RESEARCH ARTICLE

The management of Digital Learning Objects of Natural Sciences and Digital Experiment Simulation Tools by teachers

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Abstract: In the present study, we tried to find possible obstacles that Primary and Secondary education teachers face when managing Digital Learning Objects (DLOs) and/or Digital Simulation Tools (DST) in science. One hundred seventy-six teachers from all over Greece answered the questionnaire. The results showed that the main reason for refusing to deal with DLOs and DSTs is the technological equipment. Also, the lack of adequate training level B results in about 25% of the teachers who do not know the DSTs, and 30% do not know the DLOs. Factors such as the teaching experience, the specialty, the Pan-Hellenic examinations, the classes they teach in, and the number of students per class negatively affect the teachers' attitude to get involved with the DLOs the DSTs. Finally, the negative attitude seems to be related to the lack of trust in the curriculum content as teachers prefer to search DLOs and DSTs on the internet. Further research with mixed methods of analysis would help to obtain satisfactory results.

Keywords: digital learning objects, digital experiment simulation tools, teacher's attitudes, natural sciences

1   Introduction

The digital world provides many opportunities for the younger generation to develop the capacity for action, skills, knowledge, and a perspective to overcome dissatisfaction through scientific studies (Boilevin & Ravanis, 2007; Mooij, 2007; Papadakis et al., 2021). Nevertheless, the digital world is present and has invaded our lives; that is a fact. So, we cannot just say that we accept it or that we are opposed to it. We start with the assumption that digital technology's effects on education should be measurable (Kallou & Kikilia, 2021; Kalogiannakis, 2008; Papadakis et al., 2017; Papadakis et al., 2018).

In 2020, humanity reached its limits against natural disasters and the Covid-19 pandemic. Greece was one of the countries in the world that, even at an early stage (February to May), handled this crisis relatively well, which was emphasized by the international media (https://www.nytimes.com/2020/04/28/world/europe/coronavirus-Greece-europe.html). A natural consequence of this situation was the suspension of the operation of schools and the continuation of teaching online. The teachers were confronted with a method unknown and unfamiliar to them, which caused their dissatisfaction for various reasons (Kalogiannakis et al., 2009).

Many studies, such as those of Fullan (2007), Thulin (2011), Tytler (2007, report it as a western problem. They describe educational reforms as the failure of today's education systems to meet the needs of modern western societies. A long-standing problem is an artificial distinction between learning at school and real-life learning, which often inhibits the transfer of knowledge and skills and creates unwanted barriers to re-establishing learning as a strong motivator of innovative problem-solving (Kalogiannakis & Papadakis, 2008). The promotion of innovation and ongoing reform is at the heart of the "21st Century Skills Framework", which attempts to understand how learning should work in the current social needs (Dede, 2010). Among the research conducted in the global educational community, the research referred to the Natural Sciences and their difficulties during their teaching (Bahar, 1999; Ravanis, 2005).

Although, as we mentioned earlier, the innovations offered by the Digital Learning Objects in education are treated with distrust by the teachers due to many shortcomings, however, they are inextricably linked to the evolution of technology and the use of ICT in the educational process (Dodani, 2002; Quinn & Hobbs, 2000) Research on the possibilities of DLO argues

that it introduces not only innovative teaching methods but also promotes collaborative learning (Haughey & Muirhead, 2004; Redfors et al., 2014).

In the present study, we will examine how and to what extent teachers handle Digital Learning Objects (DLOs) for the Natural Sciences and whether they use - and to what extent - Digital Simulation Tools (DST) Experiments Natural Sciences in distance teaching. The research examines and records how teachers utilize the DLO and the DST in distance learning to achieve the teaching objectives. It will also be investigated whether they are aware of both DLO and Digital Experiment Simulation Tools and to what extent they use them in the learning process. We will also analyze whether it depends on gender, age, academic qualifications, teaching experience, the number of students per class and the technological equipment of the school, the utilization of the DLO, and the DST by teachers. We will answer what factors lead teachers to use DLO. and the DST in the teaching of Natural Sciences

Our research investigates the possible factors that stand in the way teachers use the DLO and the DST. Also, we will partly try to answer whether the Greek education system and the Primary Education teachers are ready for modern teaching in the course of Natural Sciences in the time of the 2020 pandemic. To answer these research questions, we must first examine and clarify the DLO operation and the DST operation.

