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Two Key Projects Aimed At Czech Pupils, Students and Teachers

The growing popularity of information and communication technologies in all areas of human activity has increased the demand not only for IT experts, but also for employees with general knowledge of informatics. Therefore, IT instruction needs to be improved, which should lead to improving digital literacy of teachers. Two national projects, in which every single pedagogical department in the Czech Republic participates, are aimed at improving the current situation.

The project titled “Activities for Developing Computational Thinking” is aimed at updating the subject Informatics at all educational levels, from kindergarten to high school. Conducted between the years 2018 and 2020, the project will result in the following:

- School curriculum
- Open source materials
- Teacher training
- Updated teacher education in pedagogical departments
- Massive e-courses for the general public
- Updated informatics (school subject):
 - University student competitions
 - Professional didactic conferences
 - Teacher competitions (in which those teachers who create study materials will participate)
- Making informatics and author access to the computer more popular

The second project titled “Developing Digital Literacy” is aimed at creating didactical and methodological support to both new and experienced teachers, helping them implement activities aimed at developing digital literacy into the instruction of general subjects in elementary schools and high schools, in accordance with the planned revision of the national curricular documents. The following are the expected project outcomes: a set of digital educational resources for primary and secondary education, including methodological materials, aimed at developing digital literacy consisting of at least 75 digital resources for ISCED levels 2 and 3 and at least 12 digital resources for ISCED level 1; and a set of activities, tools and methodologies for preschool teachers aimed at developing children’s digital (pre)literacy consisting of 6 model activities (including tools and methodologies) aimed at different areas of digital literacy, with regard to the appropriateness of their development in preschool education.

Another contribution of the project is the creation of a sophisticated structure of accredited courses (the majority of which will be e-courses) for kindergarten, elementary school and high school teachers aimed not only at developing digital literacy of children (kindergarten), pupils (elementary school) and students (high school), but also at the ability to use the acquired skills in pedagogical practice.

The data provided by the Czech School Inspectorate and other institutions prove that both projects will be beneficial. The data show that teachers’ technology skills are limited to using MS PowerPoint and that students do not have skills related to the effective and safe use of digital technology.

Tomas Javorcik

Executive Editor

INNOVATIVE TECHNOLOGIES TO MANAGE EDUCATIONAL PROCESS IN HIGHER EDUCATIONAL INSTITUTIONS

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ABSTRACT

The paper deals with one of modern effective pedagogical technologies in relation to management of the educational process with students of higher educational institutions. The authors discuss the concept of virtual excursion, formulate its advantages over traditional technologies, clarify the principles of modern pedagogical activity through a virtual excursion for the teachers and students.

The paper presents one of the lecture plans devoted to a virtual tour using Internet resources. Relying on live resources, the authors argue that a virtual excursion brings students closer to their professional tasks, teach them to associate theoretical material with practice. As for an instructor, the effective use of modern innovative, computer training technology can improve the efficiency of teaching different subjects, streamline learning activities, optimize the processes of understanding and memorizing learning material.

KEYWORDS

virtual tour, innovative technologies of teaching, modern pedagogical activity, energy saving.

1 INTRODUCTION

The world we live today has become increasingly dependent on information technologies. They are widely, intensely and effectively used by people in all spheres of life. Computer today has become a standard attribute of everyday life, becoming an indispensable facilitator in learning, work and recreation. It is computers who freed mankind from routine labor, simplified the search and obtaining the necessary and up-to-date information. Informatization of all spheres of life of society has led to the emergence of new category of culture – the informational culture. The information technology has also been widely adopted in the educational process. Since there have been changes changes in educational goals, the emphasis shifted from "acquiring knowledge" to the formation of "competencies", there is a reorientation to a person-centered approach. That is, the main goal of training is not the transfer of a certain amount of knowledge, but the formation of skills to obtain and process information, to form a high-level thinking skills: analyze,

synthesize, and evaluate. All this requires the introduction of teaching technologies into the educational process.

Today, the leading position is taken by methods and techniques of training, based on the use of modern computers, computer programs, simulators, because modern youth are very much pulled to them considerably. In our opinion, it is the personal computer, the Internet that can act as direct teachers' assistants to intensify the process of learning with students. Modern engineering education, as never before, requires a new type of teacher who uses and skillfully introduces into practice modern methods and technologies of education, the tools within psychological and pedagogical technology, methods of independent designing of pedagogical process in the context of defined practical activity. Each university teacher faces the task of making their disciplines interesting for students, raising motivation to study, helping students to discover their talents, boosting their cognitive activity. A graduate of the university must be an expert in his or her field, be mobile, be able to quickly and adequately react to changing circumstances, to ensure the most effective result of their work.

The main criterion for the quality of student learning is competence in various areas of future activity: professional, communicative, socio-economic, and general cultural ones.

In our opinion, the most effective means of developing competencies is the use of project and search methods in the learning process. It is project technologies that are one of the active forms of pedagogical technologies - they develop a high motivation for educational and cognitive activity and provide for the effective use of information and computer technologies (ICTs). The students of power engineering are very eager to participate in project or quest classes, in short, they enjoy cooperation, they enjoy to solve complex technological problems together, to put theoretical knowledge to practical actions. Relying on practical side of our students' work and continuing to search for ways to enhance motivation and opportunities to use ICTs in our work, we became interested in yet another innovative technology - a virtual tour.

Excursions accompany us all our lives, they are great teachers and reveal the cognitive motto: "It's better to see once than to hear a hundred times." The learning potential of pedagogical excursions is great: they enable the younger generation to grow intellectually, to develop the feel for beauty of the surrounding world, they are a way to combine learning with life, with practice, and they are an important means of boosting educational process. During collective excursion activities young people develop the ability to act collectively, "to get used" to the environment, both natural and social.

2 SETTING THE RESEARCH OBJECTIVES

- 1) to describe new forms, methods and means of teaching material for the purpose of successful organization of student's educational activities;
- 2) to model the advantages of innovative technology for organizing learning process with students;
- 3) to see the ways a virtual tour can facilitate students' acquisition of knowledge in the field of construction and operation of boiler plants in terms of energy conservation and environmental protection.
- 4) to develop and design complex and modern systems in the heat engineering, leaning upon certain ideas of advanced achievements in the design of facilities in heat and power engineering.

The main benefits of a virtual tour over traditional learning technologies can be presented in the form of a scheme depicted in Figure 1.

The main objective of the virtual tour is "It's better to see one once than to hear a hundred times."

Pedagogical potential of virtual tour tool:

- represents an effective opportunity to increase their intelligence, level, development, observation;
- is a combination of learning with observable life, with practical activity, which is an important means of activating the educational process;
- forms the skills of collaborative work in mini-groups, pairs;
- permits short acquaintance with various production facilities (according to the class topic), which are far apart from each other;
- allows to present the activities of industrial production enterprises and professions demanded on the job market;
- helps to make the main step towards the targeted professional orientation of students;
- allows for the use of multimedia panoramas (videos, graphs, diagrams, drawings, texts, links);
- permits to widely include illustrations, audio and video fragments.

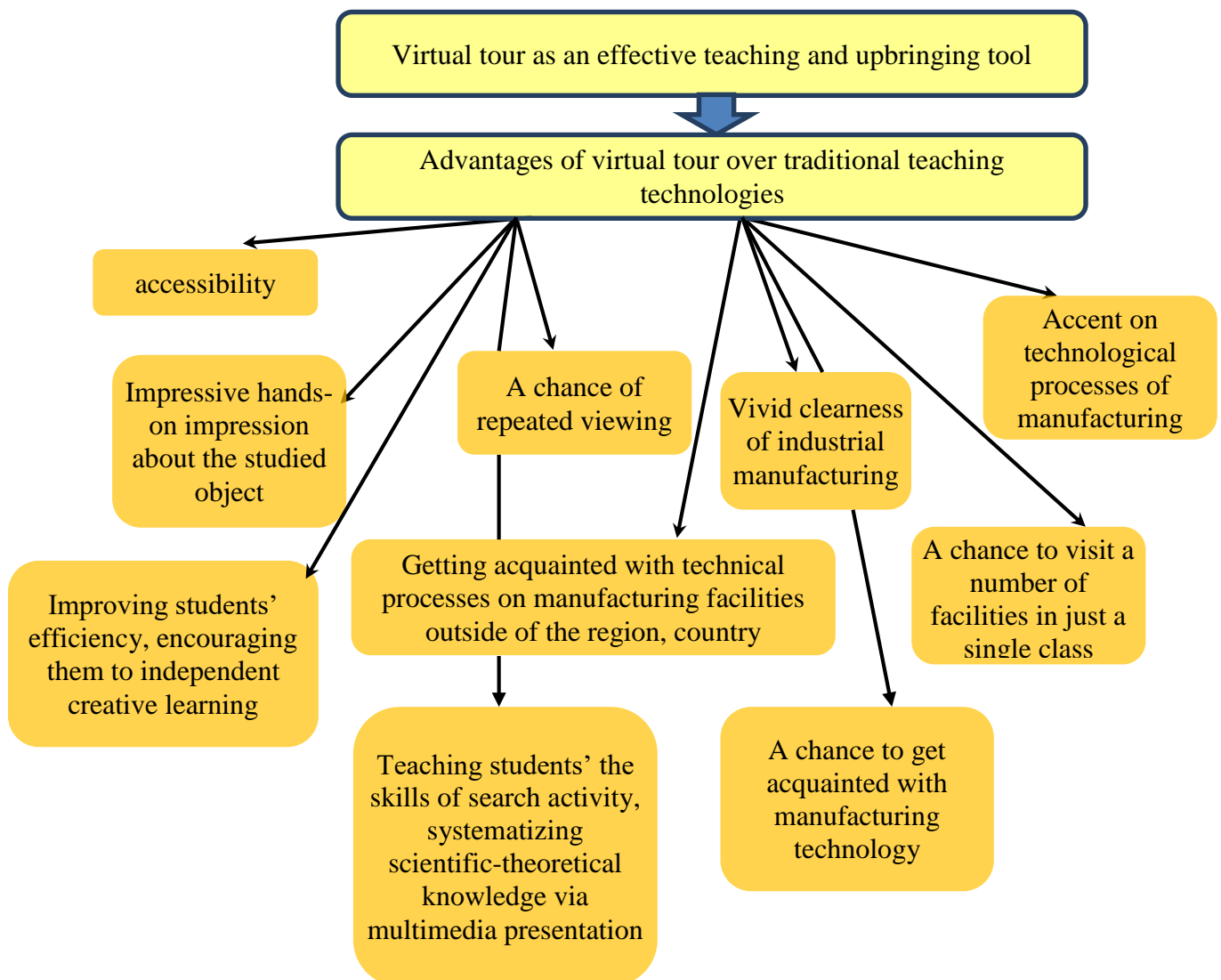


Figure 1 The benefits of a virtual tour over traditional learning technologies

Teachers’ tasks during a virtual tour are:

- to invite students to note interesting moments, copy the necessary materials into their note books;
- to perform creative research tasks in order to consolidate the studied material;
- through the final conversation, problem-solving to teach students the skills of summarizing, systematizing the information they have heard and seen during the class. Together with students, to identify important moments of learning activities;

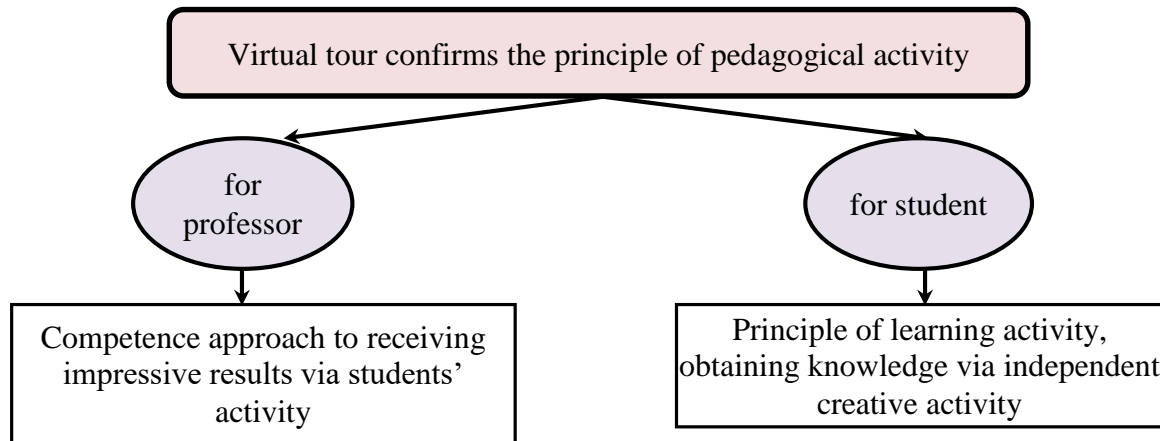


Figure 2 Principles of realization of virtual tour

- to make annotated price lists of positions in industrial enterprises, which were visited during the virtual excursion; focus students on specialties that have high demand in the labor market in the region and country;
- to change the approach to the content of tasks for self-fulfillment and practical tasks. The tasks for independent studying can be both traditionally thematic and selectable (according to the individual training of the student), outrunning in nature with the goal of starting teacher-student cooperation.

