



**UNIVERSITY OF NOVI SAD  
TECHNICAL FACULTY  
"MIHAJLO PUPIN"  
ZRENJANIN**



**ITROCONFERENCE<sup>15</sup>**

INFORMATION TECHNOLOGY AND EDUCATION DEVELOPMENT



**ITROCONFERENCE<sup>15</sup>**

INFORMATION TECHNOLOGY AND EDUCATION DEVELOPMENT



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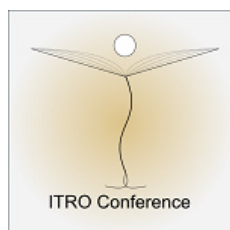
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## **INTRODUCTION**

This Proceedings present the articles delivered at the international conference Information Technology and Education Development (ITRO 2024), held for the jubilee fifteenth time on November 29, 2024. This international event was conducted in a hybrid format, combining in-person and online participation. The conference continues its tradition of bridging science, professional practice, and educational experiences, with this year's focus on the conditions and perspectives of teachers' digital competencies.

The thematic fields of the conference reflect contemporary trends in education, addressing topics such as: the digitalization of education, education in crisis situations, educational challenges, theoretical and methodological issues in contemporary pedagogy, digital didactics and media, modern communication strategies in teaching, curriculum development for contemporary education, advancements in e-learning, education management practices, methodological approaches in teaching natural and technical sciences, and the integration of information and communication technologies in education.

The conference featured three plenary lectures that explored various aspects of the main topic, with the corresponding articles included at the beginning of this volume.

In total, this edition comprises 57 peer-reviewed articles, evaluated through a double-blind review process. These contributions represent the latest research and advancements in the field.

The conference received financial support from the Provincial Secretariat for Higher Education and Scientific Research, Novi Sad. Hosting and technical support were generously provided by the Technical Faculty "Mihajlo Pupin." We extend our sincere gratitude for this invaluable assistance.

The Organizing Committee expresses its heartfelt thanks to the authors, reviewers, and participants for their contributions, which ensure the success and continued tradition of this event.

We look forward to welcoming you to the next ITRO Conference!

On behalf of the ITRO Organizing Committee

Jelena Stojanov



# CONTENTS

## PLENARY PAPERS

- Pavlova Tosheva E.**  
FORMATION OF TECHNOLOGICAL COMPETENCE IN STUDENTS.....2
- Sekulić T.**  
DIGITAL COMPETENCIES: WHAT HAVE WE DONE AND WHERE ARE WE GOING? .....9
- Marić Jurišin S.**  
CRITICAL DISTANCE - A TEACHING COMPETENCE THAT IS (NOT) SLIPPING AWAY IN THE DIGITAL AGE.....16

## SCIENTIFIC PAPERS

- Gelova E. K., Dragan G., Velinov A. and Kocaleva M. V.**  
ANALYSIS OF THE KNOWLEDGE OF PRIMARY EDUCATION STUDENTS FOR FOLLOWING SUBJECTS IN HIGHER EDUCATION RELATED TO INFORMATICS.....23
- Kostovski I., Čokanica D., Dragović R., Milošev V. and Radovanović Lj.**  
MAINTENANCE MANAGEMENT SYSTEM AND ORGANIZATIONAL BEHAVIOR IN EDUCATIONAL INSTITUTIONS .....30
- Smiljanić A. and Krneta D.**  
USING DATA WAREHOUSE FOR FORECASTING STUDENT SUCCESS .....37
- Gluvakov V. and Vučković Đ.**  
ANALYSIS OF THE IMPACT OF ORGANIZATIONAL LEARNING ON ORGANIZATIONAL CONFLICTS IN DOMESTIC COMPANIES .....43
- Vitanova M. K., Stojković N., Bande C. M., Arnautova K. and Zlatanovska B.**  
PYTHON CHATBOT: VIRTUAL ASSISTANT IN EDUCATIONAL PROCESS .....50
- Kovač D., Terek Stojanović E., Gaborov M. and Čočkalović Hronjec M.**  
ENCOURAGING CREATIVITY IN STUDENT EDUCATION.....57
- Randelović M., Jevtić R. and Stanojević Lj.**  
DIGITAL DIALOGUE IN THE FUNCTION OF OPTIMIZING THE TIME ALLOCATION OF DOMINANT ROLES IN CLASS.....64