2   Theoretical framework - Concepts and definitions

2.1   Digital Learning Objects

2.1.1   Definition of DLO

From time to time, many definitions have been given to DLO. According to the research of Norman & Porter (2007), referring to the DLO, they characterize them as:

(1) A piece of content structured to support learning through possible inclusion of educational objectives, content, resource, activities, and assessments.

(2) A piece of content designed to ensure reuse in different educational settings.

(3) A piece of content can be stored in different digital learning management (LMS) systems or used in many different delivery methods.

The DLO or Reusable Learning Objects (RLO) are learning activities in digital form, which teachers can use to introduce Information and Communication Technologies (ICT) in the educational process. According to Billings (2010), in his research, DLOs are software programs based on visual contact and can be reused to achieve the teaching goals set by the teacher. He says that they are generally small programs, which, among other things, in their description, indicate the teaching objectives that are to be achieved. This definition is completed by the research of Redmond et al. (2018), which characteristically states that the DLO combines both visual and audio information. Through their interactive use by teachers and students, they facilitate the latter to create conceptual connections and achieve learning benefits.

2.1.2   Characteristics of digital learning objects

We find the DLO as digital learning resources (Van Assche & Vuorikari, 2006). As mentioned in Sotirova's (2020)(Sotirova, 2020) research, their main features are accessibility, reuse, interoperability, and adaptability to different software. Beyond that, some other features mentioned in the research of Sinclair, Joy, Yau, & Hagan (2013) are resilience, detectability, analytic ability, and manageability.

Also, in Papastergiou & Mastrogiannis (2021) research, it is mentioned that the DLO is divided into two categories. Those who have a teaching orientation and those who have constructivism. The results showed that these two types of DLO do not differ significantly in design and usability. However, the latter was much more interactive, attractive, and valuable in teaching than the former.

2.2   Simulation programs

2.2.1   Definition

In their research, Thompson et al. (2019) describe simulation programs as programs - software (software), simulating natural phenomena in safe conditions and as realistically as possible. They help learners understand, record, and analyze various phenomena related to the Natural Sciences, think critically about them, repeat the experiment and solve any problems they may encounter.

Many students have a negative attitude towards learning Physics. Therefore, effective teaching using ICT encourages students to cultivate their positive attitudes towards the subject. Zacharia's (2003) research highlights that an educational process occurs when the teaching of Natural Sciences is combined with interactive learning to facilitate understanding the essence of each phenomenon.

Many researchers (Bradley & Kendall, 2014; Jaakkola & Nurmi, 2008; Jaakkola et al., 2011; Lim, 2015; Sokolowski, 2013) wanted to improve the learning process through the DST and studied their use during the courses. According to the research of Jimoyiannis & Komis (2001), the participation of students in the learning process was positively influenced by the entry of the faculty in the daily course of Natural Sciences, a view which agrees with the studies of Rutten et al. (2012) and Sokolowski (2013). Summarizing the findings of the research, we would say that simulation:

(1) helps learners build on their existing knowledge (Jimoyiannis & Komis, 2001).

(2) allows students to handle the variables that constitute the phenomena and observe the resulting results (Zacharia, 2005).

(3) improves the environment in which the experiment will take place in order to make it more understandable to learners (Jaakkola & Nurmi, 2008).

(4) provides constructive feedback for learners to process (Ronen & Eliahu, 2000).

(5) students can observe natural events that are not immediately visible because they can be either too big or too small, or too slow or too complicated and dangerous to watch live (Bajzek et al., 2005; Kalogiannakis & Papadakis, 2017; Ulukök & Sari, 2016).

2.2.2   Characteristics of Simulation Programs

Many researchers (Alessi & Trollip, 2021; Bradley & Kendall, 2014; Maier & Größler, 2000) have categorized DSTs by type, industry, technology, and purpose. Alessi and Trollip characterize as simulations that help shape the teaching, the environments in which they are formed, and the interpersonal interactions of the participants, making them a valuable tool for student training and the evaluation of the students their teachers.

The research of Kaufman & Ireland (2016) focused on the following three types of simulations. (see Table 1)

Table 1   Three types of simulations, according to Kaufman & Ireland

Type	Description
Scenario/Role-Play Simulations	In such a simulation, the student plays the role of the teacher. During the course, he may need to conduct research or move around analyzing the teaching scenario he has to do with the logic of the "web".
Simulations with Standardized Students	For example, with eduSIMS (http://edusims.syr.edu), the training of the managers is done by students or members of a specific community who use the simulation to develop management skills through difficult everyday situations.
Computer-Based Clinical Simulations	In this simulation program, someone can choose different teaching methods. Feedback, interaction, and reshaping of the learning scenario are the key features of the program.

