DISTANCE BASED LABORATORY SPECIALTY COURSES
ΕΞ ΑΠΟΣΤΆΣΕΩΣ ΕΡΓΑΣΤΗΡΙΑΚΑ ΜΑΘΗΜΑΤΑ ΕΙΔΙΚΟΤΗΤΑΣ

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Abstract

An important aspect of distance learning is considered to be the flexibility it provides, both in terms of the time, but also the place of its conduction. That freedom of choice makes it a necessity, for the educational institutions and their faculties, to form a detailed and specialized curriculum that implements teaching methods proven to perform better in distance education scenarios. More specifically, in fields that include courses related to either the natural sciences, such as physics, chemistry and mathematics, or the applied sciences of technology, there is a direct link between the theoretical courses and laboratory activities. The purpose of this study is to highlight the importance of finding ways that properly convey the material of laboratory specialty courses through distance learning.

Key words: *distance education, laboratory courses, specialty*

Περίληψη

Σημαντικό στοιχείο της εξ' αποστάσεως εκπαίδευσης αποτελεί η ευέλικτη μαθησιακή διαδικασία, τόσο ως προς το χρόνο, αλλά και τον τόπο πραγμάτωσης της. Η δυνατότητα πολλαπλών επιλογών κατά την εφαρμογή αυτού του τύπου εκπαίδευσης απαιτεί από τα εκπαιδευτικά ιδρύματα αλλά και τους εκπαιδευτικούς τους, τη δημιουργία λεπτομερών και εξειδικευμένων προγραμμάτων σπουδών καθώς και την εφαρμογή μεθόδων διδασκαλίας προσαρμοσμένων στην εξ΄ αποστάσεως εκπαίδευση. Συγκεκριμένα, σε μια σειρά από ειδικότητες των οποίων τα μαθήματα συνδέονται είτε με τις φυσικές επιστήμες, όπως η φυσική ή χημεία και τα μαθηματικά, είτε με τις εφαρμοσμένες επιστήμες της τεχνολογίας, υπάρχει άμεση συσχέτιση μεταξύ των θεωρητικών αποσπασμάτων και των πρακτικών εφαρμογών που εκπονούνται στα πλαίσιά τους. Ο σκοπός λοιπόν της παρούσας μελέτης είναι να αναδειχθεί η σπουδαιότητα της εύρεσης κατάλληλων τεχνικών που μεταδίδουν επ' ακριβώς το περιεχόμενο των εργαστηριακών μαθημάτων ειδικότητας μέσω εξ' αποστάσεως εκπαίδευσης.

Λέξεις κλειδιά: *εκπαίδευση, εξ αποστάσεως, εργαστηριακά μαθήματα, ειδικότητα*

INDRODUCTION

As years go by, the demand for acquiring specialized knowledge is growing more and more, making the traditional way of education to appear insufficient. Programs and training methods are gradually renewed by adopting innovative elements, a pattern that is directly related to the rapid development of technology (Evans, 1994; Ioannidou, 2011). Through distance learning, it's easy for all involved parties such as teachers, learners, and the educational material itself to interact with one another, while at the same time there is a variety of teaching methods available for anyone to utilize (Race, 1999; Armakolas, 2020). This way, it is possible to meet the needs and expectations of learners in various ways, while at the same time individuals unable to participate in

conventional training programs are given a chance of attendance (Lionarakis, 1998; Anastasiadis, 2007).

1 DISTANCE EDUCATION IN COURSES WITH LABORATORY ACTIVITIES OR PRACTICAL APPLICATIONS

According to Kennepohl & Last (2000) distance learning faces challenges when applied on programs that are based solely or mostly on laboratory courses, even if the experience gained through them leads to effective provision of learning, by attending and successfully completing said programs. During such practical courses, emphasis is placed on the development of observation and communication skills, as well as technical qualities acquired by reproducing laboratory applications (Gamage et. al., 2020). As reported by Holmberg & Bakshi (1982), there are very few distance learning programs that provide actual hands-on work in laboratories either in the field of natural sciences or other technological sciences. Two of the main reasons that prevent distance laboratory practice are as follows: first, in such courses the physical presence of students at the lab is usually required and second, the cost of acquiring equipment necessary for both the realization and the upkeeping of the lab is not negligible at all, burdening both the students and foremost the educational institutions. Now that distance education has become more and more popular, it is a necessity to explore additional ways and possible solutions in replicating properly distance laboratory courses (Georgiadi & Kokkali, 2016).

2 IMPORTANCE OF LABORATORY EXERCISES AND PRACTICAL APPLICATIONS

An important aspect of laboratory and practical training courses is the study of the basic functions that carry out a laboratory experiment as intended. According to Kirschner & Meester (1988), the practical application is a teaching method that can be used as an educational tool. It is scientifically defined as a well-designed experience in which students interact with the materials at hand in the space surrounding them and observe the phenomena that occur. Holmberg & Bakshi (1982) point out that the experience gained in a laboratory environment is not only the heart of science or technology-related courses but also an essential element that plays a key role in the successful completion of programs associated with these courses. As Reid & Shah (2007) mention, practice is vital in order to verify that the theoretical part of a course has already been taught correctly, whether it is conducted in person or remotely. If it wasn't for the lab work, students would be able certain courses behind them, by passing the corresponding exam without understanding the connection between theory and practice. More so in the fields revolving around Natural or Technological science lessons where the knowledge acquired is directly related to solving problems through activities. This way students maintain a limited view of the concepts approached, by focusing only on the theoretical or even abstract aspects of said courses.

