The Relevance of Professional Use of Smart-Complexes in the Training Process of Future Labor and Technology Teachers

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ABSTRACT

Transformational changes both in the world on the whole and in the education system in particular are constantly creating new challenges for the professional qualities of teachers. There is a profound discrepancy between the needs of the modern student and the abilities to meet these needs on the part of the teacher. There are a number of reasons for this, namely, the difference between generations, teachers' low motivation for self-development, and low digital literacy. It is very important to take into account all of these issues while training future teachers. We have experimentally determined the relevance of using SMART complexes in the process of professional training of bachelors studying in the program "Secondary education: labor training and technology", Additionally, we have proved the need for active implementation of SMART complexes into educational and professional activities of teachers.

Keywords: *SMART-complexes, teacher training, teachers of labor and technology, distance learning.*

1. RELEVANCE OF RESEARCH

Nowadays when Ukraine is in the process of integration into the European educational space, the forms, methods and means of teaching in higher education need to be updated and improved. Significant growth of the amount of educational information, the need for its rapid assimilation, analysis, generalization, systematization and storage as well as constantly expanding opportunities of the Internet have led to the widespread introduction of information technology into the professional training of future educators.

The purpose of our research is to find out the effectiveness of professional use of SMART-complexes in the process of training bachelors in the special educational program "Secondary education: labor training and technology", the first level of higher education for a bachelor's degree in 014 Secondary education, subject specialty 014.10 training and technology, fields of knowledge 01 Education/Pedagogy, qualifications: "Bachelor of Education in labor training and technology. Teacher of labor training and technology".

At present teachers' professionally significant personal qualities are facing brand-new requirements; since these qualities are supposed to reflect the intellectual and professional aspects of teachers' personality as well as influence the result of their future professional activity while revealing individual style of each teacher. Such requirements for teachers are specified in a number of legislative documents, which state that "a pedagogical worker should be a person with high moral standards, who has the appropriate pedagogical education and sufficient level of professional training. Such a person should carry out their pedagogical activities ensuring the effectiveness and quality of their work. The physical and mental state of such a professional should allow them to perform professional duties in educational institutions of the general education system of Ukraine"[[1]].

In the framework of the modern technological revolution there are transformational processes in the modern model of education, requiring the use of digital resources that take into account the age and cognitive abilities of the students[[2]; [3]].

In the context of the COVID-19 pandemic, the transition to online and blended learning in Ukraine was quite abrupt, and revealed certain problems in the modern educational process. The State Service for the Quality of

Education of Ukraine published the results of a survey on the quality of online learning during the quarantine, and 2.7% of parents reported that no online learning whatsoever actually took place in their children's schools. Among the reasons for this, the heads of educational institutions reported the lack of necessary equipment in the homes of the participants of online learning as well as limited access to the Internet, and finally – insufficient teaching skills to work remotely [[4]]. Similar problems were found by scientists from other countries, such as Kazakhstan [[5]], Nigeria [[6]] Poland, Korea [[7]] and others.

2. CONCEPT AND TERMS OF RESEARCH

A profound analysis of scientific research shows that the problem of using information, communication and SMART technologies has been the subject of research of many contemporary scientists. A lot of them suggest introducing SMART technologies into information and educational environment of the educational institution in order to solve the problems related to online and blended learning [[2]; [3]; 8; [9]; [10]; [11]]. In the papers of modern scientists a great deal of attention is paid to the problem of application of SMART technologies in the learning process of educational institutions, as well as in identifying the impact of these technologies on improving teaching efficiency and intensification of teaching and future technology teacher training, etc. [[12]].

The main goal of SMART learning is to create an environment that encourages training highly competitive professionals by developing the students' skills that are required in modern society of the XXI century, such as cooperation and communication, social responsibility, critical thinking, prompt and quality problem solving.

SMART education is a flexible learning in an interactive educational environment with the help of free content from all over the world, which allows expanding the boundaries of learning (Kademiya). This learning process should be easy to manage in order to ensure proper organization of education and flexibility of the educational process. In addition, it must be integrated with external sources of information

The need to develop an integrated intellectual educational environment is based on a sufficient degree of development of SMART-technologies and the amount of their integration into everyday life. The educational process in the SMART environment combines databases and knowledge, libraries, electronic textbooks (manuals), educational and methodical complexes, materials, etc.; software shells, means of electronic communication and provides participants in the educational process with an open model of asynchronous individual learning [[13]; [14]].