3   Methodological framework

3.1   Aim and purpose of the research

In the present research, we will examine how and to what extent the teachers handle the Digital Learning Objects (DLO) for Natural Sciences and whether they use them - and to what extent - the Digital Simulation Tools (DST) of Scientific experiments in distance learning. The present study examines how teachers utilize the DLO and the DST in distance learning to achieve the teaching objectives. In this research context, national and international research ethics guidelines are followed (Petousi & Sifaki, 2020).

In addition, it will be investigated whether they are aware of the existence of both DLO and Digital Experiment Simulation Tools and to what extent they use them in the learning process. We will also analyze whether the utilization of the DLO and the DST depends on:

(1) the sex of the teachers;

(2) the age of teachers;

(3) the academic qualifications;

(4) the teaching experience;

(5) the class in which they teach;

(6) the number of students per classroom;

(7) the technological equipment of the school.

3.2   Research population

To accomplish the research, we used as target-population all primary and secondary school teachers taught or are about to teach a science course. The method that will be used will be snowball sampling.

3.3   Data collection tool

The survey uses an anonymous online questionnaire that includes 98 multiple-choice, binary, open, and closed questions. It is essential to mention that depending on the choice of each respondent on whether or not they have prior knowledge of the DLO and DST and whether they intend to deal with the above, the number of the question's changes.

Table 2 shows the reference areas and the number of questions that make them up in more detail.

Table 2   Areas of reference and number of questions

Question reference areas	Number of questions
Demographics	3
Individual data	29
Technological equipment	13
Technical characteristics of DLO and DSTs	34
Educational process	13
Teaching objectives	6

The survey utilizes Likert's 5-tier scale, multiple-choice questions, and Yes-No binary questions. In addition, there are short-answer questions and questions where an answer of up to one paragraph is needed.

The structure of the questionnaire is characterized by internal coherence and stability, making it a reliable tool. As far as validity is concerned, this is based on research questions. The questions are appropriately designed to provide answers to both the objectives and the purpose of the survey (see Table 3).

The grouping of the questions is related to the positive or negative attitudes adopted by the teachers for DLOs and DSTs.

The Google Forms page is used to collect quantitative data. The questionnaire is addressed to all teachers who teach Natural Sciences. The sharing is done through social networking pages, the researcher's web page, as well as through e-mails.

3.4   Sharing results

The sample consists of 176 people (N = 176). For teachers to complete the online question-naire, a "bonus" is used in the form of a text containing DST. websites.

4   Results

In order to obtain the results, we used various methods of analysis with the use of the SPSS program. Figure 1 shows the basic structure of the questionnaire. It is worth pointing out that before these areas, demographic and personal questions preceded them.

Below, the results are reflected according to the groups and sub-groups of questions that arise from our research questions.

4.1   How teachers utilize DLOs and DST in distance learning

Figure 2 records the choice of teachers in the distance and lifelong teaching. The number of the teachers who are not aware of the DLO and the DST is listed as missing DLO and missing DST.

It is easy to conclude that teachers are not so familiar with distance learning. Therefore, these results form a first insight into the research objective, i.e., "whether teachers are ready for modern teaching." To answer the question "how teachers use DLO and DST in distance

Table 3 Grouped responses per field of examination (variables)

Attitudes	Answers
Positive Attitudes for DLO	They facilitate the educational process. It is a pleasant way of teaching the students. Students are more interested in this way of teaching. Students are interested in being actively involved in this way of teaching. I have noticed that student performance is improving. They are tailored for specific age groups. I can use them in the context of interdisciplinary. They meet the educational goals I have set. They are easy to use. I have plenty of options. School computers "run" the programs with great ease. It is an alternative way of teaching. They are based on modern teaching methods.
Negative Attitudes for DLO	I have not been informed about their existence. I have not been trained in them. I do not have good computer knowledge. They are causing me insecurity. They make me nervous during the learning process. I do not have time to study them. I am not interested in technologies. I have unpleasant experiences of using ICT in the learning-teaching. I think they are disorienting the kids during the lesson. I feel too old to deal with these means of teaching.
Positive Attitudes for DSTs	They facilitate the educational process. It is a pleasant way of teaching the students. Students are more interested in this way of teaching. Students are interested in being actively involved in this way of teaching. I have noticed that student performance is improving. They are tailored for specific age groups. I can use them in the context of interdisciplinary. They meet the educational goals I have set. They are easy to use. I have plenty of options. School computers "run" the programs with great ease. It is an alternative way of teaching. They are based on modern teaching methods
Negative Statements for DSTs	I am too old to learn how to handle them. I do not know how they work. I do not have enough time to learn how to operate them. I do not have enough teaching time to use them. I need someone more experienced than me in order to use them. Their use makes me afraid I might be exposed to the children by a possible mistake. Their use makes me nervous about being exposed to the children by a possible mistake. It is tricky. I do not think they help in the learning process. I think they are disorienting the kids during the lesson. I do not know how to handle a computer well. They do not actively involve my students in the educational process. They do not allow interaction between my students.