<b>Lazarova K.L., Stojkovic N., Stojanova A.I. and Bande M.C.</b> METAHEURISTICS METHODS FOR SOLVING CAPACITY VEHICLE ROUTING PROBLEM: AN OVERVIEW .....	72
<b>Bakator M., Čočkalo D., Stanisavljev S., Terek Stojanović E. and Gluvakov V.</b> PERSONALIZED LEARNING ENVIRONMENTS TAILORING EDUCATION THROUGH TECHNOLOGY .....	79
<b>Mirković S., Kavalić M. and Daruši E.</b> SOFT SKILLS IN SECONDARY EDUCATION: A BASIS FOR COMPETITIVENESS IN THE JOB MARKET .....	86
<b>Miladinović M., Miladinović Ž. and Omoran O.</b> PHYSICAL VIOLENCE IN PRIMARY SCHOOLS.....	92
<b>Bogdanović M.</b> EXPERIENCES IN THE CREATION AND USE OF ELECTRONIC TEACHING MATERIALS .....	98
<b>Saliu B. and Ramadani K.</b> USING AI FOR ACADEMIC BENEFITS. CASE STUDY WITH STUDENTS OF SEEU IN TETOVO .....	105
<b>Miladinović Ž., Miladinović M., Radosav D. and Stanković D.</b> SELF-EVALUATION OF PRIMARY SCHOOLS IN THE APPLICATION OF INFORMATION AND COMMUNICATION TECHNOLOGY .....	110
<b>Ugrinov S. and Stanisavljev S.</b> INTEGRATING SUPPLY CHAIN EDUCATION INTO STEM PROGRAMS .....	116
<b>Velinov A., Karamazova Gelova E., Nikolova A. and Zdravev Z.</b> E-LEARNING PLATFORMS FOR STUDYING CLOUD TECHNOLOGIES .....	122
<b>Gašić I., Beljin M., Stojanov Ž., Odry P., Vizvari Z. and Tadic V.</b> IMPLEMENTATION OF ARTIFICIAL INTELLIGENCE IN TEACHING AND LEARNING.....	128
<b>Tomić O. and Blagojević M.</b> ARCHITECTURE AND DEVELOPMENT METHODOLOGIES SYSTEMS: A MACHINE LEARNING-BASED APPROACH.....	133
<b>Lončarević I., Juhasz L., Grbić T., Medić S. and Buhmiller S.</b> VECTOR APPLICATIONS IN MECHANICS: A WAY TO BRING MATHEMATICS AND PHYSICS TOGETHER .....	145

<b>Duraković N., Kiss M., Grbić T., Ivetić J. and Žnidaršić A.</b> ANALYSIS OF STUDENTS' ACADEMIC ACHIEVEMENT IN THE FIELD OF PROBABILITY.....	151
<b>Buhmiler S., Medić S., Duraković N., Bajkin J. and Lončarević I.</b> NUMERICAL METHODS FOR FINDING THE ROOT OF A POLYNOMIAL .....	157
<b>Jerebic J., Bokal G. and Bokal D.</b> MENTORSHIP LESSONS LEARNED FROM LOWER SECONDARY SCHOOL REINFORCEMENT LEARNING PROJECT .....	163
<b>Praskić A., Srdić V. and Jokić S.</b> THE INFLUENCE OF MODERN FORMS OF LEARNING ON LEARNING MOTIVATION .....	170
<b>Milić T. and Vecštejn I.</b> TEACHERS' METHODS AND STRATEGIES FOR DEVELOPING STUDENTS' COMPUTING COMPETENCIES.....	177
<b>Semančik M., Szabó C., Puci Š. and Porvazník Š.</b> GENERIC FRAMEWORK FOR ONLINE MULTIPLAYER TURN-BASED GAMES IMPLEMENTATION USING RUST PROGRAMMING LANGUAGE.....	183
<b>Vecštejn I., Stojanov Ž. and Gaborov M.</b> LITERATURE REVIEW – ONTOLOGY MODELS FOR KNOWLEDGE MANAGEMENT IN SOFTWARE ENGINEERING.....	189
<b>Manigoda G., Zubac B. and Sekulić T.</b> ENHANCING MATHEMATICS EDUCATION THROUGH PROJECT-BASED LEARNING AND MODERN TECHNOLOGIES: A PRACTICAL APPROACH .....	197
<b>Jovevski D., Atanasova A., Pachemska T.A. and Peshevska Mitanovska A.</b> ENHANCING MATHEMATICS EDUCATION THROUGH DIGITAL TECHNOLOGIES AND INNOVATIVE APPROACH.....	203
<b>Tihi N. and Pejić M.</b> USE OF MOBILE PHONES FOR MATHEMATICS LEARNING IN PRIMARY SCHOOL .....	209
<b>Milić T. and Tasić N.</b> EDUCATION IN SPECIALIZED IT DEPARTMENTS IN THE REPUBLIC OF SERBIA - COMPARISON WITH INTERNATIONAL PRACTICES .....	219
<b>Đukić Popović S., Dimić V., Popović S., Todić M. and Popović I.</b> SCHOOL WITHOUT MOBILE PHONES - IMPACT ON SOCIALIZATION .....	224