The needs of society have led to the emergence of such a new concept in the field of information technology

as a SMART complex, which is a complex dynamic information system for educational and methodological purposes. A SMART complex has to meet SMART criteria (specific, measurable, attainable, relevant, time-bound); it has a static, dynamic and environmental components, provides comprehensive information about the subject with the possibility of prompt access to educational content from anywhere (provided that the Internet access is available), provides prompt assessment of educational activities by participants in the learning process [[15]].

Other scientists [[16]] interpret the concept of a SMART complex as an information dynamic system of educational and methodological direction, which encourages the development of professional knowledge and activation of the educational process, has a positive effect on mental abilities and personal qualities of students. Another definition states that it is a complex information structured system of electronic educational resource in an integrative educational environment that has an educational and methodical purpose to ensure a continuous, complete didactic cycle of the learning process, built on flexible digital technologies to form an individual educational trajectory for the student [[11]]

3. THE CURRENT STAGE OF SMART TECHNOLOGIES IMPLEMENTATION IN THE EDUCATIONAL PROCESS

One of the most important priorities in the educational modernization process is the training of educators specializing in teaching labor and technology. Technology studies taught in schools are the basis of creative learning, and they are characterized by features that distinguish them from all subsequent stages of school education. First of all, it concerns the acquisition of thorough creative knowledge, the formation of general educational competencies, the development of cognitive interests and motivation. The effectiveness of the educational process in a secondary education institution largely depends on the teacher's personality, the level of their readiness for the process of modernization in the education system [[17]; [18]].

Consequently, the teacher of technology should be characterized not only by their high level of subject knowledge necessary in secondary school, but also by a steady skill to use innovative tools and forms in their professional activities as well as the readiness to apply the acquired competencies in educational, social pedagogical, scientific-methodical and organizational-administrative activity. Currently, there are a number of contradictions arising in the professional training of future teachers of labor training and technology. These contradictions relate to the difference between the modern social requirements and the outdated stifling traditions of the education system that force the teachers to work according to the principles of the last century

learning environment. Since the humanity of the XXI century is currently undergoing the the stage of technical revolution implying the formation of a digital society, the usage of the latest information technologies in the educational process of secondary and higher education becomes an essential requirement. Therefore, the issues related to the use of SMART technologies cannot be avoided during the preparation of a future teacher of labor training and technology [[19]].

In the conditions of global quarantine and modern requirements, the teacher is forced to adapt and constantly improve their skills in the field of information and communication technologies. This is especially true for teachers who teach the school course "Labor Training" and "Technology", which require constant technical update and improving the information competence of teachers [[3]; [9]].

We believe that without the ability to effectively apply information and communication technologies, knowledge of multimedia and SMART-technologies, and opportunities to create elements of e-educational resources and the ability to navigate in the modern information global space, it is impossible to become a professional educator specializing in section 014.10 Secondary education (Labor training and technology) in the field of knowledge 01 - Education \ Pedagogy of the qualification level "bachelor", offered at the Izmail State University for the Humanities at the Faculty of Management, Administration and Information.

Today the introduction of SMART technologies is one of the most important areas of innovative educational processes not only in this university, but also all around the world. SMART complexes have to meet the new requirements of educational disciplines. They must ensure the quality of education, motivation, students' active involvement in creative, educational and scientific activities. SMART-complexes of academic disciplines must be integrated and compliant with such requirements as flexibility, integration, individual trajectory, mobility, etc. They should also include multimedia fragments and external electronic resources. To create a SMART complex of academic disciplines it is necessary to use cloud technologies, multimedia tools, interactivity, work on the Internet, etc. With the help of SMART technologies, a students can interact with the software system, select and analyze the information they need, which encourages them to work independentlym [[9]; [20]]. The system includes adaptive technologies and allows working at a pace that is convenient for the student adapting to their needs [[21]]. And the whole complex allows obtaining a complete picture of the necessary topics, and if necessary, the student can go back to revise what they need.