learning," we used the sample of teachers who prefer distance teaching. The results show higher numbers in the following responses:

(1) For Physics/Science

a. 37.5% answered that they "sometimes" use the DLO in the learning process, while 35% and 15% of the teachers answered that they use them "often" or "always."

b. Respectively 43.9% answered that they "often" use the DST in the learning process, while 29.3% and 19.5% use them "always" and "sometimes," respectively.

(2) For Geography

a. 38.7% answered that they "often" use the DLO in the learning process, while 22.6% of them use the DLO "sometimes" or "rarely."

b. 28.6% answered that they "frequently" use the DST in the learning process, followed by
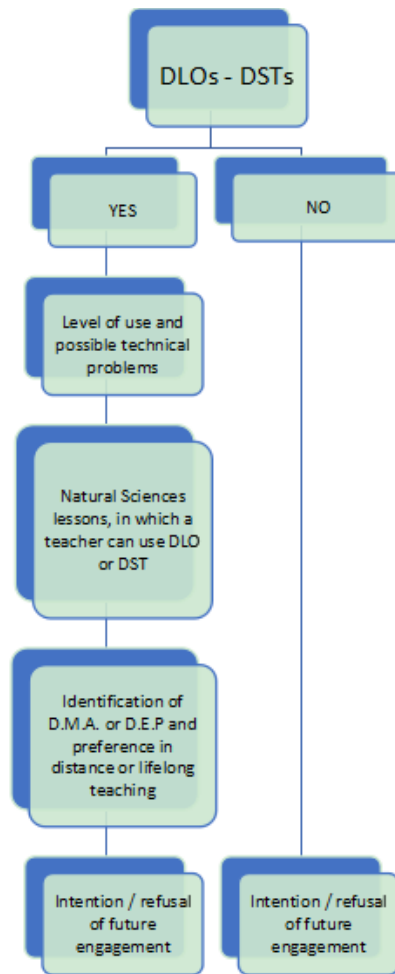
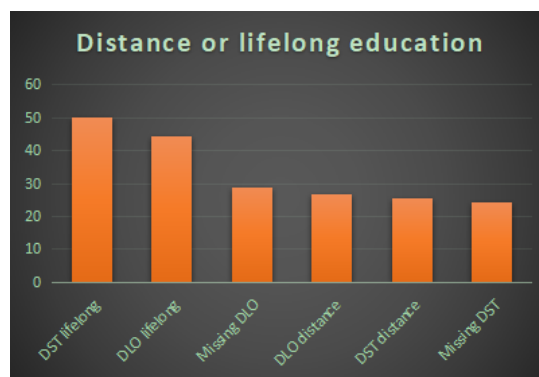**Figure 1**   Basic questionnaire body without demographics

Figure 2   The use of DLO and DSTs in *the distance and lifelong teaching*

the answers "rarely" with 21.4%, "always," and "sometimes" with 17.9%, and finally "never" with 14,3%.

(3) For Biology

50% answered that they "often" use the DLO, while 27.3% of them answered that they "never" use the DLO, and 18.2% "sometimes" use them. At this point, it would be helpful to mention that there is not a single Secondary school teacher who "always" uses the DLO. 38.1% of the teachers answered that they "sometimes" use the DST to teach, while 23.8% of them "often" use them. Also, 19% of the teachers answered that they "always" use the DST and 14.3% of them "never" use them.

