Evans, 2017).

In addition, the contribution of lesson study to the successful implementation of differentiation is another finding of the present research, as teachers' participation in the lesson study process strengthened their confidence to use a teaching approach that they had not previously implemented, either because of doubts about its implementation or because they had not thought about it. This result is also recorded in other research in the international literature, in which the strengthening of the self-confidence of the members of the lesson study group through continuous learning and improvement of their teaching in the classroom is found (Carroll, 2013; Shouffler, 2018; Sirotic, 2015; Wright, 2009). The teachers who were selected to teach the research lesson and its re-teaching were the ones who experimented the most in this research, as they had the opportunity to carry out one more teaching session in which they had the possibility of implementing other differentiation techniques. In other research, it is reported that the successful implementation of differentiated instruction is related to teachers' familiarity with it (Dixon *et al.*, 2014; Smith, 2011; Wenzel, 2017).

Furthermore, teachers' ability to address existing needs and challenges that had been presented in their classroom before or during the implementation of the lesson study cycle appeared to be directly related to their decisions about whether and how to implement certain differentiation strategies. By applying flexible grouping during the teaching of the research lesson, the teachers sought to ensure the participation of all students in the teaching and the improvement of cooperation. This finding is also included in the results of other research in the international literature (Hockett, 2010; Stone, 2012).

It was also shown that the lesson study had a positive effect on the existing beliefs and practices of all team members, as before it was implemented, the teachers implemented differentiation based on their beliefs that it would be effective for teaching their lesson and in line with the way it was usually planned. The teachers integrated the techniques and strategies of differentiation into their existing beliefs and practices gradually and this integration was not sudden and inexplicable as the teachers participated in all stages of the lesson study, which contributed to the improvement of their teaching. This finding coincides with the results of other researchers in the Greek

and international literature, who found the formation of more positive attitudes and beliefs of teachers with their participation in the lesson study (Darra & Kanellopoulou, 2016; Collins, 2017; Hockett, 2010; Hogan, 2014; Howell, 2014; Mavroudi, 2017; Panoutsos, 2015; Shouffler, 2018; Stone, 2012; Van Sickle, 2011).

The specific research also showed that there was a direct correlation between the choices of implementation of various ideas and strategies that the teachers incorporated in their teaching and the realization of their own goals for the lesson study process. The main goals of the participation of all teachers in the lesson study were the improvement of their teaching and the more effective implementation of differentiated instruction in their lessons. This finding is also found in other research, where the participating teachers focused on improving their teaching practice (Hockett, 2010; Harsono, 2016).

In addition, with the implementation of the lesson study the teachers were asked to collaborate in the planning of the learning goals. All members of the lesson study team spent considerable time setting the objectives of the research lesson, which related to the aims of the detailed curriculum, and to ensure that the research lesson work focused on these objectives more of understanding. The same finding is recorded in other research (Ariss, 2017; Darra & Kanellopoulou, 2016; Hix, 2008; Hogan, 2014; Shouffler, 2018; Wright, 2009).

Regarding the use of formative assessment, the lesson study group members spent sufficient time creating activities suitable for formative assessments. However, not all teachers used the results of recent formative assessments about their students' readiness, interests, or learning profile to the same extent in making decisions about the planning of their differentiated assignments. Additionally, they were reluctant to use more assessment tools even though the lesson study provided opportunities for discussions and implementation of processes related to differentiation. However, the team members tried to incorporate some of them when designing the research lesson, but some teachers did not implement them in their teaching as expected due to a lack of previous experience. This result is also found in other researches (Hockett, 2010).

7. Conclusions

The analysis of the qualitative data and the results of the study led to the extraction of valuable conclusions about the positive effects of the implementation of lesson study in the context of implementing differentiated instruction.

The implementation of the lesson study offered a suitable framework for planning the teaching and exploring new management strategies and techniques that favor differentiation in teaching. In particular, the lesson study empowered teachers to develop flexibility in their teaching planning, focusing on the diverse needs of their students to ensure everyone's participation in the lesson, by forming a clear framework for planning and teaching the research lesson, and by incorporating elements, which made the design more flexible and open to revisions than it was before. By offering more options, the lesson became more attractive to all students.