<b>Amižić V.</b> PERFORMANCE METRICS FOR OBJECT-ORIENTED PROGRAMMING LANGUAGES AND PYTHON USED FOR EMBEDDED SYSTEMS PROGRAMMING .....	235
<b>Pachemska T.A., Bogatinov D., Atanasova A., Jovevski D. and Huart R.</b> BUILDING EVERYDAY AND BASIC LEARNING SKILLS THROUGH PLAY: EDUCATIONAL ROBOTS AS A TOOL FOR THE IMPROVEMENT OF THE LEARNING OF STUDENTS WITH SPECIAL EDUCATIONAL NEEDS .....	239
<b>Osmani R.</b> COMMUNICATIVE LANGUAGE TEACHING: ENHANCING SPEAKING SKILLS IN NON-NATIVE LEARNERS WITH SPECIFIC REFERENCE TO SEE UNIVERSITY STUDENTS OF BES .....	245
<b>Mirković S., Kavalić M. and Daruši E.</b> THE ROLE OF ORGANIZATIONAL LEARNING IN HIGHER EDUCATION .....	251
<b>Bakator M., Đorđević L., Novaković B., Ugrinov S. and Premčevski V.</b> MACHINE LEARNING IN EDUCATIONAL METHODS FOR IMPROVING LEARNING OUTCOMES .....	257
<b>Jerković N., Šarenac U. and Berković I.</b> STUDENTS' ATTITUDES TOWARDS THE IMPORTANCE OF USING AUTOCAD TOOLS IN TEACHING .....	263
<b>Tasić N., Kovačević M., Lazić M., Praskić A., Karuović A. and Kojić M.</b> ADAPTING SCHOOL CURRICULUMS FOR 21ST CENTURY SKILLS: A TEACHER'S PERSPECTIVE ON EDUCATIONAL TRANSFORMATION .....	270
<b>Kazi Lj., Lojović T., Cvijanović Ž., Kazi M., Ognjenović V., Amižić V., Radosav D., Berković I., Kazi Z. and Glušac D.</b> MULTIMEDIA DYNAMICS IN RESPONSIVE WEB PORTAL WITH THE USE OF PRESENTATION MODELS: PRESCHOOL INSTITUTION ZRENJANIN CASE STUDY .....	275
<b>Hajrullai H. and Kreci V.</b> A HOLISTIC ANALYSIS OF EDUCATION, INSIGHTS FROM INTERNATIONAL PROJECT TO ADVANCE ACADEMIC AND RESEARCH INTEGRITY .....	281
<b>Pekez M.</b> THE DIGITALISATION OF EDUCATION: CURRENT TRENDS, CHALLENGES AND FUTURE PREDICTIONS .....	287