It should be mentioned that improving the quality of higher education is largely dependent from the use of the necessary new methods and teaching tools. Innovative learning requires the involvement of active students in the educational process. Widespread use of SMART complexes can increase the effectiveness of active teaching methods for all forms of organization of the educational process: at the stage of independent training of students, lectures, seminars, practical and laboratory classes and even at the stage of knowledge control.

The SMART complex, like any other e-learning system, includes such standard general modules as learning management system (LMS), educational content and authoring tools [[15]].

Learning management system is used to develop, manage and disseminate online learning materials with shared access [[11]]. According to the Regulations on the organization of the educational process [[22]] with the use of distance learning technologies, Izmail State University of Humanities uses an e-learning platform based on LMS Moodle. technologies (URL address - http://moodle.idgu.edu.ua/) in order to provide a unified approach to creating an e-learning environment, organization and management of distance learning. The platform is administered by the university employees. Researchers can also create electronic educational resources on Google Classroom platform (domain in Google Suite for Education: idguonline.net).

The teaching staff of the Department of Mathematics, Information Technology and Information Activity and the Department of Technological, Vocational Education and General Technical Disciplines (Vorobyov J., Dushchenko O., Dovgopolyk K., Ivlieva O., Mizyuk V., Smirnova I., etc.) pays great attention to the creation and improvement of educational content for various disciplines – publishing various manuals for students, creating modern multimedia presentations, videos, etc. The created teaching aids are effectively used both in classes of various types and during the independent studies of future teachers of labor training and technology.

The authoring tools for developing educational content include the following educational materials: electronic textbooks, presentations, simulators, educational videos, tests, which are then placed in the database of the learning management system (LMS). Among the variety of authoring tools one can make use of editors of training courses, tools for creating multimedia content, tests, questionnaires, tools for capturing images from the monitor, tools for online seminars, etc. [[23]].

Multimedia content is used to simulate complex real processes in the teaching of such courses as "Technological Workshop", "Fundamentals of design, modeling and technical design" and "Technology of construction material productions and its processing" in the following forms: situations, visualization of abstract information due to dynamic presentation of processes,

demonstration of fragments of programs, films, virtual tours, etc. They use ready-made multimedia tools, as well as create their own on the basis of GIF-animations and 3D-animations [[9]]. The Center for Innovative Technologies operates on the basis of Izmail State University of Humanities, where students have the opportunity to acquire skills related to dealing with the latest developments in IT, namely virtual reality, 3D printers, modern network equipment, Arduino kits for electronic devices, etc.

Future technology teachers should consider two possible areas of SMART complexes implementation into the educational process. The first one relates to the inclusion of these systems in the traditional methods of the historically shaped education system. In this case, SMART complexes enable the teachers and learners to enhance their educational process, individualize theirs studies and automate teachers' routine work related to accounting, measurement and assessment of students' knowledge [[24]]. The introduction of SMART-complexes in the second area brings in improvement of the technological education content, revision of methods and forms of the educational process organization in labor training lessons, construction of holistic courses based on the use of content resources in separate variable modules. Knowledge, skills and abilities in this case are considered not as the purpose, but as the means of development of the student's personality.

The use of SMART complexes of academic disciplines in the process of training future teachers of labor education and technology provides an opportunity to achieve positive learning outcomes, namely:

• increases the amount of visual information offered to students, which significantly spikes the amount of information that is retained and, as a result, the overall effectiveness of teaching the discipline;

• involves students in engaging activities, awakening their creative potential during the educational process;

• computer graphics and interactive elements of educational content enable the educators to develop visual, figurative, and creative thinking of future teachers of labor training and technology;

• the possibility of processing larger amounts of educational information in a shorter period of time;

• students are offered opportunities for research work related to computer models, during which they can independently test their hypotheses, theoretically substantiated conclusions, and establish patterns between phenomena [[6]].

4. RESEARCH RESULTS

We have conducted a scientific and pedagogical experiment at the Faculty of Management,

Administration and Information Activity of the Izmail State University for the Humanities among the students obtaining their qualification in the professional program "Secondary Education: Labor Education and Technology". The experiment has revealed the need to introduce SMART complexes in the educational process.

