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**Autoreferát dizertačnej práce**

**METHODOLGY OF USE OF LMS AT THE BACHELOR COURSES OF  
PHYSICS**

**METÓDA POUŽITIA SYSTÉMU “LEARNING MANAGEMENT” V  
BAKALÁRSKYCH KURZOCH VYUČOVANIA FYZIKY**

**na získanie akademického titulu philosophiae doctor**

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Nowadays the use of digital technologies in education and training is not only an opportunity to enhance the teaching and learning process, motivate and support teachers and students, but also a “must” that is currently described as the “digital imperative”. Despite the well-known support of digital technologies on teaching-learning process, through the possibility to increase its flexibility, to develop well-designed content, to promote advanced learning skills, to improve access to information, to foster collaborative learning methods, etc., the teaching community, does not yet feel completely comfortable with the current opportunities of integrating digital technologies in their work. In many occasions, the existing range of digital resources does not meet the individual needs and requirements of a single teacher who wishes to take advantage from digital technologies in a particular class, on a particular topic and under a determined objective. The present thesis aims to give a contribution in this direction through the research of collaborative production of knowledge, definition of models of sharing, construction and diffusion of resources, using Information and Communication Technologies (in the following ICT), with consideration of “Laboratory of Physics” subject at Bachelor Courses of Physics in Albanian context.

The thesis is composed from five chapters; the first represent a pan of European policies and achievements on supporting ICT on education; the second shows a brief explanation about the history, policies and use of ICT in the Albanian context; the third represents the state of art of LMS use on different universities, focused on pedagogical purposes and methodologies of use; the

fourth, represent the main goal, objectives, hypothesis and methodology of the research; the fifth describes the results of the research, the data collected and their analysis, followed from the conclusions. In appendix, abstracts of several papers concerning the project, presented on different international conferences, will be found; as well as the full questionnaires and open ended questions. In addition, a history of the development of the project, accompanied with chronological details concerning the birth and the growing up of the idea and the research. Also, some screenshots take during the use of LMS.

Information and communication technologies have the potential to significantly advance our progress towards the Lisbon objectives. New open and flexible forms of ICT-supported learning are increasingly being used for the re-skilling of workers, and are opening the way to new forms of education and training for the knowledge society.

Moreover, the role of traditional educational institutions, schools, colleges and universities, in educating younger generations has never been more important than it is today. Today new technologies and tools offer learners greater flexibility, easier access to information and the opportunity to match learning to their specific needs, circumstances and learning profile. Technological developments, such as the internet, mobile communications and virtual environments, create possibilities to support learning in new ways. The crucial role of information and communication technologies (ICT) in building Europe's social and human capital is reflected in the strong emphasis given to technology in educational action programmes. Open and flexible forms of technology-enhanced learning contribute increasingly to the quality of education and training systems. ICT make teaching

and training processes more tailored to the needs of the learner, help foster and support innovation in pedagogy, and make learning more engaging.

The research carried out in the framework of this thesis in the Albanian context, has been developed like a pilot project. Albania is a small country with 2.204.000 inhabitants (courtesy of Wikipedia) and the number of Universities is high. There are 15 State Universities and 37 private Universities. The Albanian context of online courses at the University level, can be described at a very low level, but is clear that we have the potential to complete this itinerary, and to receive all benefits from e-learning.

The Learning management system (in the following LMS) is software packages. It enable experts to create, deliver, and manage online courses. Most LMSs are web-based and allow for learner registration and assessment online. The pedagogical paradigms of teaching and learning on the basis of a LMS environment are those related to constructivism, particularly socialconstructivism.

Social interaction, a key component in the Social Constructivist pedagogy, is also influenced by the impact of technology. As a result of these changes, the social interactions between students and students, and teachers and students have changed. Because students learn in a social setting by communicating with more knowledgeable people, educators in an online environment must redefine their communication skills. Part of social interaction in the context of an online learning environment includes learner participation in group work. Communication practices within virtual group work include email, texting and instant messaging, all of which provide for a social presence. Prior to technology,

a social presence was communicated by dialogue and social clues such as facial expressions, non-verbal clues and inflection. Technology requires a distinct interaction with learners and high technology devices providing a strong interaction between the learner, learner/instructor, and the content as well as other learners” in the distance education environment Online learning management systems such as Moodle are based on Social Constructivism where a culture is fostered by the collaboration of groups to construct knowledge. With the advancement of technology, constructivist learning theories have been reviewed and revised from educators.