These can be creative-cognitive tasks such as:

- creative report after excursion, practice in production facilities;
- create an album or presentation of the necessary technical documentation on the topic being studied;
- prepare a mini-report on the topic of the next lesson using the materials of the virtual tour.

STUDENTS DURING VIRTUAL EXCURSION

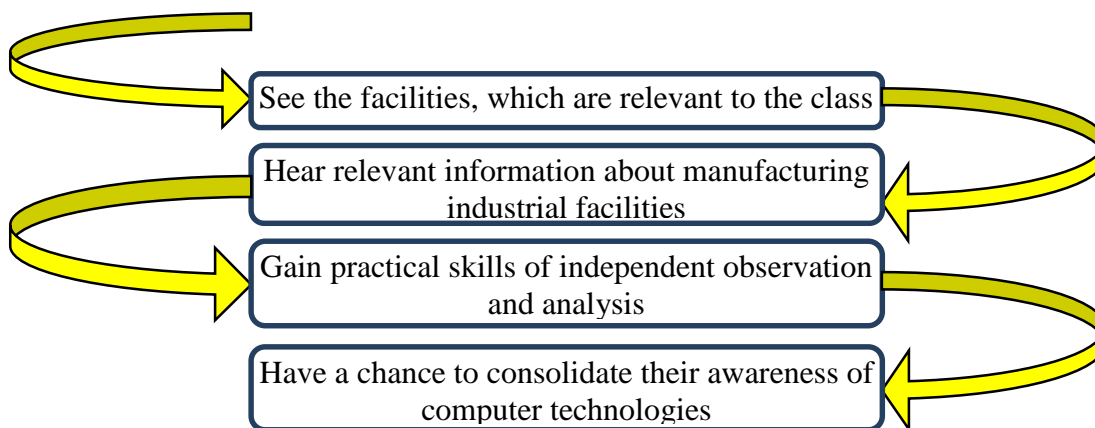


Figure 3 Knowledge acquired by students during a virtual tour

3 RESEARCH RESULTS

The excursion work at our university is systematic and planned, and has a close connection with the curricula of specialty disciplines. First of all, the excursions to production facilities strengthen students' motivation to work in the chosen profession, excursions serve as a form of visual familiarization of students with technologies, production management, the content and working conditions, help them obtain profound knowledge for further work in the field. Besides, most importantly, during excursions students have an opportunity to get effective information to choose a subject and fulfill the course and diploma project more successfully.

Today, the actual solution to this problem is becoming a bit harder due to some technological reasons. To help study the technological processes we can use videos made in production plants, though their quality does not always meet the requirements. The analysis of video stories shows that sometimes there are actual errors, expressive features of the screen do not always correspond to didactic tasks, interactivity is not supported by cognitive activity.

This is where we can apply the innovative pedagogical technology of virtual tour over the Internet. Students' connection to the Internet provides them with an individual cognitive trajectory, which makes the process of learning more manageable, rational and more productive in terms of opportunities for the development of the creative potential of each student.

The term "virtual" in English means "a similar one, the one that can not be distinguished". A virtual excursion is an organizational form of learning that differs from real tour with virtual mapping of objects, where we observe conditions for self-observation, a collection of necessary facts. Characteristic features of virtual reality are: real time simulation; imitation of the environment with a high degree of realism; the ability to influence the surrounding circumstances and have feedback.

The planning and conduction of educational virtual tours consists of three stages: preparatory, excursions themselves and the final stage - summing up the excursion.

I. Preparatory stage.

1. The purpose of the tour is defined - development of skills of dealing with various information sources, ability to analyze and transmit information, study production and technological processes in the given field, aspects of organization behind technological equipment and ways to improve production efficiency.
2. The selection of the object of study. The objects of excursion are the Internet images of real objects; the description of technological processes, raw materials needed, photo gallery of products, equipment, price lists, video clips. Having already learnt the object of the tour, the teacher introduces himself or herself with the information of the site and creates for the students the route of excursions (a guide to the sites) - this may be a list of URLs. The route of the excursion is developed as follows: the teacher indicates the pages and the sequence in which they should be reviewed by the students.
3. Formulation of problems, setting the tasks which students will need to solve in classes (which objects demand special attention and what needs to be observed).
4. Determining the forms of reporting or visual representation of the results of the tour.

In preparing for a virtual tour the teacher must adhere to the sanitary and hygienic norms of work on the computer, take into account the spontaneity and uncontrollability of the placement of information on the Internet. The instructor must prepare for a virtual tour in advance, as there can be some unforeseen

circumstances during the excursion: low speed of information transfer, termination of work, or, conversely, updating of a website or a link that was given as a part of assignment.

II. At the stage of virtual tour itself students get acquainted with the materials on the presented online. They select information, organize the selected information according to the specified features, transform information and finally create their own presentations for reporting. The search method plays an important role in activating students' work during the virtual excursion. Students not only get acquainted with the technical process, but also actively search for information about the materials used, technological equipment in production. This is achieved by raising problematic issues before the tour or by obtaining certain creative tasks. More difficult tasks can be given to students who have been working on the Web for a long time and have the skills necessary for independent search for information. During the excursion, students can record abstracts in a notebook, copy materials from the site into their excursion portfolios, make notes.

III The final stage. The tour ends with a final interview when the teachers together with the students summarize, systematize what they have seen, heard, teachers highlight the essential, the most important, see students' impressions, do preliminary assessment, define the deadlines for creative home task. When planning creative tasks, the teacher expands the range of reporting activities, which allows to create a "free choice situation", where students can choose from a range of reporting forms or offer their own within their interests and opportunities. These may include posters, presentations, photo sessions, written reviews, posts, articles to the magazine or the compilation of albums using the illustrative material of the sites visited. Information collected by students during a virtual tour can be embodied as flash animation and become a learning tool that the teacher can use in other groups or courses.

Algorithm for preparing a virtual tour

1. Defining the topic of the class.
2. Setting the goals and objectives of the selected excursion.
3. Preparing the route of the virtual tour (structure of classes, methodical tools, modes of work).
4. Selecting and studying the excursion objects (mini-presentations, presenting reports, creative presentations, viewing abstracts from educational video films about a certain production facility).
5. Recommendations, announcements of additional information sources on the topic.
6. Completion of the " excursion portfolio" (photographs, drawings, diagrams).
7. Choosing interactive methodical techniques for the guided tour.
8. Demonstrating the tour, including it in the course of the lesson.

Practical class on this problem.

Lecture in group ТЕП-14-1д

Lecturer: Ph.D., associate professor Glushchenko O.L.

Discipline: "Boiler installations of industrial enterprises"

The topic of the lecture: "Boiler installations in systems of power engineering of industrial enterprises".

Goal and tasks of the lecture:

To deliver to students the knowledge in the field of construction and operation of boiler plants under conditions of energy saving and environmental protection.

As a result of studying this section the student should

know:

- general scheme of the boiler plant;
- construction of steam and water heating boilers and separate elements.

be able:

- to draw up the thermal circuits of boilers and determine their parameters;
- perform calculations for heat boilers.

Studying this section will allow the student to acquire such **professional competence** as the ability to demonstrate practical engineering skills in the design and operation of heat and power equipment.

Program learning outcomes:

1. The ability to develop and design complex products in the heat energy industry, processes and systems that meet established requirements, which may include awareness of non-technical aspects (society, health and safety, environment, economy and industry); the selection and application of an adequate design methodology.

2. The ability to use some awareness of advanced achievements in the design of objects in heat engineering.

Type of class: virtual tour.

Route list of virtual tour

1. Introduction into a new topic. Motivation of students' educational activity.

Designation of boiler plants.

- a) teacher-student cooperation, the viewing of videos, prepared by students, a preparatory task for independent study;
- b) computer presentation
 - types of boilers;
 - types of fuel for boiler installations;
 - what is the waste after production of overheated steam?

(drawing up of the "portfolio of excursion", summarizing the main points in their notes)

c) interesting facts from the material being studied, for instance;

"In the early 19th century the first steam boilers produced steam with pressure 0.5 - 0.6 MPa and had a productivity of hundreds of kilograms per hour. Currently, steam generators with a pressure of up to 25 MPa (and even up to 31 MPa) are used for steam production at temperatures up to 570 °C and with productivity up to 4000 tons per hour. "

2. Initial consolidation of the material heard and seen.

Frontal Interrogation (work in groups).

I - What is the purpose of boiler plants?

II - What types of boiler units can there be?

III - What types of fuel are used in boiler plants?

IV - What is used to produce water vapor?

3. Presenting new material.

Introduction to technological schemes of boiler plants:

a) the ones that work on solid fuel (virtual excursion to the technical drawing office)

On the screen, with the help of a projector, we present a general technological scheme of a boiler plant, which works on solid fuel (analyzing the scheme, copying it into students' notes - "briefcases of excursions").

Watching the film "The running of a coal-fired power station in the city of Drex (England)"

- Students' mini-reports, consideration of each component of the boiler plant (furnace, feston, drum, steam overheater, economizer, air heater)
- Element of creative-search tasks for independent study - to recommend to students to find materials on the Internet as to the work of boiler plants on solid fuels in the country and region (photo materials, video clips).

b) the boiler plants working on gaseous fuels:

- designing the circuit with the projector on the screen. Analyzing the structure of the boiler, understanding its characteristics;
- watching a video about the work of the boiler unit on gaseous fuels.

consolidating the seen and heard through a written response to the control questions on the topic (express test).

Collective reflection as to a problematic question: "What is your opinion, which boiler plants are more effective? What kind of fuel and what boiler plants will be used in future?"

Recommendations for students as to additional information sources on the topic, a brief summary of section in the textbook for independently study.

4. Conclusions of the class, evaluation of student performance.

Each student compiles a "portfolio of excursions" (diagrams, drawings, answers to problematic issues; theses during the heard and seen during the virtual tour, photos).