To determine the need for the use of SMART-technologies in the educational process of future teachers of labor training and technology and their future professional activities, a survey was conducted among students of the Faculty of Management, Administration and Information Activities. The total number of respondents is 21 people. Among them are first and second-year students of specialty 014 Secondary education, subject specialty 014.10 Labor training and technologies at Izmail State University for the Humanities

For high-quality implementation of SMART complexes it is necessary for a teacher of labor training to master modern information and communication technologies [[17]]. As part of our pedagogical project, we offered our students to self-assess their own digital literacy. 30% of respondents indicated that their digital literacy is satisfactory, 55% indicated a sufficient level of expertise in dealing with digital tools, and 20% rated their own digital literacy at a high level.

The students were asked to assess how well they have mastered programs, services and applications that they studied during the course "Information and Communication Technologies for Professional Purposes" and which are used when working with SMART complexes (Figure 1).

We can conclude that the level of mastery of certain applications is quite sufficient to work with SMART complexes. Within the framework of European integration processes and reformation of higher education in Ukraine, the students' impact on educational and professional programs, their content and components is essential. That is why we offered the students to state which programs, services, applications and skills they would like to master additionally. One third of all students (33%) are satisfied with the content of the discipline, but some students mentioned that they would like to master certain special purpose programs, such as Fusion360, AutoCad, The Gimp, Adobe Illustrator and some services for creating electronic educational resources, such as Graasp and Kahoot (Figure 2).