(4) For Chemistry

32% answered that they "often" use the DLO, while 28% of the teachers answered that they either use them "sometimes" or "never." Also, 30.8% of the teachers said they "always" or "often" use them. The answer "never" was given by the 15.4% of the teachers, whereas the answers "rarely" and "sometimes" were given by the 11.5% of the teachers each. For the interpretation of the results, it should be noted that the double percentages are mentioned in the results and that the answer "never" was possibly chosen by those who do not teach them at all, because if they stated in a previous question that they do not know the DLO, they would not reach to this question. However, we also leave open the possibility that a teacher chose "never" for his lesson.

4.2   To what extent do teachers know and use DLOs and DST?

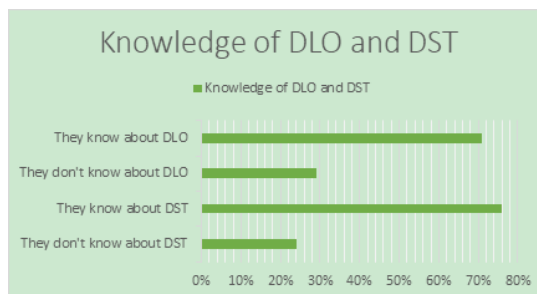The findings of the research on the knowledge of DLO and DST. are presented in Figure 3.

Figure 3   Knowledge of DLOs and DSTs

As for their use of the DLOs, 45.6% of those who know them said they "frequently" use them. The following answer is "rarely" with 28%, followed by answers "very often," "all the time," and "hardly ever" with 14.4%, 6.4%, and 5.6%, respectively. The responses related to the use of the DSTs are almost equal to the options "rarely," "frequently," and "hardly ever" with 29.5%, 27.3%, and 26.7% respectively, followed by the answers "very often" with 9.7% and "all the time" with 6.8%.

4.3   "To what extent does teachers' attitude depend on gender, age, academic qualifications, teaching experience, student numbers, and technological equipment?"

The results briefly showed that teachers' gender is associated with negative attitudes. Age groups seem to be particularly affected by negative attitudes towards DST. However, mixed research is needed to clarify the results, as heterogeneity has been found. The Postgraduate Diploma and University degree group present a statistically significant difference in the DST's negative attitudes in studies. There is a correlation between teachers' teaching experience and their negative attitudes towards DST. In teachers' specialty, there is a common heterogeneity of positive attitudes for the DLO and the DST, from the following groups of specialties:

(1) PE 71 with PE 02 (Special Education with Philologists)
(2) PE 60 with PE 04.02 (Kindergarten teachers with Chemists)
(3) PE 60 with PE 02 (Kindergarten teachers with Philologists)
(4) PE 60 with PE 01 (Kindergarten teachers with Theologians)
(5) PE 04.01 with PE 02 (Physicists with Philologists)
(6) PE 70 with PE 02 (Teachers with Philologists)
(7) PE 70 with PE 01 (Teachers with Theologians)

In terms of the positive attitudes for the DLOs, there was heterogeneity in the following groups of specialties:

PE 04.04 with PE 02 (Biologists with Philologists)

Only in terms of positive attitudes for DST, there is heterogeneity in the group of specialties between PE 04.01 and PE 01 (Physicists with Theologians).

Regarding the direction of the study of the teachers when they were sitting for the Pan-Hellenic examinations, the results show a significant statistical difference-heterogeneity in the negative attitudes for the DLO in the six (6) groups below, as presented in Table 4.

As far as the relevance to the Natural Sciences of Postgraduate or Doctoral Degrees is concerned, there is no correlation. Regarding the ICT Training, the results show a statistically

Table 4   Groups of guidelines for the Pan-Hellenic examinations showing heterogeneity

Groups	sig.	Explanation of group numbers
1-4	0.031	(Positive Direction with Bundle 1)
2-4	0.021	(Theoretical Direction with Bundle 1)
2-7	0.014	(Theoretical Direction with Bundle 4)
4-7	0.024	(Bundle 1 with Bundle 4)
6-7	0.048	(Bundle 3 with Bundle 4)

significant difference between the group of teachers who have received level B and level A training, attributed to the statistical difference between those who maintain positive attitudes towards the DLOs and answered NO other two categories. As for the negative attitudes towards the DLO, the group of differentiated teachers is the one that has received only first-level ICT training. Also, the training seems to be related to the intention of teachers to deal with the DLO in the future. Regarding the positive attitudes towards the DST, the group of teachers who have not received any training tends to differ from the other two groups, while the negative attitudes towards DST, the group of teachers who have received ICT A-level training, tend to differ from the other two groups.