Teacher's concluding remarks:

Let me thank you for your creative work today. Thanks to our effective cooperation we managed to make the first steps in the study of the topic "Boiler installations in power systems of industrial enterprises". Using the virtual tour technology we combined the theoretical and practical part of our lesson and we are now acquainted with the main issues of the first sub-topic, namely: the designation of boiler plants and their specificity depending on the type of fuel selected; we determined which kind of fuel for boiler plants is more rational and advantageous today in terms of expenses.

In the next lesson, we will become acquainted with the classification and marking of boilers. In order for the next lesson to enrich your cognitive interest, I suggest that we get prepared together:

(outpacing home task):

- to find on the Internet some video clips about the work of boilers with natural and forced circulation (virtual excursion to enterprises of the city and region);
- to prepare schemes for the circulation of water and steam-water mixture in following kinds of boilers:
 - with natural circulation;
 - with multiple coercive circulation;
 - direct traffic.

(for more efficient performing of these practical tasks, it is recommend to use online materials and the following textbooks:

1. Sidelkovsky L.N., Yurienev V.A. *Steam generators of industrial enterprises*. – M.: Energia, 1978. – 336p.
2. Sokolov B.A. *Boiler plants and their operation: a textbook for the intr. professional education* - M. Publishing Center "Akademiya", 2007. – 432 p.
3. Lipov Yu.M., Tretyakov Yu.M. *Boiler plants and steam generators. Moscow-Izhevsk: RI "Regular and chaotic dynamics", 2003. – 592 p.)*

CONCLUSION

Based on personal experience, we claim that the creation of virtual tours is a complex process that requires a lot of creative effort. However, the result is worth it, since virtual excursion implements the principles of modern pedagogical activity: the principle of competence approach – obtaining high results through the activities of students, the principle of cognitive activity – through independent, creative activities for obtaining new knowledge. Virtual excursion thoroughly contributes to the popularization of the use of modern computer educational technologies in the study of special technical disciplines, is a methodological benchmark for preparing students for their chosen specialty. Thus, if we teach students not only to work, to learn on their own, to overcome difficulties, but also to enjoy it, then we can argue confidently that we have fulfilled the main challenge facing higher education today.

We are convinced that the future of education is in comprehensive innovations, in personal growth and the search for new ways and opportunities for future development.

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PROBLEMS OF DISTANCE EDUCATION

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ABSTRACT

Distance learning and e-learning have significantly developed in recent years. It is also due to changing educational requirements, especially for adults. The article aims to show the advantages and disadvantages of distance learning. Examples of the 20-year use of the distance learning form of computer science describe the difficulties associated with the implementation and implementation of this form of teaching. The results of students in the full-time and distance form of teaching in the bachelor's study of computer science are compared. Long-term findings show that distant students have significantly lower scores in the first years of study than full-time bachelor students. In the following years of study, the differences diminish, and students' results are comparable. The article describes the possibilities of improving the quality of distance learning.

KEYWORDS

Distance learning, education, e-learning, Learning Management System, t-test.

1 INTRODUCTION

In recent years, the need for distance and combined forms of education has grown increasingly. It is mainly due to increased demands for tertiary education and the need for frequent changes in vocational education. Traditional full-time teaching can often not be used in employee training. The problem of distance learning is that most participants have no practical experience with this form of teaching. This leads to worse results for distance students. Students need not only to prepare quality teaching materials but also to adapt their teaching methods (Van de Vord 2010) (Klímová 2015). It turns that distance learning is difficult for the students. The most important problem lies in abilities of students to manage their studies. Part of students is unable to plan a well-proportioned schedule for learning. They often start to learn at the end of the semester before course exam. They are requested to finish successfully courses and that why they don't have enough time to complete all course requirements, and often they fail in the whole study (McPhee 2012). The first semester of a study is the most problematic period of studies. There are many such students that interrupt their studies on this period. One of the reasons is wrong information and incorrect idea about the distance learning (Levy 2007) (Shachar, Neumann 2003).

2 DISTANCE LEARNING AT THE DEPARTMENT OF INFORMATICS AND COMPUTERS

The Department of Informatics and Computers at the University of Ostrava started to deal with the realisation of the distance learning form using information and communication technologies for the first time in 1998. This was a distance study of the Bachelor's degree in Applied Informatics, preferably for hearing impaired students. The demand for such a form of the study came from the secondary school for the hearing impaired. Ten students enrolled in the study. These were students from all over the Czech

Republic. To ensure the unique requirements of the deaf students, the services of sign language interpreters were used, which took part in all the tutorials. The high demandingness of the study, the specific form of study and, above all, the inadequate preparation of secondary school students caused only two students to complete the study.

Interest in distance learning also increased among students without health disabilities. After the bachelor study program Applied Informatics, the distant form of teaching was added in the Bachelor's degree program Informatics as well as in the follow-up master program of Informatics.

Each course has learning materials in the LMS Moodle, to which both distance and full-time students have access. In addition to LMS, two to five tutorials are available for each course in the semester. They aim to consult on unclear and more complex topics.

Within 20 years, different technologies and methodologies have been tested to improve the distance and combined forms of teaching. When introducing distance learning, there was a need for teachers to undertake distance learning courses. None of the teachers had experience with this form of teaching. In the early years, Lotus LearningSpace was used to install Lotus Notes Client to create and manage courses. The system was later replaced by the IBM Workplace Collaborative Learning commercial product. However, this system was designed for the corporate sphere. IBM Lotus Workplace Collaborative Learning Authoring Tool was delivered to this LMS. The application was unnecessarily complicated for most teachers and did not allow some functionality, such as randomly generating test questions and answers. That is why the system was replaced by Tutor 2000 and ToolBook Instructor, which better responded to didactic requirements. Its disadvantage was that the courses created were not common websites and required the presence of certain plugins. Therefore, all of these systems have been replaced by LMS Moodle, which has proved to be the most appropriate system for teaching at the university.

To improve the quality of teaching, the study materials were gradually developed. In addition to teaching texts and presentations, video recordings of lectures and seminars and other multimedia teaching materials were gradually created. MediaSite was used to record video lectures in which the video captured by the teacher synchronised with the slides of the presentation. Distant students appreciate the opportunity to play video from lectures, seminars or tutorials. Video helps them better understand learning themes.

Experience with distance course management shows that it is essential to motivate students to work actively on a continuous basis. Students who work continuously during the semester usually have better results. Continuous activity can be assured, for example, by assisting with regular tasks that students have to develop, for example, once every 2-3 weeks. A more extended period between correspondence tasks proved to be inappropriate. Students were only studying at a glance, and many of them have dropped out of their studies early. Because they left their assignments for the credit week, they found that they were not able to handle everything. A significant role is played by distance learning in communication. Due to the minimal presence of face to face communication, it is necessary to support and develop other communication tools. It was very advantageous to evaluate the activity in the electronic conference of the course. Students asked and helped each other with ambiguity. Online communication tools have been used less, due to the different time capabilities of course participants (Okaz 2015). Experience has shown that attendance tutorials are also important for distance learning. It is essential, however, to explain to students that tutorials do not take the form of a lecture but a consultation. Students who attended regular tutorials usually had better results.

3 ADVANTAGES AND DISADVANTAGES OF DISTANCE LEARNING

Distance learning requires students and teachers to have a completely different approach than regular daytime lessons. As demonstrated by practical experience, this is a very demanding form of education. Fundamental issues and difficulties include:

- Students and many teachers have little or no experience with this form of teaching,
- teachers feel they can use the same pedagogical and didactic practices as in full-time teaching,
- teaching requires students to be highly motivated and able to deal with time efficiently,
- complex and demanding preparation of teaching and study materials,
- the need for thorough technical security.

As opposed to full-time teaching, it is necessary to provide an extensive preparation for the distance and combined forms. Students must already have all study materials, assignment of correspondence tasks, technically prepared control systems, means of communication, and so on. However, this requires a lot of work both technically and methodically and didactically.

We surveyed among students of distance learning forms. As the reason for choosing distance learning, students are most likely to study at work. Other causes include efforts to expand qualifications, increase chances in the labour market, increase awareness of information and communication technologies (Hannay, Newvine 2006).

The most common advantages of distance learning are given by students:

- Opportunity to study at work,
- the possibility to study in time, which the student determines himself,
- the possibility to individually plan the work and study mode,
- not to attend school daily,
- the ability to process and forward tasks over the Internet.

On the contrary, as the fundamental disadvantages and practical problems of distance learning, students stated:

- Limited personal contact with the teacher and other students,
- missing classical lectures and seminars,
- occasional lousy communication with some tutors,
- self-study occasionally escape information, which the student would have recorded during his / her attendance,
- the difficulty of organising the time correctly,
- more considerable difficulty in understanding some terms,
- to retain motivation for the study.

Many students thought that distance learning would be more comfortable and less demanding for students. That was not true, of course. Graduates of the full-time and distance forms of studies must have the same knowledge and skills. Nearly no student had any practical experience with distance learning.

As can be seen from the monitoring of distance learning, the educational institutions influence the quality of distance learning by two primary factors. The first is the level of distance learning curricula and online courses. The other is the way and the quality of the teaching process management. Another factor influencing students' success is their motivation and discipline. The distance and combined form of teaching place much more emphasis on these factors than in daytime lessons where students are under the direct supervision of the teacher.

A significant problem of distance and combined forms of teaching is the ability of students to devote themselves to their study affairs. A certain number of students are not able to correctly plan their studies during the semester. It is often the case that the lessons are devoted to just before the exam period. Since they have more than one course of instruction, they do not have enough time to complete all the tasks and often end their studies. Therefore, the role of the tutor, which has the task of activating students and encouraging them to work continuously, is significant.

In each learning process, the role of the teacher is significant. It not only mediates new knowledge and skills but mainly leads and guides the learning process. Helping students with problems, evaluating them, and communicating. However, in the distant form of teaching, these roles need to be significantly reduced, especially as regards the methods and forms of the teacher's work.

The role of the teacher - the tutor moves from the grantee of the new knowledge mainly to the control element of the learning process. Much more tutor needs to be involved in managing communication, assessing students' work, supporting their motivation, and guiding the learning process rather than explaining the new curriculum. Many educators who begin with this form of learning do not realise these experiences and try to apply their experience from the day-to-day lessons to the distance education. From the knowledge gained in our department, we have come to the fact that it is appropriate for the teacher himself to test the role of the student in a practical e-learning course.

4 COMPARING THE SUCCESS OF DISTANCE AND FULL-TIME STUDENTS

Already from the beginning of the implementation of distance learning, it has been shown that distance students have more difficulty in completing individual courses. By improving the quality of teaching materials and learning itself, the success of distance students has improved but is still lower than that of full-time students. It is especially noticeable at the beginning of the Bachelor's degree program.

We compared the results of students in courses. We used statistical methods. For comparison, the results of the two groups (distance and full-time students), we used the T-test: Two-Sample Assuming Equal Variances. Two sample t-test is used to compare the difference between two populations. This parametric test assumes that the variances are the same in both groups. This assumption we tested by the F-Test Two-Sample for Variances. For analysis of the results in each item was measured as having detected data variability. We used a coefficient of variation. To interpret the results of the second stage classification was done the t-test. For evaluating the results were used MS Excel and statistical software Wizard for the operating system Mac OS X and statistical software Statistics Visualizer for iPad (Řehák, Brom, 2015) (Chráská 2007) (Švaříček, Šed'ová 2007).

We have set up the hypothesis that describes study results in courses:

H1 - Distant students have worse study results than full-time students.

The results

The following part of the paper describes the comparison of results of full-time students and distance students. Distance learning puts students at much higher demands than studying full-time. This is reflected in the results of the students. We can observe the differences between the group of distance learners and a group of full-time students. The difference is mainly in the first semester. The success rate of full-time students is 64% in the first semester. The success of distance learners is only 39% in the first semester (Figure 1).