Future teachers of labor training and technology were asked to choose programs, services and applications that, in their opinion, they will be able to use effectively during their own professional activities (Figure 3).
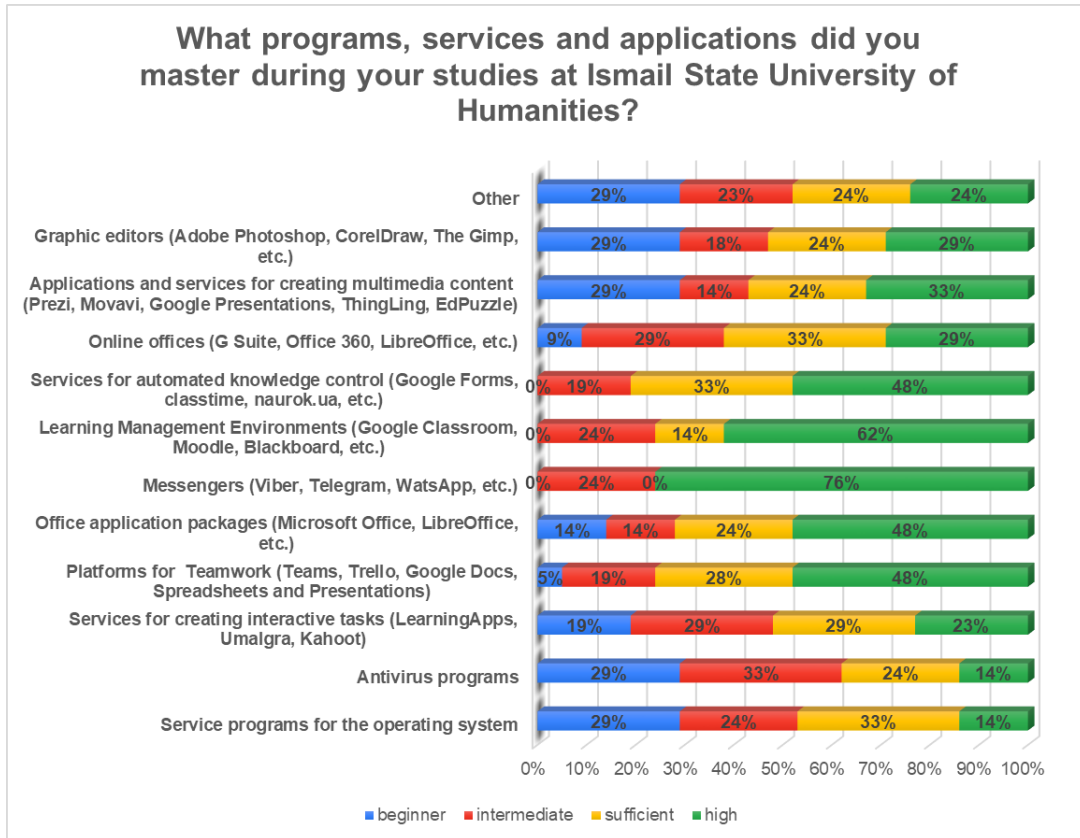
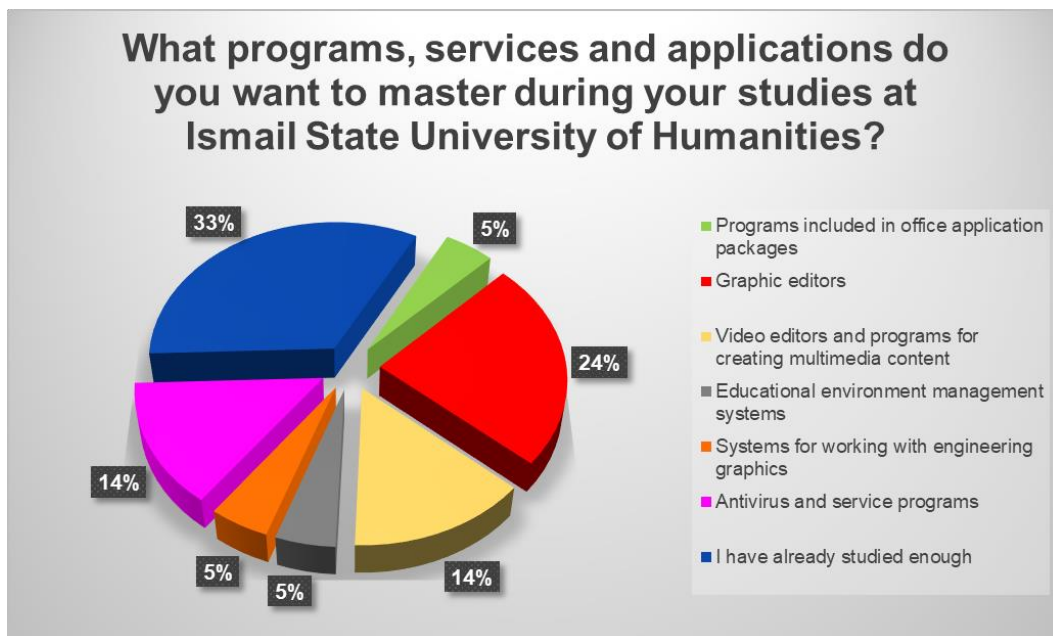**Figure 1** Students' level of mastering programs, services and application

Figure 2 Additional programs, services and applications that students wanted to master during their studies at the university

One of the mandatory components of the educational and professional program "Secondary education: labor training and technology" is writing a course paper on the basics of design, modeling and technical design as well as methods of labor training, technology and drawing. Other components include training and internships,

during which it is advisable to use the acquired skills to work with the above information and communication technologies, as well as to implement the use of SMART complexes [[25]].
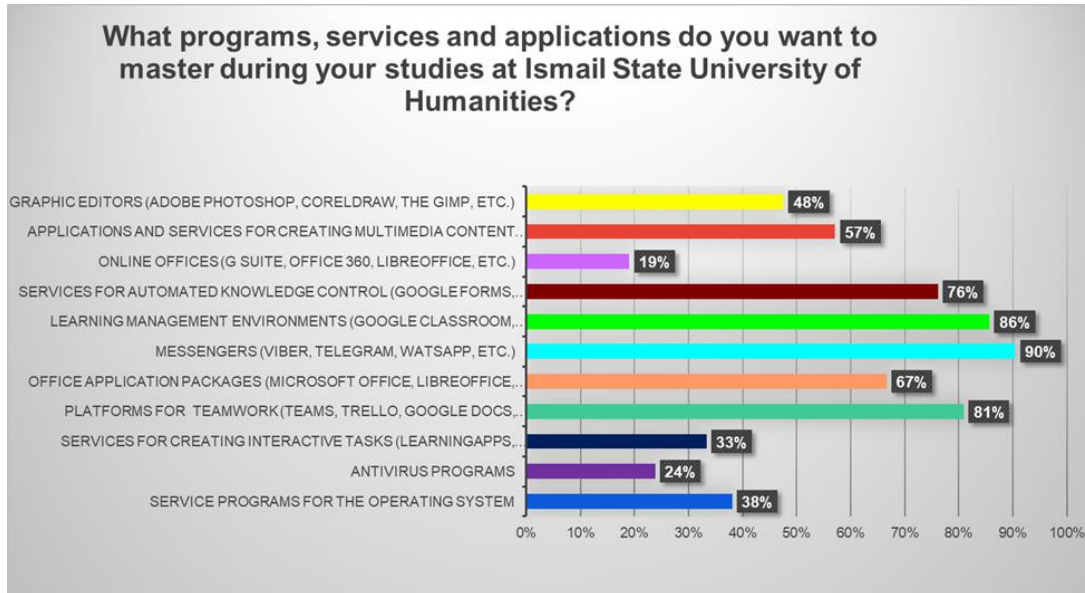