There are different learning managementsystems, including Blackboard Learning System, WebCT, Angel/LMS, eCollege, LearningSpace, etc., as well as open-source learning systems such as The Sakai Project, Open SourcePortfolio Initiative, Moodle, uPortal, Docebo etc. Moodle is chosen by many universities in the world, both public and private. There are 73,298 registered sites on 225 countries ([www.moodle.org](http://www.moodle.org)) for a variety of bureaucratic compliances, registration for exams, etc... The most applied for is in blended learning mode, which is used to create Moodle courses to support traditional courses. Moodle focuses on giving educators the best tools to manage and promote learning and allows teachers to organize, manage and deliver course materials. From a didactic point of view, the usage of multimedia tools to create attractive activities makes the learning process friendlier for students. As a consequence, these activities increase the interest of the students in their studies.

Teachers can provide students with a large amount of resources that they cannot usually show in the classroom due to time constraints. Lesson tasks within

Moodle can be linked to any resources that are uploaded to one's server or that are available on the Internet. The students' exploration of any of the content-based resources can be easily assessed by using any of the Moodle based evaluation and feedback tools. Moodle has pedagogical advantages since it was built in accordance with the teaching approach which emphasizes the construction of knowledge through active and interactive learning, and learning multi-sensory experience through multimedia.

Practical activities LMS provide a wide array of practical activities such as quizzes, workshops, assignments and forums that can be incorporated in the courses. In addition, the LMS will allow the performance of new and more dynamic activities, including group work and cooperation.

During the development of the research, the first year of experimentation, some of the functionalities of Moodle have been used: course materials repository, available anytime, anywhere; course organization, so that students will know exactly the type of activity and the amount of time to devote to the studying of each course module; communication utilities, to allow collaboration between students and facilitate the interaction between students and lecturers; in addition the students have been guided to produce digital learning objects, such videos, photos, reports. Creating course materials and adapting them into a self-contained format can be a time consuming task. Also, the production of videos. However, this effort will be transferable and reusable and, therefore, pays-off the invested time.

The second year of experimentation, the same activities of the previous year have been carried out, with the purpose to wisely select the activities to be performed

and the assessment mechanisms to be applied. Moodle offers several options to support the assessment process. E.g., for the assessment online to the traditional lab, is very important that the students of one group, don't see the work of the others, so the teacher can use a wiki tool for a group. While, for the assessment online of the MBL lab, this is not necessary, because each student obtain a singular result. On this case, the teacher can ask to receive the reports through a forum. Another aspect of the second year experience is that the older students assumed with happiness the role of tutors for their younger colleagues, realizing a peer to peer learning in a collaborative context. The novelty of the digital teaching process can be in itself a strong incentive for the students to dedicate time to their studies, navigating the LMS and accessing all available content.

#### *The main goal, objectives and hypothesis*

The project "Methodology of use of LMS at the Bachelor courses of physics", aims to study and research how to enhance collaborative production of knowledge, definition of models of sharing, construction and diffusion of resources, using digital technologies, with consideration of "Laboratory of Physics" subject in the Albanian context.

#### *Objectives*

- O1. Research of the attitude of Albanian students towards the use of Digital Technologies.
- O2. Research of effective methodologies of use of LMS, through the experimentation of an online collaborative environment concerning "Laboratory of Physics".

O3. Research of criteria and characteristics that must have a digital resources to be effective in an e-learning environment.

O4. Research of students' expectations about the use of LMS

### *Hypothesis*

H1. Online activities can be integrated together with the traditional "Laboratory of Physics" courses, through the use of a Learning Management System.

H2. The production of digital learning objects from the groups of students, during the Laboratory Courses, can be used to support students learning performance.

H3. The introduction of online activities, through a Learning Management System, increases the opportunities of collaborative learning.

H4. The Learning Management System, allowing very fast communication at anytime among students and professor through the forum, support the maintenance of a continuous interest for the arguments treated during the traditional courses.

H5. Different aspects of LMS's use can be improved in order to increase its efficiency and to support physics education.

### *Methodology of the research*

The methodology of research, is the qualitative research and case studies. The data has been collected on two ways: 1. through questionnaires formulated to be answered according to the Likert scale and to be analyzed on a descriptive way; 2. through interviews composed from open – ended questions, to be analyzed through the highlighting of key words. The sample is composed from students of Bachelor Degree on Physics with profile on teaching physics. Due to the fact that

they make practice of teaching during the period of studies, on some survey they are considered pre-service teachers. In some cases, the survey is extended to teachers in-service that followed the Master Degree on Teaching Physics, Mathematics or Informatics, at the Faculty of Natural Science of University “L.Gurakuqi” of Shkoder, and to pre-service teachers that followed the Master Degree on Teaching, at the Faculty of Education Science at the same University.