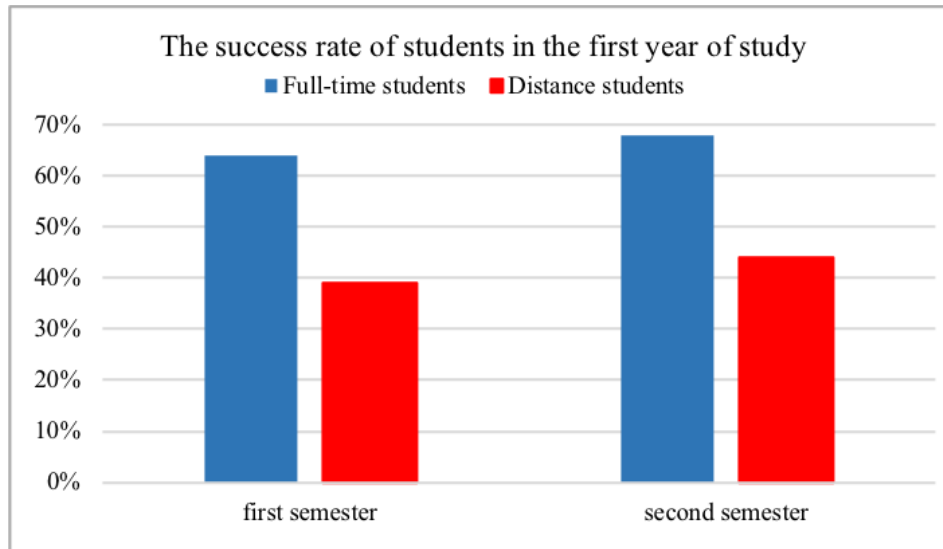


Figure 1 The success rate of students in the first year

We've compared the results in courses: Basics of programming (typically first semester), Architecture of hardware and Fundamentals of operating systems (typically first semester), Programming in C/C++ (typically third semester) and Object-Oriented Programming (typically third semester). Each student can receive a maximum of 100 points. For the success of the course, he must gain at least 51 points.

The following chart (Figure 2) shows a comparison of the success of distance students and full-time students in course Computer architecture and Fundamentals of operating systems. Students usually study this course in the first semester. Results show differences in the past eight academic years. The graph shows that the results of distance learners are worse than those full-time students.

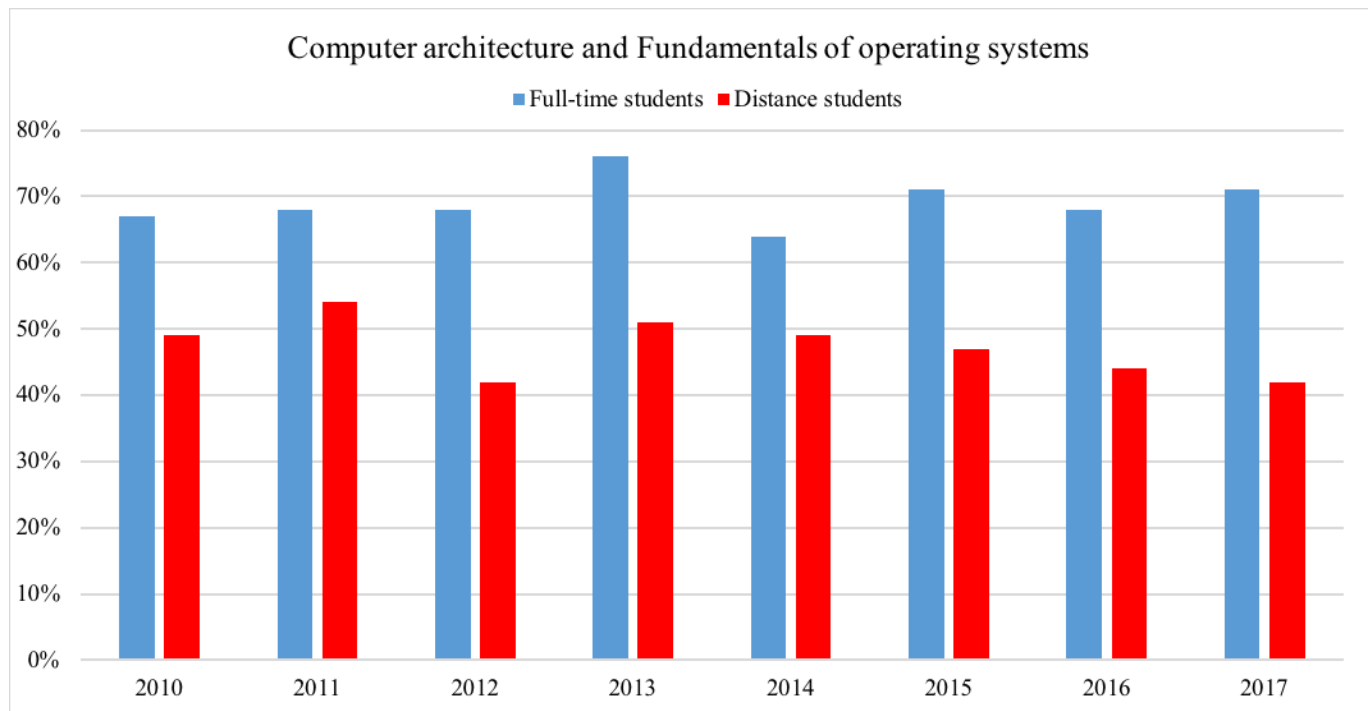


Figure 2 The average of successful students in course Computer architecture and Fundamentals of operating systems (typically first semester)

For courses Architecture of hardware and Fundamentals of operating systems, Programming in C/C++ and Object-Oriented Programming F-test confirmed compliance variances. Therefore, was further carried t-Test: Two-Sample Assuming Equal Variances. The results in table number two show that we must reject the null hypothesis. Distant students had worse results than full-time students.

Table 1 T-Test: Two-Sample Assuming Equal Variances for course Architecture of hardware and Fundamentals of operating systems

t-Test: Two-Sample Assuming Equal Variances	Distance students	Full-time students
Mean	39,05	54,95
Variance	1643,70	1020,12
Observations (number of students)	76	94
P(T<=t) one-tail	0,00239	
t Critical one-tail	1,65397	
P(T<=t) two-tail	0,00478	
t Critical two-tail	1,97419	

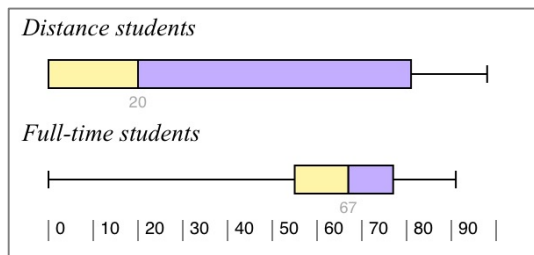


Figure 3 Successful students in course Architecture of hardware and Fundamentals of operating systems

We conducted F-test that we ensure that the variances in the two groups are identical. The test showed the great diversity of variances, so we made t-Test: Two-Sample Assuming Unequal Variances. The course Basics of programming: we can reject the null hypothesis based on the results in the table. The average number of full-time students are pointing higher than for distance learners. The results, of course, show that we reject the null hypothesis. Distant students had worse outcomes than full-time students.

Table 2 T-Test: Two-Sample Assuming Unequal Variances for course Basics of programming

t-Test: Two-Sample Assuming Unequal Variances	Distance students	Full-time students
Mean	28,06	54,83
Variance	1366,06	829,06
Observations (number of students)	52	66
P(T<=t) one-tail	0,00002	
t Critical one-tail	1,66123	
P(T<=t) two-tail	0,00004	
t Critical two-tail	1,98552	

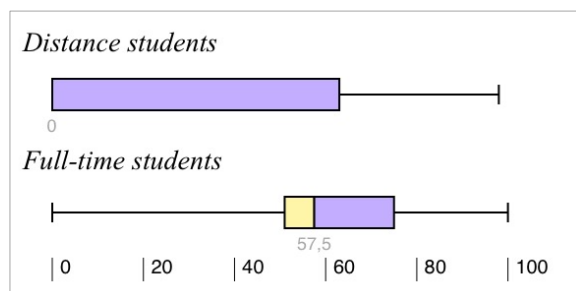


Figure 4 Successful students in course Basics of programming

Figure 5 shows a comparison of the successful completion of the Basic Programming course in the last three years. While attendance students successfully scored on average 74%, then distance students only 40%.

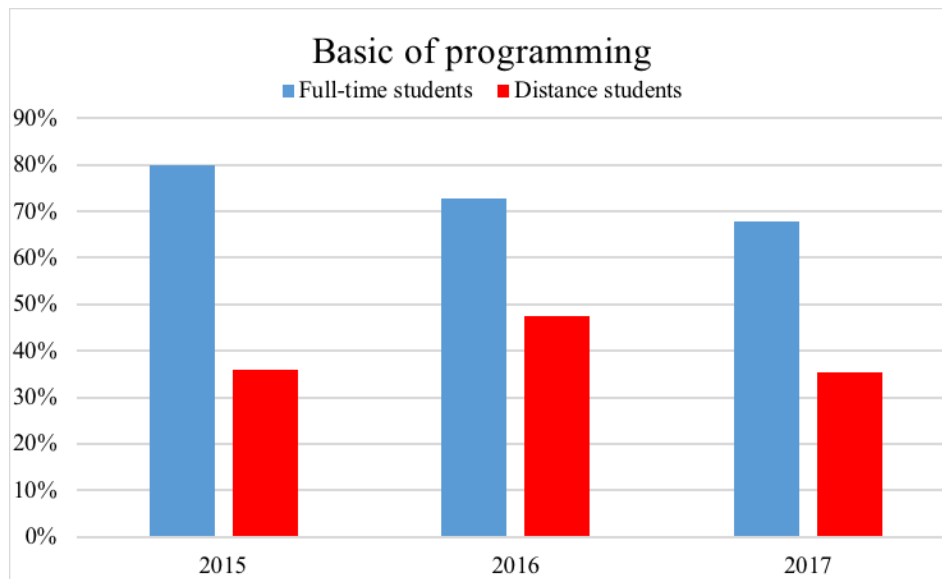


Figure 5 Successful students in course Basics of programming (typically first semester)

Figure 6 shows the percentage of students in course Programming in C/C++. Students typically study in this course in the third semester. The average of successful students in distance learning is 69% and in the full-time study is almost 75%. Differences between the two groups are not so pronounced. Distance students in higher semesters are more successful study and do better organise and manage.