<b>Jerković N. and Jovanović A.</b> THE IMPACT OF THE MENTOR IN THE PROCESS OF WRITING A FINAL THESIS: EXPERIENCES OF STUDENTS.....	292
<b>Felbab S., Radulović B. and Dobrilović D.</b> INFLUXDB AS AN EDUCATIONAL EXAMPLE OF A TIME-SERIES DATABASE USED IN THE INDUSTRIAL INTERNET OF THINGS SYSTEM FOR DUST MONITORING .....	300
<b>Kotevski B., Koceska N. and Koceski S.</b> ONLINE EXAM PROCTORING SYSTEM – STUDENT PERSPECTIVE .....	308
<b>Baftijari B. and Koceski S.</b> REVIEW ON SOFTWARE APPLICATIONS FOR CHILDREN WITH DYSLEXIA.....	318
<b>Vignjević K., Blažić M., Dobardžić D., Glušac D., Brtka E. and Jovanov N.</b> BLENDED LEARNING: CHALLENGES AND OPPORTUNITIES FOR HIGHER EDUCATION.....	324
<b>Hristovska V. and Koceska N.</b> USING ICT IN THE EDUCATION OF CHILDREN WITH SPECIAL NEEDS: A SCOPING REVIEW .....	333
<b>Kazi Lj., Lojović T., Cvijanović Ž. and Chotaliya N.</b> SOFTWARE EVOLUTION MONITORING FRAMEWORK IN THE CONTEXT OF SOFTWARE PROJECTS AND MAINTENANCE STANDARDS: CASE STUDY OF PRESCHOOL INSTITUTION WEB PORTAL.....	343
<b>Dobardžić D., Vignjević K., Radulović B. and Ognjenović V.</b> INTEGRATING OLAP FOR ASSESSING AND ENHANCING TEACHER DIGITAL COMPETENCIES IN MODERN EDUCATION.....	349
<b>Glušac Da.</b> DIGITALIZATION AND LEGAL EDUCATION .....	356
<b>Maćešić I., Pardanjac M., Jokić S., Ljubojev N. and Karuović A.</b> THE IMPORTANCE AND ROLE OF ELEMENTARY SCHOOLS WEBSITE IN THE REALIZATION OF DISTANCE LEARNING.....	360
<b>Ametović N., Brtka E., Makitan V., Novokmet P., Jovanov N. and Kószó A.</b> MOBILE APPLICATION FOR MUSIC STREAMING SERVICES .....	367
<b>Lemboye M. A. and Cherkashin E.A.</b> THE ROLE OF ARTIFICIAL INTELLIGENCE IN AGRICULTURAL SUPPLY CHAINS IN DEVELOPING COUNTRIES .....	374

**Nyikes Z., Tóth L. and Kovács T. A.**

NEW TECHNOLOGIES IN THE SERVICE OF INDUSTRIAL DIGITALIZATION:  
INDUSTRY 4.0 AND THE EVOLUTION OF COMPUTER NETWORKS.....380



# ***SCIENTIFIC PAPERS***

# Analysis of the Knowledge of Primary Education Students for Following Subjects in Higher Education Related to Informatics

Gelova E. K.<sup>\*1</sup>, Dragan G.<sup>\*2</sup>, Velinov A.<sup>\*3</sup> and Kocaleva M. V.<sup>\*4</sup>

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**Abstract.** In this paper, our goal is to check the level of knowledge about basic IT concepts and the use of basic applications among students from Primary Education, with a special emphasis on students in the ninth grade, as students who will soon continue their education in one of the secondary schools and most of them later in higher education institutions. This information is important to us because at a large number of faculties students have a subject in which a large part of the material taught to students in primary and secondary education is repeated and is related to basic information concepts. That is why it is important for students to learn and remember the basic IT concepts, to know how to use the basic applications that are used every day and to deepen the knowledge acquired earlier during their education.

*Key words and phrases:* IT concepts, Primary Education, applications, Informatics, Higher Education

## 1 INTRODUCTION

The subject Computer Applications is studied in the first year of the Mathematics Department at the Faculty of Computer Science at Goce Delcev University Stip. In the teaching program of the mentioned subject, information topics necessary for elementary knowledge of computer technology as well as the applications that are used on a daily basis are studied. More about the topics studied in the subject Computer Applications can be found in (Elena, Mirjana, & Zoran, 2023a) and (Elena, Mirjana, & Zoran, 2023b). The weak basic knowledge of information concepts among some of the students, as well as the students who are transitioning to secondary education, prompted the idea of creating this research. The same reasons were for the introduction of the Computer Applications subject in the first year in the curriculum of the study program teaching Mathematics. By introducing this subject, students renew the knowledge acquired previously, and are trained to use the applications that would be used the most during their studies. We are witnessing more and more that in the Primary Education, but also in the Secondary Education, topics that cover Programming are forced in the Informatics classes, and the basic terms in the Informatics are in a way neglected because they are only mentioned and during the classes they are not dealt with the basic applications. It causes situations where students are not familiar with these concepts through everyday life. The problem with weak basic knowledge of information technology terms among some of the students will always be present. This is a problem all over the world because we are all oriented more towards topics that are more commonly accepted and more interesting. This problem has become especially popular with the last global pandemic when the teaching was conducted online.