Concerning the classes taught by teachers, the survey results show that teachers who teach in E' and F' classes of Primary school are statistically significantly differentiated from those who teach in another class regarding positive attitudes towards DLO. Correlation is found in teachers teaching B' and C' classes of Primary school and their future intention to engage with the DLO.

Also, there is a correlation between teachers who teach in Year 2, 3, and 4 of Primary school with prior knowledge of the DLO. As far as DST is concerned, there is a statistically significant difference between those who teach in Kindergarten and the others in terms of negative attitudes towards DST. Moreover, there is a statistically significant correlation between the teachers who teach in the 2nd Year of High school and the others regarding their future involvement with the DST. Finally, a correlation is found between the teachers who teach in Kindergarten and the 1st Year of Primary school compared to the others regarding their prior knowledge of the DST.

The number of pupils in the classes shows a statistically significant difference in positive attitudes from teachers who have 15, 16, 26, or 27 pupils in their classroom. In addition, there is a statistically significant difference in negative attitudes from teachers who have 7 or 17 pupils in their classroom. At the same time, there is a correlation between teachers who have 15 and 27 students in their classroom with future involvement of teachers with DLO and with DST.s, while a correlation is found between teachers who have 21 students in their classroom and prior knowledge of the DLO Similarly, there is a correlation between those teachers who have 25 students in their classroom and having prior knowledge of the DST.

Concerning technological equipment, the results show heterogeneity and statistically significant difference in responses both in terms of positive and negative attitudes and for DLOs and DST.s. Finally, a correlation is identified between the technological equipment and future use of the DST.

4.4   "Factors that lead teachers to use the DLOs and DST"

According to the teachers' answers, 36.8% of the respondents agree that the DLOs facilitate the educational process. 47.2% believe that it is a pleasant way of teaching. 42.4% strongly agree that students show more interest in this way of teaching. 43.2% agreed that students are interested in being actively involved in this way of teaching. 40.8% agree that they have noticed an improvement in student performance. 35.2% strongly agree that the DLOs can be used in the context of Interdisciplinarity. 51.2% agree that the DLOs meet the goals of the teacher. 45.6% agree that they are easy to use. 32.8% agree that they have a variety of options. 40.8% agree that it is an alternative way of teaching. 39.2% agree that the DLOs are based on modern teaching methods. Some answers that show the will of these teachers to use the DLO are "*Some phenomena are not described only with words or with an image. MOVEMENT is very desirable . Also the meanings are given much faster.* ", "*There is a better achievement of goals and responses by the students,*" and "*They help children with learning difficulties.*" For the DST, it is true that 42.1% of the respondents agree that DST facilitates the educational process. 43.6% completely agree that it is a pleasant way of teaching. 39.8% completely agreed that students show more interest in this way of teaching. 39.8% agreed that students are interested in being actively involved in this way of teaching. 40.6% agree that they have noticed an improvement in student performance. 32.3% agree that they are adapted to specific age groups. 36.8% agree that the DLOs can be used in the context of Interdisciplinarity. 44.4% agree that the DLOs meet the goals of the teacher. 35.3% agree that they are easy to use. 31.6% completely agree that they

have a variety of options. 41.4% agree that it is an alternative way of teaching. Finally, 42.9% agree that the DLOs are based on modern teaching methods. Also, answers such as "*They work supportively for students with learning difficulties or disabilities*," "*They save enough teaching time,*" and "*I consider them necessary*" emphasize even more the "thirst" of the teachers to use the DST.

By recording their views about why they would be interested in engaging with the DLO, we received responses such as: "*Through their use, better learning outcomes are achieved as they contribute to learning. They mobilize the active participation of all students (through visualization), which they find attractive, exciting, and ultimately functional as it makes it easier for them to understand the different concepts pleasantly.*"

Many more answers emphasized the importance of the DLOs in the educational process, and many also agreed that "*it is the future of education.*" For the DST, the answers that aroused great interest were the following: "*It is a simple way for the students to see the results of an experiment and its process without collecting any material. It also allows the representation of experiments that are not feasible in the classroom.*"

Answers such as "*They help the students to understand the subject better*" and "*they are interesting*" were often slightly changed, as the necessity and the ease of the DST are often stressed in education. As a general comment, we would say that the DLOs have fanatical supporters, fewer in population than those who choose the DST due to convenience and immediacy. In conclusion, what prevails is the intention of the teachers to deal with both the DLOs and the DSTs. Finally, in the results, we observe a significantly more significant difference - 30.6 percentage units between the positive and negative answers for the IBAs and 47.4 percentage units' difference between the positive and negative answers for the DST – of those who choose to deal with the DST rather than with the DLOs.