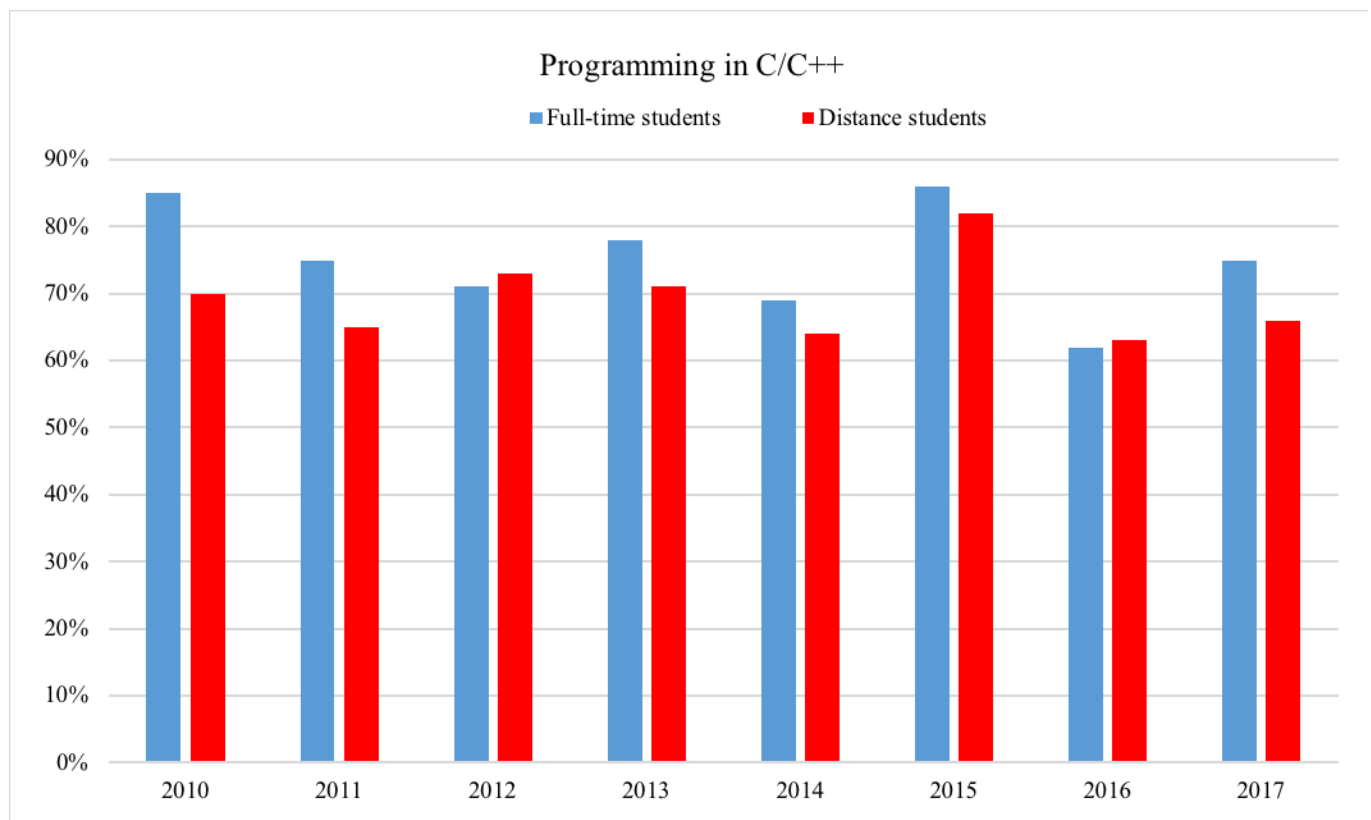


Figure 6 The average of successful students in course Programming in C/C++ (typically third semester)

The results for the course Object-oriented Programming show that it is confirmed null hypothesis. Full-time students had about the same results as distance students. But in the group of the spacer, it is also part of students who acquired zero or very few points (Figure 7 and Table 3).

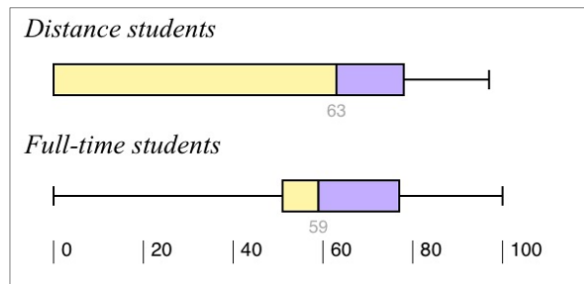


Figure 7 Successful students in course Object-oriented Programming

Table 3 T-Test: Two-Sample Assuming Equal Variances for course Object-Oriented Programming

t-Test: Two-Sample Assuming Equal Variances	Distance students	Full-time students
Mean	45,79	54,93
Variance	1421,21	880,62
Observations (number of students)	28	55
P(T<=t) one-tail	0,12	
t Critical one-tail	1,66	
P(T<=t) two-tail	0,23	
t Critical two-tail	1,99	

Previous results demonstrate the integrity of the hypothesis H1. At the beginning of their studies, distance students have the significantly worse results than full-time students. A large part of distance students not complete the first year of study successfully.

The survey shows that it is necessary to focus more on distance students in the first year. It is not enough just to prepare study materials. Multimedia and interactive materials can facilitate self. Experience shows that it is necessary to motivate students to regular work. We can achieve more frequent correspondent assignments, tests and projects (Cavanaugh, Gillan 2004).

CONCLUSION

Distance learning is currently being requested. It allows students to study at work or a great distance. This corresponds to the requirements for frequent change of professional knowledge and skills. Distance learning in conjunction with information and communication technologies brings new opportunities and benefits. At the same time, however, this form of teaching brings new problems. The research results show that distance students have worse outcomes than full-time students. Students, especially in the first years of distance learning have significantly poorer success rate than full-time students. Many distance students in the first semester will not come to the exam. It is necessary to improve the quality of studies, offer quality learning materials and ensure good governance study. To a considerable degree of improvement contributes use e-conference rate and increase students' activity during the semester. It is advisable to insert solved examples, video tutorials and video lectures into online courses. The most important problem lies in abilities of students to manage their studies. Part of students is unable to plan the well-proportioned

schedule for learning. They often start to learn at the end of the semester before course exam. They are requested to finish several courses successfully and that why they don't have enough time to complete all course requirements, and often they fail in the whole study. Nearly 60% of the distance students do not complete the first year. Full-time students are more successful than distance students. 66% of full-time students completing the courses. Differences between the groups are small in subsequent semesters.

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ANALYSIS OF SITUATION OF INTEGRATING INFORMATION AND COMMUNICATION TECHNOLOGY IN INDIAN HIGHER EDUCATION

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ABSTRACT

India is a growing ICT country in the world. In the most recent research findings ICT provides us several ways of learning and it also affects teachers by providing alternative teaching styles. With the use of the latest technology, teachers can grasp the significance of technology. To use it efficiently and creatively, the teacher should have right and positive attitude. By keeping this thing in view, the concerned study describing the attitude of Indian teachers towards ICT in education in relation to their affiliation with the University is conducted. More than three hundred teachers from different faculties of six universities located in two states of India have participated in the academic year 2015. The statistical test like Z-test and T-test at 5% confidence level proves that University affiliation did not affect the teachers' attitude towards ICT in higher education.

KEYWORDS

Higher Education, ICT, Attitude, Private teacher, Government teacher.

1 INTRODUCTION AND RELATED WORK

After 69 years of independence, a long-time span, the name of India is now added up with the name of developed countries i.e. America, China, England, Russia, Japan, and Russia etc. India's higher education system is the third largest in the world, next to the United States and China. Indian higher education system is controlling and managing through one major regulatory body, indirectly by the Ministry of Human Resource Development (MHRD), New Delhi. The educational structure consists of universities established by an Act of Parliament for Central university and of a State Legislature Act for state universities. Deemed universities can award their own degrees through central government notification. Institutions established State Legislative Act and colleges affiliated to the University (both government -aided and –unaided). Information is regarded as a collection of raw data, consisting of symbols, signs, signals & surrogates that can be compiled into messages (text, audio, images or digital) for communications (Prasher R., 2002).

The victory of Information and communication technology (ICT) in teaching and learning depends powerfully upon the commitment of both teachers and students in education. The competent use of ICT resources by teachers and students is very necessary in educational institutions. Educators are expected to be the leaders of this educational revolution. ICT is essential to any higher education institution that hopes

to succeed in a 21st-century world driven by intense globalization. (Kumar K. & Patil S.,2013) found that there is a significant difference between private and government secondary school teacher's attitude towards using new technology. This indicates that private secondary school teachers show their positive attitude towards using new technology compared to government secondary school teachers. But on the other hand (Shah S. & Thoker A., 2013) proved significant difference between teaching attitude of government and private secondary school teachers, the government secondary school teachers have higher teaching attitude towards their teaching profession as compared to private secondary school teachers. (Poonam & Bala S.,2014) found a significant difference between government and private school teacher's opinion towards the availability of computers for non-teaching staff. According to (Meenatchii B.,2015) there is a significant difference in the attitude towards using ICT in teaching between the types of institutions and private teacher educators have a greater attitude in using ICT for teaching. (Thakur G.,2014) described that Indian government schools have no quality neither latest ICT infrastructure and the lack of ICT enabled train teachers to instruct students. (Joy J. & Sirhari M., 2015) and (Nikkah Z., & Mehra V.,2014) also wrote strong literature about the attitude analysis of Indian teachers. The present paper is written to explore the attitude of Indian teachers towards ICT using differential analysis.

T and Z tests are the two-popular statistical hypothesis testing methods which are mostly used to compare the statistical mean of samples. The T-test is also referred as the "Student T-test". It is appropriate to use when a limited sample size is given such as less than 30 and we are not aware of the standard deviation (SD) of samples. On the other hand, Z-test is also playing a vital role to test hypothesis having more than 30 observations. For apply Z-test, it is a requirement of prior calculation of standard deviation of samples. To apply the differential analysis of samples, the authors applied both T-test and Z-test which are appropriate. Both of statistical tests find the significant mean difference of two independent samples. The proposed null and alternate hypotheses are tested using both tests at 5% confidence level.

2 OBJECTIVE AND HYPOTHESIS

The present study is conducted with the objective to find a significant difference between the attitude of government and private University teachers towards information and communication technology in education. Therefore, we build one null hypothesis and its corresponding alternate hypothesis for a said objective which is mentioned below:

H01: There is no significant difference between the attitude of government and private University teacher towards information and communication technology in education.

H01A: There is a significant difference between the attitude of government and private University teacher towards information and communication technology in education.

2 DESIGN AND METHODOLOGY

The present study includes a quantitative and an empirical method. A descriptive survey method with stratified random sampling technique is applied to collect primary data of 344 teachers from six universities with the help of "5- point" liker type structured questionnaire during the academic year 2015. The research instrument used 35 questions describing ICT five factors such availability, usability, problem, solution, and opportunity. For the selection of variables Item analysis test (DV–DP test by Kelley's in 1939) has been applied. This study includes 35 dependent and 2 independent variables only.

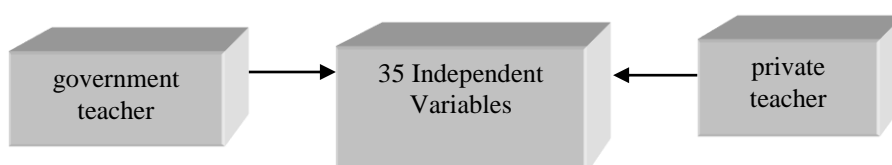


Figure 1 Dependencies of teacher affiliation on attitudinal variables

Figure 1 shows a schematic view of both types of variables dependent and independent. It shows the dependency of 4 independent variables on 35 dependent variables. There are 35 variables defined for measure the attitude of the teacher towards ICT affected

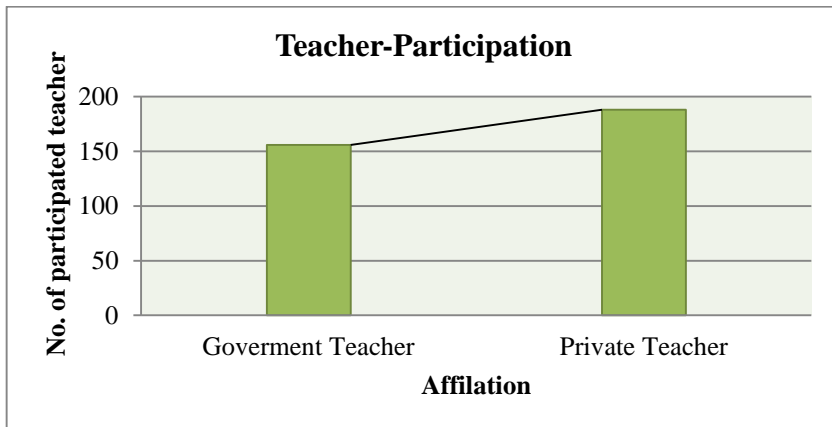


Figure 2 Teacher’s affiliation

Figure 2 depicts high participation of a private University and out of 344 teachers 156 were government and 188 teachers belonged to private universities.