We are witnessing how the program for Informatics classes with the new concept is combined with the subject of Technical Education and the importance of Informatics is decreasing more and more. By introducing the subject of Technical Education as an integral part of the Informatics program, the hours planned for information technology concepts are reduced and the opportunity is given to omit or reduce the hours needed to work with computer applications. (Mile, Marija, Emil, & Nevena, 2012) present the state of the curriculum in Macedonian primary and secondary schools, concerning informatics, the most recent changes and plans for near future. The



methods of teaching Informatics are very important. The extent to which methods such as visual learning, aural, verbal, physical, logical, social and personal are applied in the study of information subjects has been examined in (Mirjana, Aleksandra, Biljana & Natasa 2021). Teaching practice proves the importance not only of using new methods and digital tools, but also of creating didactic applications to facilitate the teaching process in elementary schools (Veronika, 2018), (Ladislav & Takáč, 2021), (Aliya, 2022). Changes in the teaching process and in the holding of Informatics classes have occurred during the pandemic with Covid-19 virus. Research for the functioning of the educational process during the pandemic with Covid-19 can be found in (Elena & Mirjana 2022). The use of interactive applications in class of subject Computer applications will be very useful. (Blagoj, Marija, Mirjana, & Aleksandra, 2016) demonstrates a successful e-learning application developed with Adobe Captivate, which is a powerful tool for creating e-learning content. The ability of the professor to maintain IT skills is very valuable. An analysis of the teachers' ICT competencies and their skills can be found in (Aliya & Veronika 2023).

In this paper we present an analysis of the knowledge of primary education students for topics related to Informatics. The paper is structured as follows. In Section 2, we describe methodologies for performing the analysis. Main results from the research can be seen in Section 3. Discussion for the results is given in Section 4. The last Section 5 is a conclusion of our work.

## 2 METHODOLOGIES

For the purpose of this paper, the testing for the knowledge of Information Technology concepts for students from primary education was done through a questionnaire which can be seen in Appendix A.

As an opportunity to see this situation in primary education, we conducted an examination of the students through anonymous questionnaires, which allow to properly test the knowledge of the students. As a test group, 3 classes in the primary school of St. Cyril and Methodius from St. Nikole were selected. The students are from classes 9-1, 9-2 and 9-4 with a total number of respondents of 50 students, which will give a clear picture of the students' readiness for working with a computer, working with Microsoft Office and knowledge of hardware and software, during their transition from primary to secondary education. The questionnaire itself consists of 15 questions that cover the syllabus of the Computer Applications subject and are appropriately formulated to be comprehensible to students who in their formal education deal with the same topics in the Informatics subject for the sixth and seventh grades. According to this, the questionnaire can be divided into several parts, according to the type and topic of questions that it addresses: Components of the computer, Units of measurement in computer technology, History of computer technology and current state, Internet and Internet services, E-mail, Windows operating system, MS Word, MS Excel and MS PowerPoint.

As a survey sample, only students from the 9th grade, who have studied the subject 2-3 years ago, were taken, so solving the questionnaire relies on the knowledge of Information Technology, mostly on the practical application of what was previously learned, as well as on logical thinking. In doing so, it is considered that the research includes students from different socio-economic backgrounds.

Finally, a conclusion from the results is obtained and an idea for the change in the teaching process in future is made.

In context of the analysis, we will make a clear division into genders, boys and girls, in order to show trends in knowledge between male and female students. The information from the testing will also serve to see the students' ability to create activities in other subjects, such as making a presentation in the Macedonian language class, creating a table in the Natural sciences class, etc.

## 3 MAIN RESULTS

The first question in the questionnaire is about the availability of information technology in students' homes. Students who have access to a computer at home will have an easier time mastering the various computer applications they encounter in computer science classes. The question refers to the availability of a computer at home, a laptop, a desktop or both, which means that smartphones, tablets and other electronic devices are

excluded, for compatibility with the program in the Computer Applications subject. Students have the option not to answer the question if they do not have any of the answers offered. The results can be seen in Figure 1.