4.5 "Factors that prevent teachers from using the DLOs and the DST"

This sub-section studies the factors that prevent teachers from using the DLO and the DST. The answers show that 32.4% of the respondents characterize the technological equipment of their School Unit as "moderate." 21% describe the technological equipment as "little" and "enough" respectively, while 12.5% describe it as "incomplete," with the remaining 13.1% describing it as "complete." Regarding the access to a computer that supports the programs which are needed for distance learning, 15.3% answered 'No,' 39.2% answered 'Yes,' while 45.5% admit that although they do have access, the computer most of the times cannot support all the programs which are necessary for teaching at the same time. In addition, the teachers answer the question of whether they have problems with the internet. Their answers are almost divided into similar percentages, as shown in Table 5.

Table 5   Groups of guidelines for the Pan-Hellenic examinations showing heterogeneity

Percentage	Select an answer
23.9%	All the time
23.3%	Very often
22.7%	often
21.0%	seldom
9.1%	never

They then answer whether a change or cancellation has been made to the course due to WebEx, internet, or P.C., to check whether these three reasons affect the learning process. From the answers, it is concluded that the internet and the distance learning program proposed by the Ministry of Education (2020) plays a fairly significant role in the educational process since a large proportion of the teachers reply that the change or cancellation of the teaching is often due to these two factors.

Another component that is being considered in this research is the possibility that the use of the school textbook will affect the educational process. This is the most critical teacher's manual since the Ministry of Education proposes it. The results are presented in Table 6. However, they disagree with the view that this is what the teachers trust.

The analysis of the Table 7 concludes with relative certainty that the CURRICULUM is not what the teachers trust.

The worrying statistic resulting from the answers to the question "how often do you use the DSTs in S.E." is that only 6.8% and 9.7% answer "all the time" and "very often" respectively, while very high percentages receive the answer "often" with 27.3%, which somewhat normalizes

Table 6   Search rates for DLO on the internet, the Photodentro platform, or the curriculum

Search DLO in	Internet	Photodentro platform	Curriculum
never	4.8	10.4	19.2
seldom	12.8	13.6	27.2
Sometimes	26.4	30.4	31.2
often	36.8	29.6	16.8
always	19.2	16.0	5.6

Table 7   DST search rates on the internet or in the Curriculum

Search DST in	Internet	Curriculum
never	6.8	17.3
seldom	3.0	21.8
Sometimes	18.8	31.6
often	43.6	21.1
always	27.8	8.3

the situation. On the contrary, only 29.5% of the respondents choose the answer "seldom," while a significant 26.7% choose the answer "very rarely."

Also, this research suggests that the internet and the Webex distance learning program are the two most common causes of interruption of their course when it is carried out using DST, while quite a large percentage (17%) of the students are not subjected to the use of DSTs, which highlights problems resulting from computer failures. On the other side, the results show that the respondents do not take age as a serious variable. However, many teachers state that they do not know how the computer works, while some also focus on the lack of staff and teaching time. Moreover, the same seems to be true for those who admit that factors such as anxiety and fear affect their positive attitude towards DST. However, a positive sign is that many teachers believe that the DST supports the learning process.

First of all, it should be stressed that 41.2% of the teachers claim that they have never been informed about the existence of the DLO. A similar percentage is found in whether they have received any training about the DLO, with 39.2% giving a negative answer. 29.4% agree that they do not have good computer knowledge, while 31.4% agree that the DLO makes them feel insecure. 33.3% of the teachers agree that they experience anxiety problems during the learning process as they use DLO, while 39.2% agree that they do not have time to study their use. When the teachers were asked to write why they do not want to deal with the DST in the future, the answers were:

(1) "*They are time-consuming.*"

(2) "*Experiment simulation tools are offered more in the context of the Physics class of Year 5 and 6 of Primary school in which I am not experienced.*"

The answers for the DLO were similar when they were asked to write why they do not want to deal with the DLO.