The research started on the academic year 2009-2010, and continued up to the end of the first semester of the academic year 2013-2014, on January 2014.

## ***RESULTS***

### *ON LINE LEARNING TO SUPPORT THE ELABORATION OF LABORATORY OF PHYSICS ACTIVITIES*

The first year of experimentation covered the subject of “Laboratory of Physics”, which is part of Bachelor’s Degree curriculum in Physics for the academic year 2009-2010. The activities were concentrated on the topic of “Optics” that is integrated into a second year course; it includes some experiences from geometrical optics, from wave optics and quantum optics. In the lab activities we carried out: a study of prisms; determination of the focal length of convergent lenses; determination of the focal length of divergent lenses; study of optic microscopes and measurements of small dimensions within it; measurement of the refractive index of transparent substances through the optic microscope; determination of light’s wavelength with the aid of diffraction grating; determination of the intensity of a source of light through a Bunsen photometer, measurement of the reflection index.

Online activities, through a learning management system, have been introduced. The LMS platform was activated, where the professor inserted study material in pdf format and gave them assignments. In this learning experience, the assignments belonged to two categories: 1. Group assignments that required making video recordings and taking photos of the laboratory work. 2. Individual assignments that involved writing reports about the development of the activities and analyzing the data collected.

*THE USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES BY  
PRE-SERVICE AND IN-SERVICE TEACHERS*

A questionnaire was designed by the project team EU-ISE (Effective use of ICT in Science Education) and administered to science teachers in five countries: Finland, Slovakia, Spain, Poland and Scotland during the scholastic year 2005/2006. During the academic year 2009/2010, the questionnaire was administered to 32 in-service science teachers and to 21 pre-service science teachers in the northern region of Albania, Region of Shkoder. The pre-service teachers were following the final year of a Masters in Science Teaching and have finished teacher training period at school.

The data explored responses to a large number of statements (items) regarding ICT and its value in enhancing science education, the self-evaluation of ICT competences, the availability of technologies at schools, the management of learning through ICT, and the inclusion of new technologies in the classroom. Most items used a four point Likert scale where the highest score, 4, indicates “strongly agree”, but item 12 offered only three choices, with a 3, being “strongly agree”.

## *THE INTEGRATION OF AUDIOVISUAL PRACTICES IN THE DESIGN OF ONLINE COURSES OF LABORATORY OF PHYSICS*

This research was carried out during the academic year 2010-2011. It was inspired by an activity developed one year before, during the academic year 2009-2010, that dealt with the integration of traditional courses of Laboratory of Physics with online activities. Part of the activities included the production of digital learning objects, such as photos, videos, reports, graphics, designs, etc. and the communication between students and professors through a Learning Management System. It was quite a new experience, but during the development of these activities, the production of videos of lab works by the students was particularly interesting, especially their motivation and enthusiasm to perform this activity, from the point of view of the effectiveness of teaching learning process.

Before going through this experience, the students were not sure about how the digital technology could support the learning process of a certain subject. But, these activities brought them closer to the use of technology in the teaching process.

## *THE INTEGRATION OF E-LEARNING AT SCHOOL, THE PERSPECTIVE OF PRE-SERVICE TEACHERS*

Schools from remote mountain villages have to face several difficulties, in addition to those related to laboratories, educational materials, etc.; in fact, they have to arrange all their activities bearing in mind the possibility of bad weather and the fact that one school often covers the needs of a group of small villages scattered over a wide area. During the winter months, some teachers and students are often unable to attend lessons and the dropout rate is higher in these areas. There are also problems connected to a shortage of teachers at these schools,

the small number of students and their geographical isolation, to the unwillingness of many new teachers to work in these schools, to the inadequacy of teacher training for this particular kind of school, to the lack of equipment available and laboratories, etc. Furthermore, teachers at multigrade schools, that are a reality in rural areas, have to teach two or more age groups simultaneously, and possibly more than one curriculum subject in the same class.

The use of different forms of technology-supported learning and distance education models have been advocated for the enhancement of quality and accessibility of teacher training programs in rural areas, and a growing mass of international experience clearly demonstrates that digital technologies offer promising solutions to the challenges of providing appropriate training and support to rural schools (Koulouris, P. & Sotiriou, S., 2007), (Barajas, M. et al. 2007).