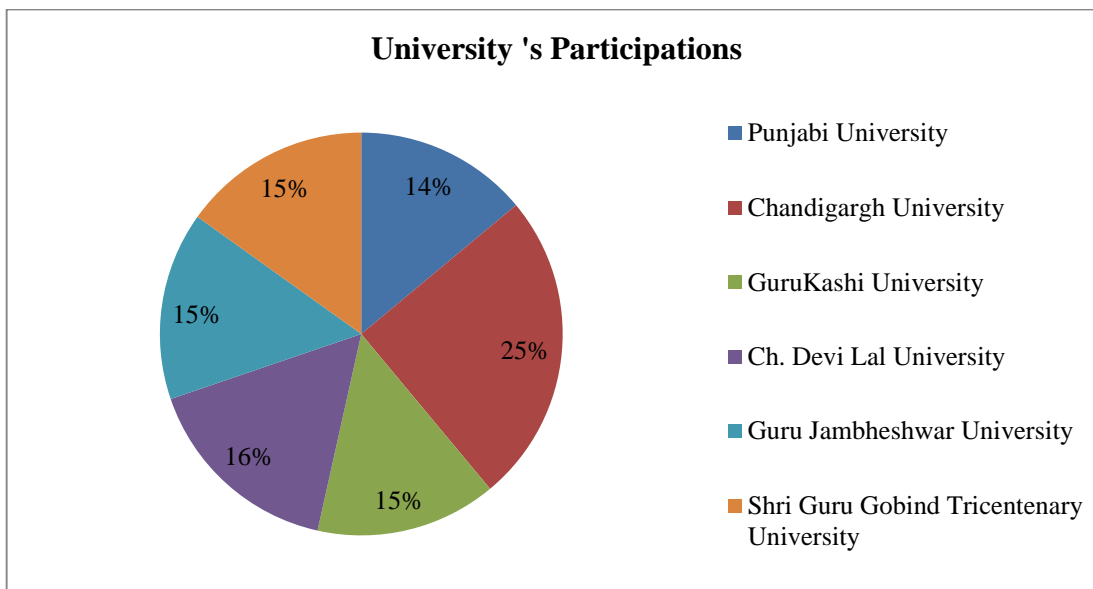


Figure 3 Participation of universities

Figure 3 shows the participated universities from two states of India. The upper three universities are situated at Punjab state and lower three universities are located at Haryana state. The maximum responses collected from Chandigarh University. The maximum teachers (25%) were from Chandigarh University and minimum teachers (14%) were from Punjabi University. Out of 344 teachers, 156 were from government and 188 were from private universities have participated. Out of 6 universities, three had private affiliation and the rest had government affiliation.

4 RESULTS AND DISCUSSION

The collected data set of 344 teachers have been evaluated using popular Microsoft data analysis tools in MS-Excel 2007. For testing, null hypothesis H01 “There is no significant difference between the attitude of government and private University teacher towards information and communication technology in education” both T-test and Z-test at 5% significant level for 68 degrees of freedom are applied. The following Table 1 showing combined results of both applied tests. We have calculated the two values named

Z-Value and T-Value and then after comparing these values with their corresponding observed values which are table value in the statistic.

Table 1 T-test and z-test on h01 at 5% significant level

T& Z- Static	government teacher	private teacher	Status
Mean	362	3.85	
Variance	0.07	0.06	
Calculated T-Value	0.44		
Observed T-Value	2.0		Failed to Reject
Calculated Z-Value	0.44		
Observed Z-Value	1.96		
Significant at 5 % Level	Not Significant at 5 %		

Table 1 reveals that calculated values for both Z and T are smaller than their corresponding observed values at 5 % level of significance for 68 degree of freedom which is not significant at this level ($1.96 > |0.44| < 2.0$). Therefore, the mean difference between government teachers and private University teachers is identical here. In this case, null hypothesis H01 "There is no significant difference between the attitude of government and private University teachers towards information and communication technology in education" is found failed to reject which reveals no meaningful mean difference between private and government teacher towards ICT for their University affiliation status. Hence our alternate hypothesis H01A "There is a significant difference between the opinion of government and private University teacher towards information and communication technology", it failed to accept here. Thus, it is concluded that there is no significant difference between the attitude of private and government teachers towards ICT. Further, to discover the mean difference between 156 government teachers and 188 private University teachers towards five factors, we have applied both T-test and Z-test at 5% significant level for varying degree of freedom.

Table 2 ICT factor mean difference of government-private university teachers using t-test

T-Static	Availability	Usability	Problem	Opportunity
Calculated T-Value	0.53	1.63	1.16	1.16
Observed T-Value	2.10	2.14	2.77	2.11
Degree of Freedom	18	14	8	16
Significant at 5% confidence level	Not Significant at 5% Level			

Table 2 exploring findings of T-test after applying on 344 samples of teachers from private and government universities. The calculated T-values are smaller than observed T- values for five factors at 5% significant level. These values are not significant at 5% level. Though, there is no meaningful difference between government teachers and private University teachers for these factors. Therefore, there is no significance between opinions of government teachers and private University teachers towards availability, usability, problem, solution and opportunity factors. The second alternative is to evaluate the mean difference

between private and government teachers is Z-test. We used Z-test at 5% significance level for known variances. Following Table 3 is presenting the Z-values for various factors under consideration.

Table 3 Factor mean difference between government-private university teachers using z-test

Z-Static	Availability	Usability	Problem	Solution	Opportunity
Calculated Z-Value	0.53	1.60	1.15	0.32	0.56
Observed Z-Value	1.96				
Significant at 5% confidence level	Not Significant at 5% Level				

Data from Table 3 shows that calculated Z-values are smaller than the observed Z-values at 5% significant level for five factors. Hence these values are not significant at 5% level. It is found that no meaningful difference in between mean value of private and government teachers for these five factors.

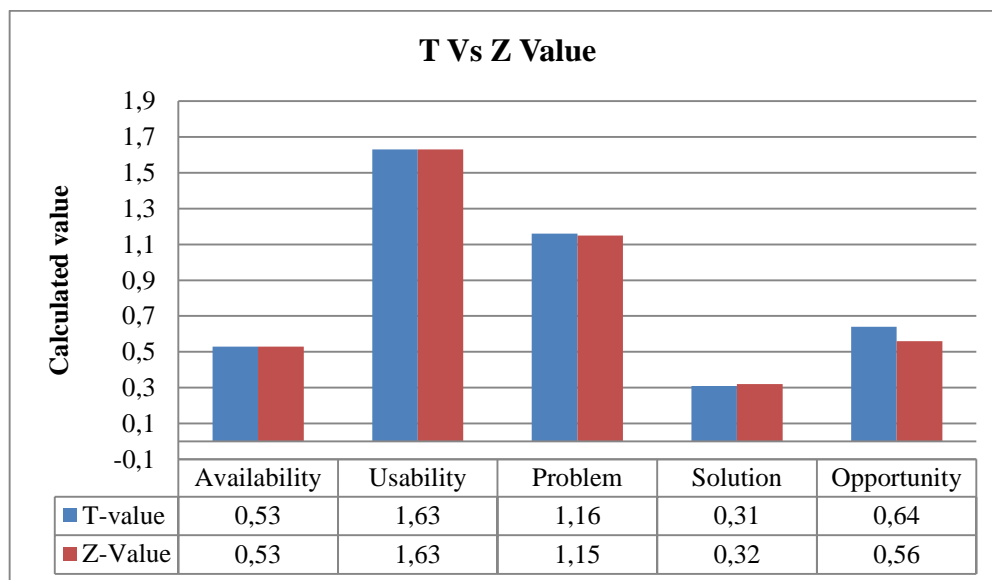


Figure 4 T Vs z value of ICT factors

Figure 4 reflects there is no significant difference between results of calculated values of T-test and Z test for five ICT factors. It is revealed that University affiliation status did not affect the attitude of Indian teachers towards ICT availability, usability, problem, solution but in case of opportunity factor, the T- value is found little bit maximum as compared to Z-value.

CONCLUSION

This paper is written to explore the significant differences between Indian teachers toward ICT in relation to their University’s affiliation such as government and private. After successfully applied statistical test we have found no meaningful difference in between response of private University teacher and government University teacher of India. (Meenatchii B., 2015) found a significant difference in the college (higher educational institution) teacher’s attitude towards ICT in teaching between the types of institutions and private teacher educators have a greater attitude in using ICT for teaching. Similarly, government teachers differ significantly in ICT literacy from private teachers” of (Mohanty S.P. & Pandua M., 2012) is contradictory to our findings here. Further, an outcome of this study is also against the findings of (Kumar K. & Patil S., 2013) and (Shah S. & Thoker A., 2013). Further, at detail analysis of five ICT factor using

statistical test, we have also concluded that University affiliation did not affect Indian University teachers' attitude. This paper is not only beneficial for future researchers of educational informatics but it also informs European teachers about Indian teachers' attitude towards ICT in the Higher education of India.

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INTERACTIVE MATERIAL FOR MATHEMATICS INSTRUCTION

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ABSTRACT

The education area is developing constantly, with innovative approaches to instruction emerging all the time. Digital technology, programs, software and all kinds of applications are used on a daily basis not only in informatics instruction, but also in humanities subjects such as history, foreign language, etc. Since working with modern technology comes naturally for today's students, they find instruction which uses interactive elements more attractive as it is more active, dynamic and visual. The paper is aimed at interactive study materials which could be used in upper primary school mathematics instruction. The created interactive study materials should make instruction more effective and encourage students to be more active in class. Our proposals are based on the 7th grade curriculum. The created materials will be based on the key didactic principles, curriculum and teachers' ideas and requirements. Moreover, the created materials will be implemented into instruction. Afterward, the materials will be evaluated by both teachers and students through a questionnaire survey.

KEYWORDS

Interactivity, interactive whiteboard, mathematics, SMART Notebook, study material.

1 INTRODUCTION

In developed countries, computer technology is used in instruction. Computer programs are used on a daily basis not only in science-based subjects. Standard teaching aids have been replaced by modern teaching methods and aids. According to the Czech News Agency, modern teaching aids are popular among both students and teachers. The Ministry of Education, Youth and Sports supports the use of those aids, intending to expand it in the future (Novinky.cz, 2017). An interactive whiteboard changes the way in which teaching aids are used in instruction. In his book "Teaching Today" (2008), Petty quotes a Chinese proverb which goes, "I hear and I forget, I see and I remember, I do and I understand".

2 INTERACTIVE WHITEBOARD IN INSTRUCTION

Since the current generation of students grew up with modern technology, they find instruction which uses an interactive whiteboard more attractive as it makes it more active, dynamic and visual.

Despite their popularity, creating interactive whiteboard presentations is time consuming for teachers as they lack technical skills. Materials can be downloaded. However, they may not always be suitable for the particular type of instruction. The majority of materials are used in upper primary school instruction, especially in the following subjects: biology, geography and foreign language. However, the available materials are not detailed enough and thus are not suitable for upper primary school instruction. The

majority of available materials are aimed at humanities subjects and foreign languages. Materials for mathematics instruction are not that common. Moreover, mathematics is not a popular subject among students. That is why this paper is aimed at creating mathematics study materials suitable for an interactive whiteboard.