Furthermore, with the implementation of the lesson study, all team members were encouraged to jointly plan the learning goals of the research lesson, applying new differentiation strategies and techniques in their teaching, enriching their knowledge of differentiation.

Also, all the teachers who participated in the implementation of the lesson study were helped to manage the differentiation actively through the group discussions, which were implemented during the formation of the teaching plan of the research lesson and related to the choice of differentiated tasks and in their most effective implementation. The implementation of various suggestions of differentiation and continuous assessment improved their teaching.

In addition, teachers' participation in the lesson study contributed to the successful implementation of differentiation, as their participation strengthened their confidence to use a teaching approach that they had not previously implemented, either because of doubts about its implementation or because they had not thought of it. The teachers who were selected to teach the research lesson and its re-teaching were the ones who experimented the most in this research, as they had the opportunity to carry out one more lesson in which they had the possibility of implementing other differentiation techniques. In addition, teachers' ability to address existing needs and challenges that had presented themselves in their classroom before or during the implementation of the lesson study cycle appeared to be directly related to their decisions about whether and how to implement certain strategies differentiation. By implementing flexible grouping during the teaching of the research lesson, the teachers sought to ensure the participation of all students in the teaching and to improve cooperation.

Furthermore, it was shown that the lesson study had a positive effect on the existing beliefs and practices of all team members, as before it was implemented, the teachers implemented the differentiation based on their beliefs that it would be effective for teaching their lesson and in line with the way it was usually planned. The teachers gradually integrated the techniques and strategies of differentiation into their existing beliefs and practices, and this integration was not sudden and inexplicable as the teachers participated in all stages of the lesson study, which contributed to the improvement of their teaching.

Also, in this particular research, it was shown that there was a direct correlation between the choices of implementation of various ideas and strategies that the teachers incorporated into their teaching and the realization of their own goals for the lesson study process. The main goals of the participation of all teachers in the lesson study were the improvement of their teaching and the more effective implementation of differentiated instruction in their lessons.

In addition, the implementation of lesson study encouraged teachers to collaborate in planning learning goals. All members of the lesson study team spent considerable time setting the objectives of the research lesson, which related to the aims of the detailed curriculum, and to ensure that the research lesson work focused on these objectives, more of understanding.

Finally, regarding the use of formative assessment by the members of the lesson study group, it was found that not all teachers used the results of the recent formative assessment regarding the readiness, interests, or learning profile of their students to the same extent for making decisions about the planning of their differentiated tasks. In addition, they were reluctant to use more assessment tools even though the lesson study offered opportunities for discussions and implementation of processes related to differentiation. However, the team members tried to incorporate some of them during the planning of the research lesson, but some teachers did not implement them in their teaching as expected due to lack of previous experience.

Conflict of Interest Statement

The authors declare no conflicts of interest.

About the Author(s)

Eurydice-Maria Kanellopoulou is a teacher in secondary education. She has completed postgraduate studies at the Hellenic Open University and is a PhD candidate at the Pedagogical Department of Elementary Education of the University of the Aegean. She has participated with papers in Greek and international scientific conferences and her articles have been published in Greek and foreign magazines. Contact details: evikanell@gmail.com.

Dr. Maria Darra is Associate Professor with subject in "School Pedagogy: Educational planning and evaluation of educational work" at the Department of Primary Education of the University of the Aegean. She is graduate of the Pedagogical Department of Primary Education of the National and Kapodistrian University of Athens and of the Department of Philosophy-Pedagogy-Psychology, of the Faculty of Philosophy of the Aristotle University of Thessaloniki. She has a Thesis Postgraduate Diploma Specialization in the field of Sciences of Education from the Pedagogical Department of Primary Education of the National and Kapodistrian University of Athens and Doctoral Degree from the Pedagogical Department of Primary Education of the National and Kapodistrian University of Athens. Her works have been published in international and Greek scientific journals, collective volumes and proceedings of international and Greek conferences.

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