Moreover, in recent years a lot of attention has been paid to the role that satellite telecommunication can play in bridging the digital divide and distance education is seen as a major field of application in this area, as this technology provides a delivery option facilitating access to new student populations in distance locations. Previous studies on the application of ICT on Education in Albania, have shown clearly that the majority of teachers agree that ICT can be used in science education to enhance the teaching learning process.

In the remote mountain zones, the teacher is considered as an agent of change, a person who may disseminate innovation and make progress. In the digital age, a role of the teacher is also founding new digital learning culture in the rural community.

Therefore it is important to investigate about the teachers opinion about the use of digital technology for distance learning; for this reason a questionnaire was designed to explore the opinion of teachers with regard to four questions:

1. attitudes towards e-learning;
2. attitudes towards e-learning in remote rural schools;
3. attitudes towards the evaluation and monitoring of the teaching learning process;
4. attitudes towards the teacher, training, web resources, technical support.

The sample consists of native teachers from communes and villages, who completed their previous studies in their home community; most of them have teaching experience and are well aware of the conditions of remote mountain schools.

They were asked to “Think about the school where you teach; think about the difficulties connected to the rural context. Imagine that your school is fully equipped with computers and broadband. Imagine you can use the didactic resources available online and benefit from the support that ICT offers for distance education. At this point, please, complete the following questionnaire”.

For the purposes of this study is adopted the Higher Education Founding Council for England’s definition of e-learning as “any learning that uses Digital Technologies”.Digital Technologies (in the following DT), is a term that is being increasingly used in education in place of the dated term ICT. It is used to refer to the ever-evolving suite of digital software, hardware and architecture used in learning and teaching in the school, the home and beyond.

## *STUDENT'S EXPECTATIONS ON THE USE OF LEARNING MANAGEMENT SYSTEM*

The introduction of digital technologies on support of teaching-learning, have influenced deeply this process. In some cases, a great change has been produced, especially concerning the birth and the development of open and distance education that in the last decades has allowed communities of learners and their teachers to interact with one another despite being situated in differing geographical locations. Due to the importance and the complexity of the argument, a lot of researchers from the field of education, as well as psychologists, sociologists, specialists on information technology or on communication, anthropologists, etc..., have been inspired to study and carry out research.

In particular, for the application of Learning Management System to create online courses, social constructivist theories have been reviewed and revised. Technology's greatest pedagogical impact within this theory may be in the area of social construction and interaction. The application of technology in a virtual classroom removes all physical contact and the environment of the system must be determined through email, texting and discussion forums. However, it must remember that e-learning is much more complex in terms of technology, pedagogy and social impacts, compared with other innovation technologies. E-learning has become an adequate and recently very important way for transferring knowledge from educational institutions to learners, in comparison to traditional face-to-face education. In that frame a proportion of nowadays education is provided through the internet with support of modern information and

communication technology. In particular, the use of LMS imply a change of communication, partial or total, through teacher and learner or learner and learner from the direct communication to the virtual one. In nowadays educational practice three main types and/or formats of e-learning are: web-supported e-learning; blended e-learning; and fully online e-learning. Main difference among selected types of e-learning is the level of face-to-face interaction; from merely face-to-face interaction in web supported e-learning to none face-to-face interaction in fully online e-learning. In the context of social interaction of members in e-learning process we put our focus on the role and importance of non-verbal communication in different types of e-learning. But on the other hand is important to emphasize, that e-learning and traditional education differs significantly. Among several important differences (e.g. materials used, assessment process) the communication process among participants in e-learning is changed. Therefore often perceived obstacles in e-learning process are related to lack of face-to-face communication and inability of participants to perceive non-verbal communication of others. Non-verbal communication refers to a communication transmitted through actions and behaviors rather than thorough words.