Figure 3 The most widely used programs, services and applications during the professional activity of a teacher of labor education according to students

However, as our study has showed, 43% of applicants are generally familiar with the term *SMART complex* and only 29% have had some experience with such a technology, which indicates that students are quite underinformed in this field. Students indicated that they want to use SMART-complexes in their professional activities in the future as needed (67%) or on a regular basis (9%), and would like to learn how to do this.

It is necessary to consider the need for SMART complexes to meet psychological, didactic and methodological requirements in the educational process such as adaptability to the individual capabilities of the student, the future teacher of technology, etc.; interactivity in the process of their practical training and application of technical means; realization of great opportunities of computer visualization of practically all educational information; development of intellectual potential of applicants, future teachers; systematic and structure-functional connection of the presentation of educational material in the educational process; ensuring the completeness (integrity) and continuity of the didactic cycle of education in the teaching of all , disciplines without any exceptions [[2]; [3]; [19]]. The main technical means of creating and implementing SMART technologies is a computer equipped with the necessary software and additional peripherals that are available in the educational institution, for example:

interactive panels, augmented and virtual reality controllers and glasses, 3D-printers and scanners, etc. [[9]]. Of course, the computer does not replace the teacher, but is only a means of pedagogical activity, the teacher's assistant. Due to the active development of scientific and technical means, SMART-technologies can be used in conducting almost all types of training sessions in the process of training modern teachers of labor training and technology.

The importance of implementing SMART-complexes in the educational process of students, future teachers of labor training and technology will help make the training material more saturated, visual, bright and accessible. This is relevant for the disciplines "Methods of labor training, technology and drawing", "Descriptive geometry and drawing", "Theoretical and applied mechanics", "Fundamentals of Electrical Engineering", "Materials Science" and other disciplines and special methodological courses for future teachers of labor training and technology.

As a result of our experimental work, we have come to the conclusion that the use of SMART-complexes is relevant and necessary in the training of teachers of labor training and technology. Applicants are highly interested in modern developments in the field of information and

communication technologies in general and in SMART technologies in particular.

5. CONCLUSIONS

Thus, having considered the main aspects of using SMART-complexes in the educational process of students studying for a bachelor degree in the program called "Secondary education: labor training and technology", specialty 014 Secondary education, subject specialty 014.10 training and technology, fields of knowledge 01 Education / Pedagogy, qualifications: "Bachelor of Education in labor training and technology. Teacher of Labor Education and Technology "of Izmail State University for the Humanities, we can conclude that the effectiveness of the educational process will be significantly increased, provided that SMART complexes are corrected used in the educational activities of higher education. We have experimentally proved that modern updates and improvements of forms, methods and means of teaching as well as the use of smart complexes, etc., in higher education can significantly increase the level of professional training of future teachers of labor education and technology. According to the results of our research we can state that the use of SMART complexes in general, and elements of foreign SMART complexes, in particular in the process of training future teachers of labor training and technology, indicate the relevance of further research in this area and further systemic introduction of SMART complexes in the educational process of future teachers of labor training and technology.

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