An interactive whiteboard is an electronic device used for educational purposes. Since it offers a number of new options, it should help make both the preparation and instruction itself easier for the teacher. As far as students are concerned, it makes the learning process more attractive and interesting (Skarda, 2016).

An interactive whiteboard was first used in Canada in 1991. In the Czech Republic, it was first used in 1996. Due to its high price, an interactive whiteboard was a scarce commodity (Neumajer, 2008). Between the years 2004 and 2005, the number of interactive whiteboards in schools increased from 300 to 871. Thanks to the “EU Money to Schools” project, the number of interactive boards in schools increased significantly between the years 2010 and 2012 (Cerny, 2015). The main goal of the project was to develop knowledge and skills related to information and communication technology, mathematics, foreign languages, reading and information literacy, etc (MEYS, 2010). Nowadays, interactive whiteboards are used in the majority of primary schools, kindergartens, grammar schools and special schools.

As any other device, aid or material, an interactive whiteboard and its use in instruction, too, has pros and cons (Dostal, 2009).

Table 1 Interactive Whiteboard Pros and Cons

Pros	Cons
Motivates students to learn	Students become disinterested
Learning by playing	Teachers only use it as a projector
Use of animations, images, sounds	Creation of interactive whiteboard presentations is time consuming and technically challenging for teachers
Visual presentation	Surface can be damaged
Draws students' attention and encourages them to be active	Students do not use a book
Helps develop computer and information literacy	Text might be difficult to read in bright light
Materials can be easily edited	Energy intensity
Enables users to share information on the Internet	
Materials can be used repeatedly	

3 APPLYING DIDACTIC PRINCIPLES IN INTERACTIVE MATERIALS

The following key didactic principles need to be taken into account when creating (not only) interactive study materials – motivation, visualization, appropriateness, feedback, self-reliance, learning by playing, continuity, permanency and control (Malach, 2002).

Motivation

Motivation is the basis of every class. Working with an interactive whiteboard (i.e. a new aid) alone is motivational as it offers new options. However, nothing lasts forever. Therefore, the teacher needs to find a way to draw the attention of students. One way to do so is to use an image, song, video file related to the topic when using an interactive whiteboard for the first time. For instance, in science-based subjects it is recommended to start with an experiment which students conduct themselves.

Visualization

Komensky considers visualization to be the most natural part of education. An interactive whiteboard offers a variety of options. Moving text/images, use of sound/video catches students' attention and helps them understand the rules and remember new information. If the teacher wants to teach students about animal sounds, they can either choose from a variety of sounds in the gallery or record the sounds themselves.

Appropriateness

An interactive whiteboard should be used for approximately 30 minutes at a time. However, the teacher needs to realize what age group they are teaching and adjust not only the time spent with an interactive whiteboard but also the content, length and form of study materials accordingly.

Feedback

Feedback from students (what they have learned) is extremely important for teachers. An interactive whiteboard can be used to test knowledge, e.g. the layering of objects when the correct answers are hidden behind objects. Also a part of the software is predefined interactive exercises which the teacher can adjust and then use to test knowledge.

Self-Reliance

The student should be able to use the acquired knowledge to solve practical tasks. Creating such tasks is challenging for the teacher.

Learning by Playing

No activity, including working with an interactive whiteboard, is stress-free. That is why games should be used to motivate students. They can be used both at the beginning of class or as a reward for completing a task. However, instruction should not be based on games, but rather use them as a motivational tool.

Continuity

An interactive whiteboard can be used to logically structure a class (step by step). The teacher can use links to provide additional information which is related to the discussed topic.

Permanency

Motivational, expository and fixation exercises, which can be easily created using the predefined exercises from the interactive whiteboard software, can be used for knowledge retention.

Control

Students can come across websites, which contain misleading or incorrect information. The teacher should be aware of this possibility and inform students about it.

4 PROPOSING AND CREATING STUDY MATERIALS

The proposed materials are based on the 7th grade curriculum taught in two Vratimov primary schools (Masaryk Square and Datynska Street, respectively), taking into account the requirements of mathematics teachers. As far as content is concerned, the following mathematics textbooks were used: Primary School Mathematics 7: arithmetic; Primary School Mathematics 7: geometry; Mathematics Workbook 1, 2 and 3.

Application of interactive elements

To create the study materials, the SMART Notebook 16 program was used, which is compatible with the previous versions of the software and is intended for creating content for interactive whiteboards.

All the materials are identical, they only differ in color. The header and footer are made of shapes offered by the SMART Notebook program. All the study materials contain a title page with the topic title (Figure 1) and content divided into chapters (Figure 2). Using the function "link to page", one can choose a

particular chapter. By tapping on the aforementioned link, the user is redirected to the beginning of the selected chapter.

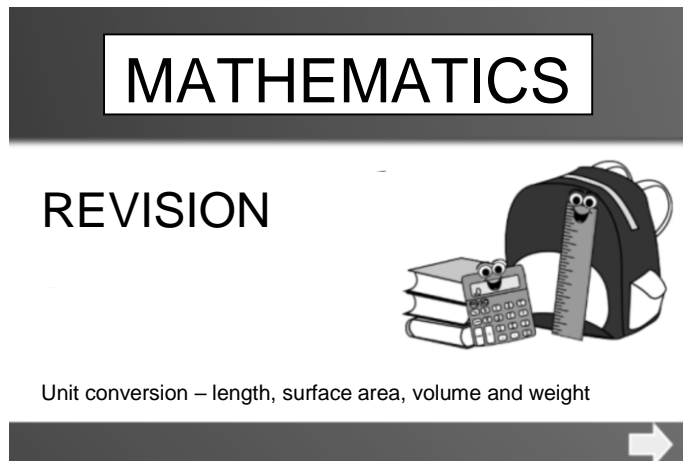


Figure 1 Title page

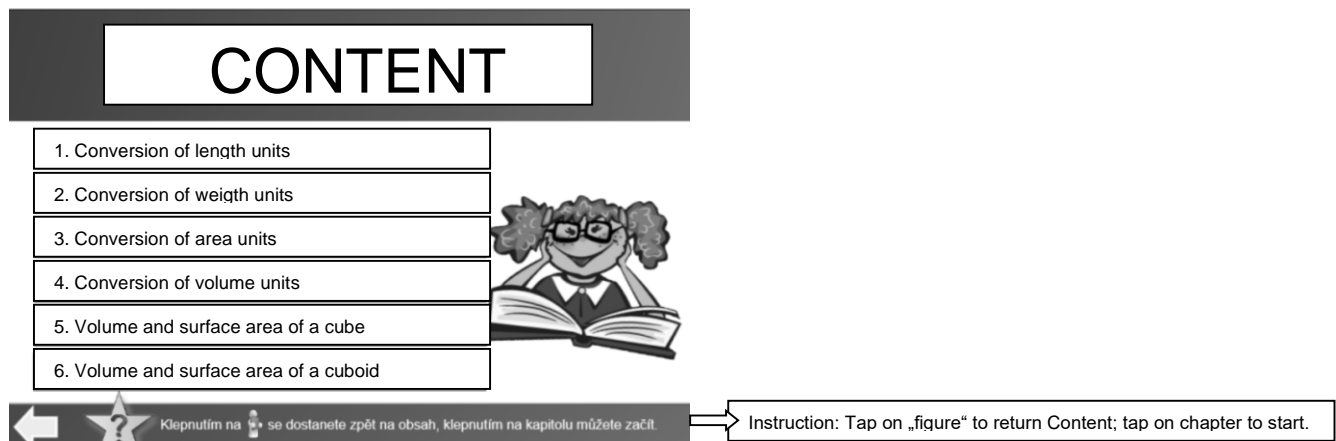


Figure 2 Content

Arrows (which are also based on the “link to page” function) are used to navigate in the materials. In order to return to Content, all one has to do is tap on the figure in the top left corner (Figure 3).

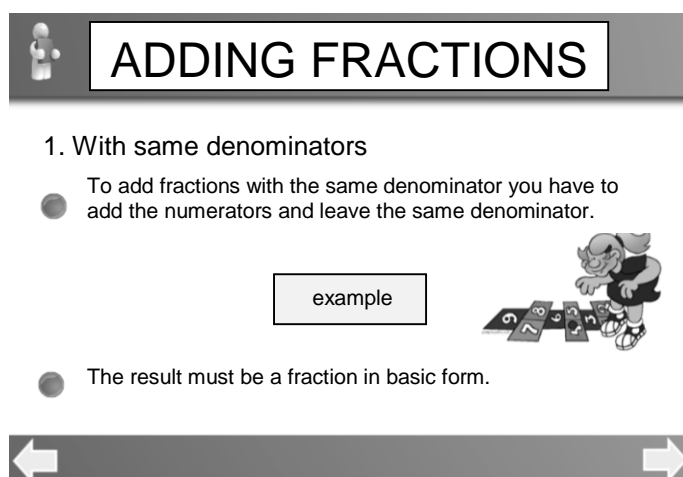


Figure 3 Material controls

The “link to page” function is also used for word problems where students are required to write down the solution process. When they solve the problem, they tap on the apple (Figure 4) and are redirected to the correct answer (Figure 5).