A survey is extended to the students involved on the experimentation from the academic year 2009-2010 to the 2013-2014. Online courses have been construct and delivered parallel to the traditional existing courses, reproducing the structure of the traditional one, with the objective to integrate this last with online activities. The sample is composed from 42 students involved in the experimentation. The online courses developed are: “Laboratory of Physics”, “Use of MicroComputer

Based Laboratory on teaching physics”, “ICT to support teaching-learning process”. Each student has followed one or two of courses mentioned above through the support of the Learning Management System. The survey is conducted at the end of the online course. Open - ended questions are designed as such on purpose to encourage students to give a wide range of responses. The question are: What did you expected from the use of LMS? What were your impressions after used it? What are the strong points? What are weak points? According to your opinion, what can be modified and how?What did you like? What did you dislike? According to your opinion, what can be modified and how? The data collected from interviews have been analyzed highlighting the themes that are particularly dominant, as well as concepts that run around this themes. The manual analysis of the data highlights several themes particularly dominant.1.Generally, students were enthusiastic about the use of the system and believed that it should be used more widely. Many students suggested that the LMS should be more widely used at all university courses and at all universities. In addition, they think that due to the development of digital technologies and their application to e-learning, LMS should be used also at schools. 2. They were positive about using online communication as a means for sharing knowledge and information, for discussing and interacting with staff and other students. Many students commented positively on the student to student and student to staff interaction that occurred on the websites.Many students were very positive about the communication potential of the system for sharing. 3. Although they were happy to have the flexibility of access to lecture notes online, they recognized the potential for using communication and other tools to enhance their learning. Also

felt that communication and other tools were very important for their learning.

### *CONCLUSIONS*

The study detailed in this thesis was designed to develop knowledge about the collaborative production of knowledge, using digital technologies. Further matters of importance here were the construction and diffusion of resources related to the subject “Laboratory of Physics”. As described in part 1 of chapter 5, the online activities have been integrated into physics laboratory courses, and effectively used to improve students’ learning performances to have a positive influence on their attitude to the lab work. In addition, on-line collaborative learning have been combined with the traditional teaching-learning process increasing the opportunities for student collaboration. The results of this research show that many aspects of collaborative learning based on online courses can increase self-esteem in students, enhance their satisfaction with the learning experience, promote a positive attitude towards the subject matter, provide weaker students with extensive one-on-one tutoring and so on. The online environment, enables teachers to interact in an effective way with the students, and it stimulates students to exchange their opinions and compare results and methods of lab activities. The research highlighted that Albanian students have good attitude towards the use of Digital Technologies.

The opinion of in-service and pre-service Albanian science teachers regarding ICT and its value in enhancing science education, the self-evaluation of ICT competences, the availability of technologies at schools, the management of learning through ICT, and the inclusion of new technologies in the classroom have been investigated. An analysis of the data collected in this project, shows

clearly that the majority of teachers agree that ICT can be used in science education to provide access to resources like web pages, texts, databases, videos, demonstrations, etc..., make learning active, constructive, co-operative, increase interest and motivation of learners and their involvement in classroom activities and help students to increase their digital competence.

The effective methodologies of use of LMS, through the experimentation of an online collaborative environment concerning “Laboratory of Physics” have been explored; the criteria and characteristics that must have a digital resources to be effective in an e-learning environment. As result, the described experience of video production activities have been integrated into traditional physics laboratory courses. These activities have increased the effectiveness of learning process, the sustainability of knowledge, the collaboration among students.

The question of e-learning in remote mountain schools in Albania, has been treated. The adoption of internet and the creation of new structures for e-learning can form a solid ground for the transformation of education processes in these rural zones. The results of the questionnaire described in the paragraph mentioned above have highlighted that future teachers of these areas, even though they do not have any direct experience with e-learning, either as teachers or students, are very interested in its use; besides, they are confident that it can support a relevant growth of the quality in schools of remote mountain villages. In fact, its characteristics can help to solve some specific problems for teaching and learning activities in this context. It is important to highlight that teachers are conscious that e-learning does not reduce the cost of teaching and learning activities, even though it can help to reduce the drop out in schools of rural areas. To reach this

aim it is crucial the willingness of policy-makers, teachers, students and their families to adopt new ways of education. The student's expectations about the use of LMS, have been highlighted. Generally, they were enthusiastic about the use of the system and believed that it should be used more widely. They were positive about using online communication as a means for sharing knowledge and information, for discussing and interacting with staff and other students. Although they were happy to have the flexibility of access to lecture notes online, they recognized the potential for using communication and other tools to enhance their learning.

The hypothesis written at the beginning of this project has been verified. In particular, regarding the fifth hypothesis that assert that different aspects of LMS's use can be improved in order to increase its efficiency and to support physics education, I can highlight the suggestion of the students to integrate the LMS with audiovisual tools, similar to Skype, that is coherent with the importance that the specialists attribute to body language, posture, gesture, eye contact and the tone of voice on the impact of communication.

Finally, the Learning Management System can be used successfully at the Bachelor Courses of Physics for the integration of traditional courses with online activities, in parallel with the traditional course.