It is particularly important to note that the educative effectiveness of the laboratory or practical activities depends on the level of precision set in the goals and objectives of the laboratory learning process (Reid & Shah, 2007). More specifically, it is essential to have predetermined teaching approach, i.e. to indicate in detail who will be taught, which means will be used and how, and last but not least the expected results of the practice.

3 USEFUL ELEMENTS IN LABORATORY PRACTICE

According to Pickering (1987), it is important to give a clear explanation of the scientific method expected to be carried out during laboratory applications. That is in order to create an environment of trust and understanding among all involved parties. Kirschner & Meester (1988) consider that the following student-centered goals should be set, when taking an internship. More specifically, the student should be able to:

- Express assumptions.
- Propose ways of problem-solving.
- Use his knowledge and skills in unknown situations.
- Create experimental devices to explore hypothetical scenarios.
- Uses laboratory or practical skills while performing experiments or practical applications.
- Interpret the experimental data.
- Provide a detailed description of an experiment or practical application process.

According to Reid & Shah (2007), there are several reasons why laboratory or practical courses need to be included in the fields of the Natural Sciences, or the Sciences of Technology.

Some of them focus on the fact that students need to (Holmberg & Bakshi, 1982):

- Acquire new knowledge or retrieve knowledge that they have already acquired.
- Gain experience in utilizing specific laboratory equipment and become familiar with it.
- Understand the theoretical approach and how that is reflected through laboratory or practical training.
- Develop abstract and interpretive skills, observation and teamwork skills, time management skills, as well as abilities related to data analysis and communication.

4 METHODS OF PROVIDING LABORATORY DISTANCE EDUCATION

The easiest way of providing laboratory training, either in person or from a distance, is by making to possible for the students to gain access to the lab facilities themselves. To achieve that, laboratory training can be carried out on days and periods that the facilities are available, such as the weekends, or during the holidays (Holmberg & Bakshi, 1982).

This alternative option has already been used at the Open University of Canada (Kennepohl & Last, 2000), and while it has been already integrated into undergraduate programs of the Hellenic Open University, where sometimes workshops are held during the summer holidays. One of the most significant advantages of this approach is the experience the students gain in a real laboratory environment by having the opportunity to interact with actual materials and become familiar with practical applications and real problems/experiments. This process involves teachers and other experienced technicians, who advise, guide and supervise the trainees through the entire procedure, so that everything is completed correctly and in safety. In such an environment, students can interact with both the teaching staff, the technicians and their classmates, a process that enables them to generate ideas, discuss on and analyze what has been brought on the table, and gain new experiences (Kember, 1982).

On the other hand, teachers can evaluate the capabilities and needs of their students and provide them with a context of motivation and enthusiasm. This allows students to take initiative, evaluate their work and eliminate negative emotions such as isolation created through distance learning processes.

CONCLUSIONS

The literature review conducted in our research showed that the proposed alternative form of laboratory training has many advantages. Inevitably, however, this method, like most, has several drawbacks that need to be mentioned. Such an implementation requires a significant budget for the educational institution to be able to cover operating costs, equipment costs, safety compliance costs. This cost is significantly reduced when distance learning programs are provided by educational structures, which, at the same time, offer conventional in person teaching methods. However, students have to cater for additional traveling or accommodation expenses in order to be present. They will also have to sacrifice a significant portion of their vacation time to be able to participate in a program conducted this way (Georgiadi & Kokkali, 2016).

In addition, the curriculum of most Natural Sciences or Technology Sciences courses is designed in such a way that there is a direct connection between theory and practice, using one to reinforce the other. Nevertheless, the interdependence of these two elements leads to a decrease in the efficiency of such educational programs (Kember, 1982). Finally, another disadvantage focuses on the fact that students have to prepare and implement several laboratory or practical applications in a very short time, which makes it difficult for them to strive for a deeper understanding and consolidation of new knowledge (Kennepohl & Last, 2000; Georgiadi & Kokkali, 2016).

After all, the evolution of methods is continuous, as new tools are constantly developed and the needs of students change significantly as time goes by (Kennepohl & Last, 2000). According to Georgiou, Dimitropoulos & Manitsaris (2007), an application that consists of a combination of hypermedia and virtual reality technology is essentially a virtual lab. This is available to several educational institutions for laboratory practices that take place from a distance. It acts as an alternative that allows students to intervene and change the conditions of the experiments, monitor the changes that take place, analyze the data, and extract conclusions. This method attracts students' interest by creating a pleasant and interactive learning environment.

In conclusion, both practice and laboratory exercise is an important and necessary tool that helps students acquire the knowledge and experience required in a wide range of courses (Georgiadi & Kokkali, 2016).

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