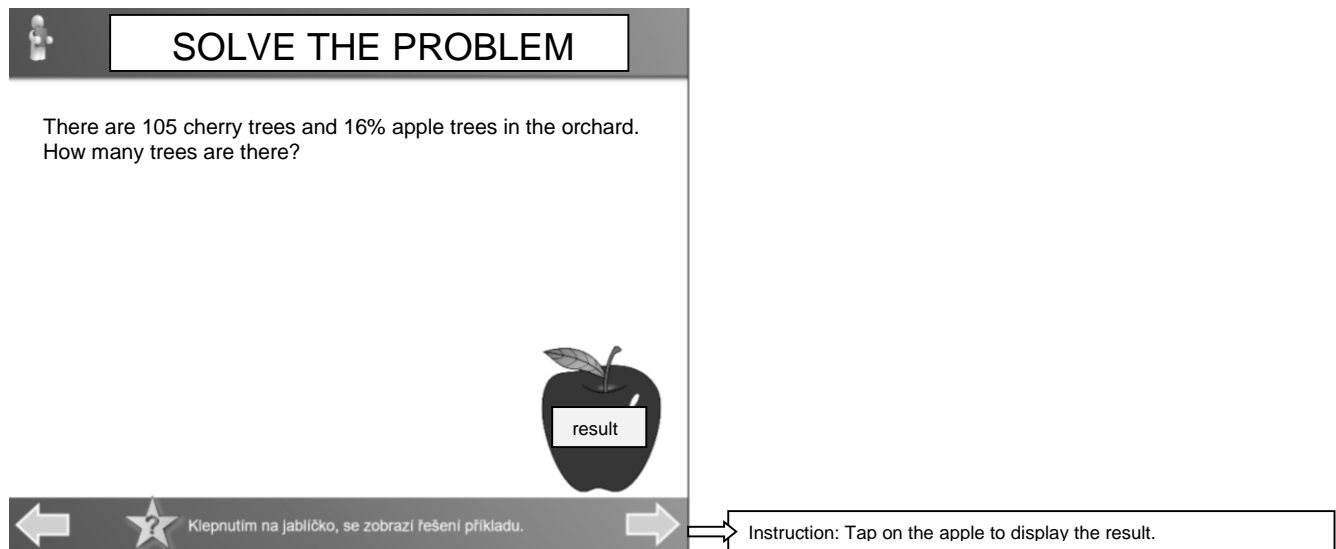


Figure 4 Link to correct solution – image of apple

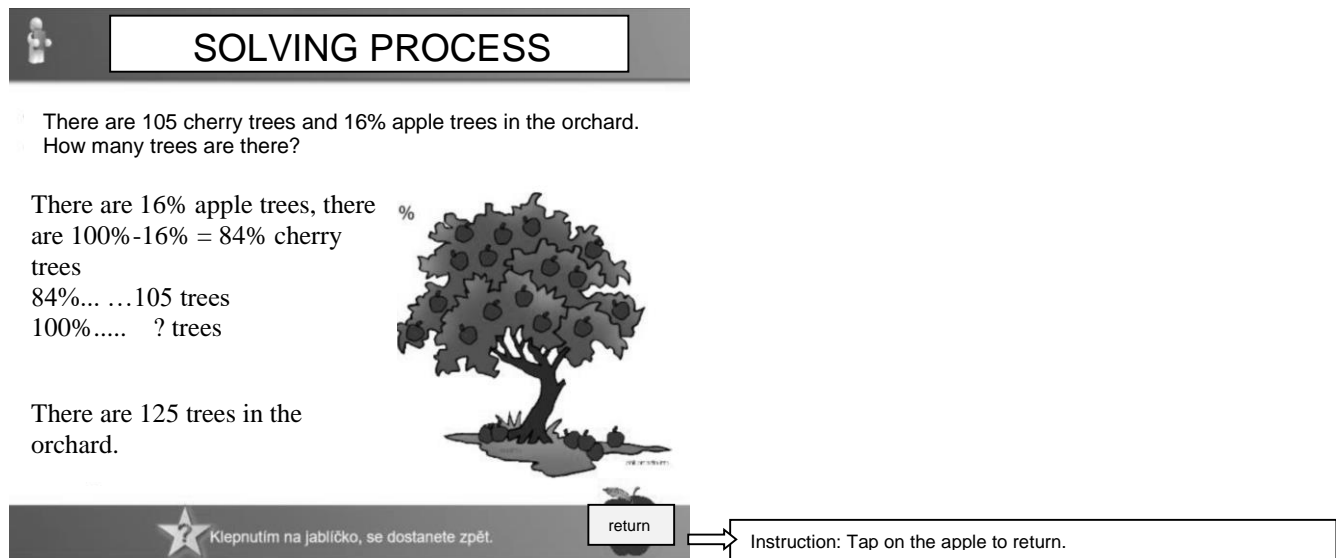


Figure 5 Displaying correct solution

The second most used function in the materials is “*object animation*” – darken. The authors used this function to hide the correct results. When the student solves the problem, they tap on an object which becomes dark, and the correct result appears (Figure 6).

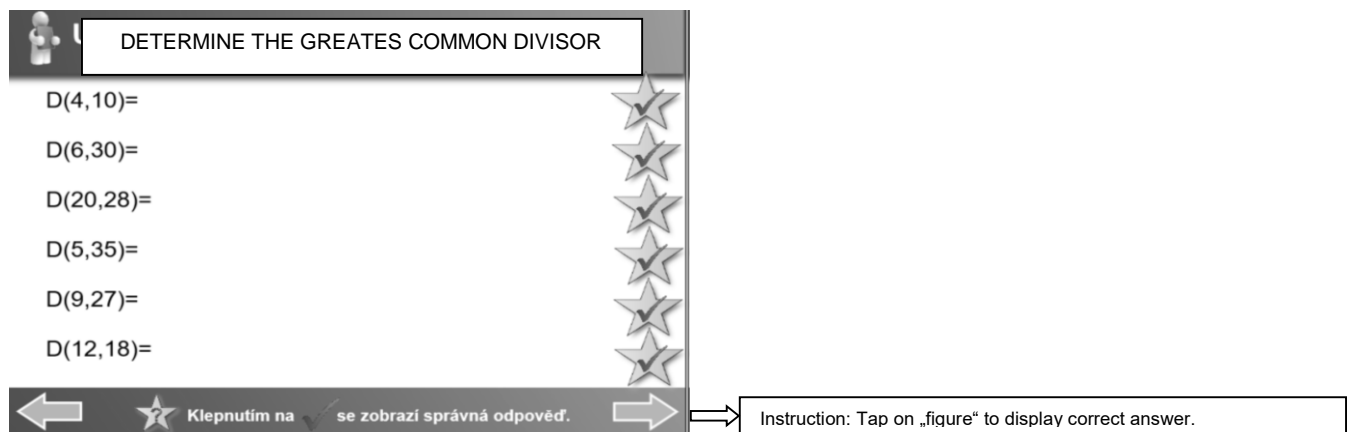


Figure 6 Using object animation “darken”

In order to make the tasks as well-arranged as possible, the authors used tables (and the “cell shading” function to hide the results). Tapping on the shaded cell reveals the correct result (Figure 7).

	17,256		0,987		21,049	
dozens		20				
units						
tenths						
hundredths						

Figure 7 “Cell shading” function in use

Using the “infinite cloner” function, one can make a number of copies of the object. All one has to do to clone the object is drag it with their finger. In the materials this function is used when the student is required to fill in the missing number (Figure 8).

Figure 8 “Infinite cloner” function in use

As many as 5 interactive study materials were created (Revising 6th grade curriculum; Fractions I; Fractions II; Unit conversions – volume and surface area of a cube and cuboid; Percentage), with each study material corresponding to one class.

5 STUDY MATERIAL IN PRACTICE

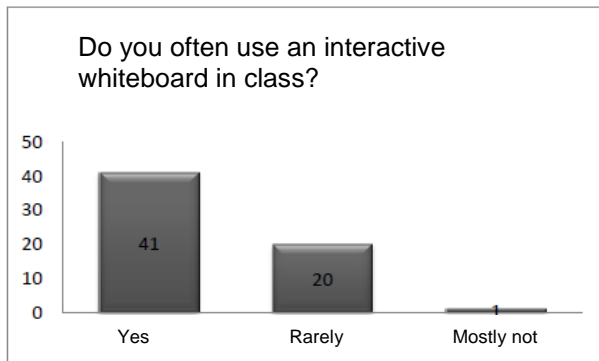
The created study materials were used in four 7th grade classes, with approximately 20 students in the classroom. However, since some students were absent due to illness, the number of students in the classroom varied.

A questionnaire survey was used to obtain feedback from both the students and the teachers. The questionnaire was anonymous and contained both open-ended and close-ended questions. The questionnaire was aimed at determining whether or not the created study materials were effective and whether or not it motivated the students to be more active in class. The students were asked whether or not they enjoyed interactive whiteboard-based mathematics instruction and whether or not it helped them better understand the discussed curriculum.

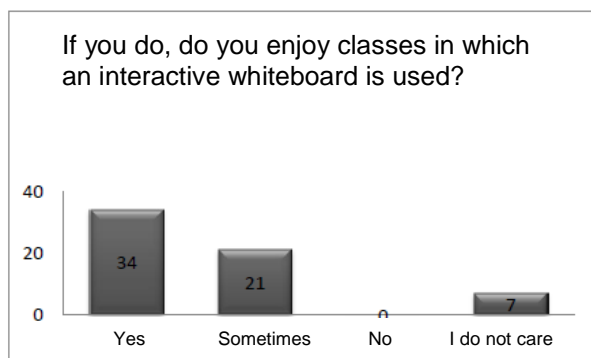
Student questionnaire evaluation

Since some students were absent due to illness, 62 students filled out the questionnaire. The answers were converted to graphs for better clarity. The x-axis contains respondents' answers while the y-axis contains the number of students.

Graph 1 shows whether or not students use an interactive whiteboard often. Nearly 70% of the students answered *Yes*. Graph 2 shows students' answers to the question whether or not they enjoy interactive whiteboard-based classes. More than 30% of the students answered *Sometimes*. This may be caused by the materials being inappropriate or being presented as regular presentations (i.e. not containing any animations, etc.).

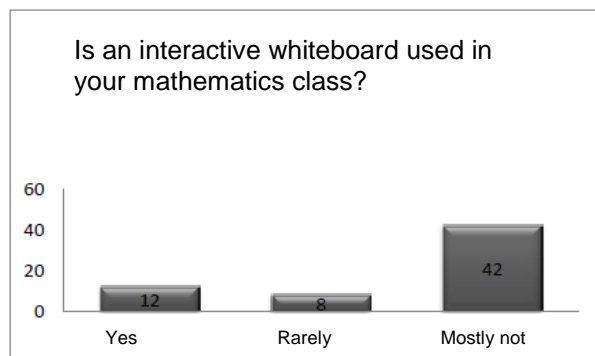


Graph 1 Use of interactive whiteboard in class



Graph 2 Popularity of interactive whiteboard

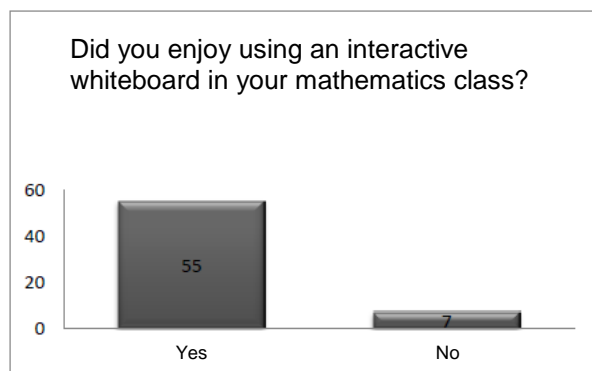
Is an interactive whiteboard used in your mathematics class? Answers to this question can be seen in Graph 3. The majority of students answered *Mostly not*.



Graph 3 Use of interactive whiteboard in mathematics class

When asked if they liked using an interactive whiteboard, nearly 90% of the students answered *Yes* (Graph 4). Only seven respondents answered negatively. The respondents were required to provide at least three

reasons why they *did/did not like using an interactive whiteboard*. The majority of students stated that their mathematics classes were more attractive, materials were easier to follow and the curriculum was easier to understand. The students also stated that they enjoyed the “created” activities such as tests, clozes, etc. Nearly all the students who answered *No* stated that they preferred to solve problems in their journals.



Graph 4 Did you enjoy using interactive whiteboard in mathematics class?

In the last question, the authors asked the students whether or not the created materials and an interactive whiteboard helped them better understand the curriculum. Nearly 84% of the respondents answered *Yes* (which was the authors’ goal – apart from wanting students to enjoy interactive whiteboard-based instruction).

Teacher questionnaire evaluation

Three primary school teachers who rarely use an interactive whiteboard in mathematics instruction filled out the questionnaire. They do not create interactive whiteboard presentations because it is time consuming and technically challenging for them, which they see as a minus. However, they will be able to use the created materials in other classes. The teachers were excited about an interactive whiteboard, especially about the participation of the students and the overall visualization of the material.

CONCLUSION

Since today’s students are familiar with information technology, they find instruction which uses modern teaching aids – such as an interactive whiteboard – much more attractive. The paper was aimed at designing and creating innovative interactive whiteboard presentations based on the mathematics curriculum. The created materials were supposed to make mathematics instruction more diverse and motivate students to be more active in class.

The students stated that they enjoyed interactive whiteboard-based mathematics classes as it helped them better understand the curriculum. They would like more such classes as they find them more attractive and beneficial. The teachers’ answers showed that they rarely use an interactive whiteboard in their mathematics classes. They do not create interactive whiteboard presentations because it is time consuming and technically challenging for them. However, the teachers like the created materials and will use them in other classes. They agreed that the students were more active and enthusiastic.

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