(3) "*I do not know how to use a computer.*"

(4) "*I am scared and anxious.*"

Another obstacle appears to be the results of those who initially answered that they know about the DLO and the DST. Concerning the DSTs, the answers to "whether DSTs are tailored to specific age groups" tend to be more negative than the DLOs. Finally, as far as the question of whether computers can "run" the programs required for the DLOs and the DSTs is concerned, we observe that the highest percentages are found in the answers "I am indecisive" and "I disagree," which gives a negative attitude in the views of the respondents.

5   Limitations

The limited time to research in conjunction with Greece's situation during the preparation period is considered two significant obstacles that had to be overcome. Pandemic conditions are such that they do not allow easy maneuvering in problems such as searching teachers' e-mail addresses, although access to such data is considered more accessible. Also, it is impossible to share work from school to school, except by e-mail.

Concerning the research part of the present study, it should be noted that the lack of a sufficient number of DLO and DST related to Special Education restricts from the beginning the number of positive teacher attitudes towards the DLO and the DST about Natural Sciences. Also, due to the conditions during a pandemic and the limited time, it was not possible to carry out a mixed method of research (qualitative and quantitative together) in order for teachers to express their thoughts clearly and clarify the points where heterogeneity was found.

6   Conclusions

As mentioned above, the study aimed to examine and record how teachers use the DLO and the DST in distance learning to achieve teaching objectives. In addition, it was investigated whether they are aware of the existence of both DLOs and DSTs, as well as to what extent they use them in the teaching process. We also analyzed whether it depends on gender, age, academic qualifications, teaching experience, the number of students per class, the school's technological equipment, the utilization of the DLO, and the DST by teachers. Finally, we answered what factors lead teachers to use the DLO and the DST in the teaching of Natural Sciences. The purpose of our research was to investigate the possible factors that prevent teachers from making use of the DLO. and the DST and partly answer whether the Greek education system and consequently Primary Education teachers are ready for the modern teaching in the course of Natural Sciences in the time of the pandemic of 2020.

From the above analysis of the answers, the most fundamental obstacle faced by teachers in making use of the DLOs and the DST is the technological equipment of the school they teach. The results showed that both the internet connection and the WebEx program made it quite difficult for teachers to teach through distance learning. However, mixed qualitative research is necessary due to the heterogeneity of the results, which could investigate teachers' attitudes through the direct way of the interviews. The lack of B' level ICT training is, as it seems, a key factor for teachers who have a negative attitude towards DLO. It was found that those who have no training or level A training tend to affect using the DLO in the educational process negatively. We assume that the deepening that the teachers are called to carry out during the B 'level of training is the one that essentially determines their attitude. In addition, the lack of substantial training results in about 25% of teachers not being aware of the DST, but also 30% not being aware of the DLOs.

Regarding the DLOs, there is fear and insecurity on the part of teachers. The results show that the DST is considered more immediate and effortless by nature, while the DST, although less popular, has a more "fanatical" audience. Also, the lack of trust in the curriculum content leads teachers to search about the DLO and DST on the internet. Inevitably, this process will create problems on many levels such as time, insecurity, fear that these tools do not fit their teaching subject, how demanding their use is, etc. Our view is that further research is needed in specific areas to define clearly what obstacles teachers may face.

Further research is needed on whether teaching experience, teachers' specialty, the Pan-Hellenic directions, the classes they teach, and the number of students per classroom influence their attitude towards their involvement with the DLO and the DST. Although the results obtained correlate teachers' refusal to be involved with the DLOs and the DST, in some cases, there is heterogeneity that needs to be clarified through mixed research methods. Finally, concerning the training received by teachers (A' or B' level), although it seems that those who have ICT A' level training do not have a positive attitude towards the DLO, in order to define clearly what obstacles teachers may face in the future that could be another research with a mixed analysis of quantitative and qualitative methods of analysis to obtain satisfactory results.

7   Discussion

In summary, we would say that this work is considered valuable and necessary as it presents teachers' attitudes towards teaching innovation and the direct use of these modern teaching methods in both life and distance teaching (Papadakis et al., 2021). At the same time, it examines whether there was or is a background in which teachers can teach in a completely different way, under challenging conditions, combining teaching and innovation. Perhaps the most critical finding of this work is that the education system, constantly volatile and sporadic, was not ready for such radical changes (Tzagkaraki et al., 2021). Not all teachers have attended a Level B training program and facilities; school equipment was considered low-level by the interviewees themselves. Therefore, all teachers should attend Level B training to enable the next generation of teachers to learn about the benefits of using ICT in the educational process, which coincides with that of (Haas et al., 2018; Zacharia, 2003).

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