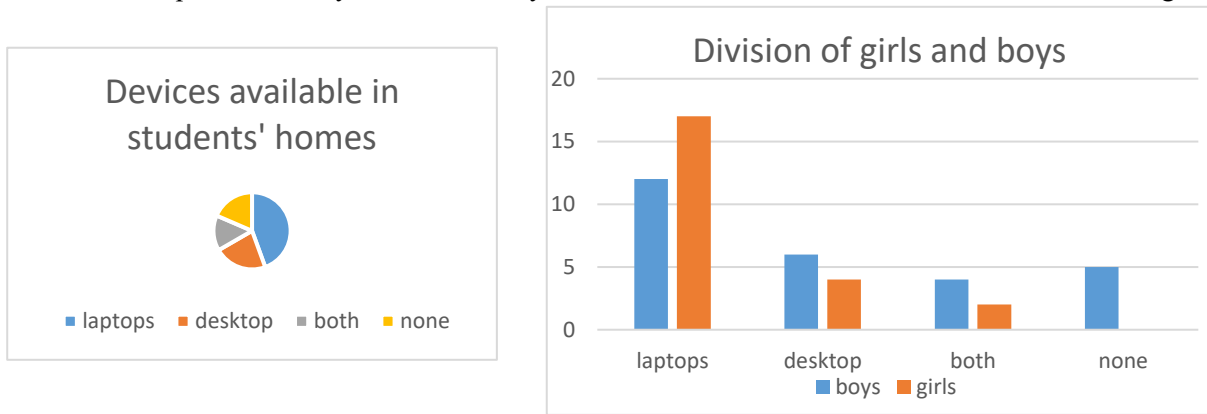


Figure 1: Answers to the first question

The second question, what is hardware, was answered correctly by 42 respondents, and incorrectly by 8. If we divide by gender, girls have a higher percentage of correct answers, 22 correct answers, and boys have 20 correct answers. From this we can conclude that a large number of respondents have good knowledge of computer hardware. Most of those who answered the question incorrectly represent the part of those who do not have a computer at home, so we can conclude that owning an IT device and working with it is an important factor in knowing computer components.

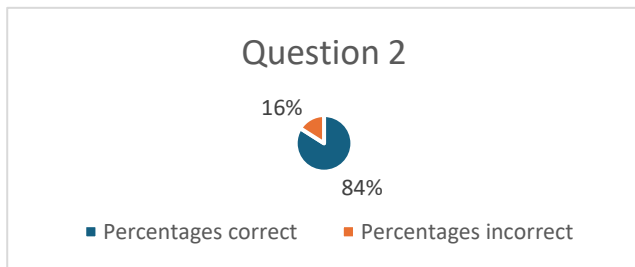


Figure 2: Answers to the second question in percentages

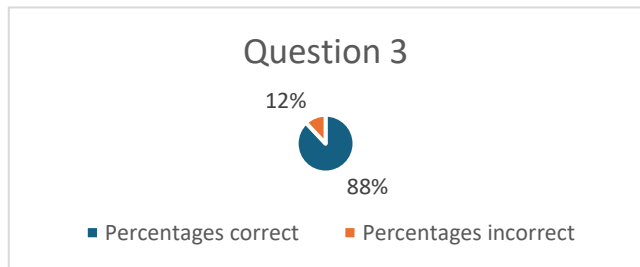


Figure 3: Answers to the third question in percentages

The third question was about keyboard familiarity i.e. of its appearance and layout of buttons. This question follows the trends of answers from the previous question so that 44 respondents answered correctly and 6 respondents from the three departments answered incorrectly. We can also notice that boys have a higher percentage of correct answers 24, compared to girls who have 20 correct answers. Figure 2 and Figure 3 show the answers of the second and third question respectively.

We got similar results for the fourth question, 42 correct versus 8 incorrect answers. The knowledge of measurement units is satisfactory, most of the respondents know the binary number system which is used by the computer, i.e. they know which digits are the basis. 44 respondents answered the fifth question correctly, and 6 incorrectly. Among the boys, 23 respondents answered correctly, and among the girls, a total of 21 respondents answered correctly.

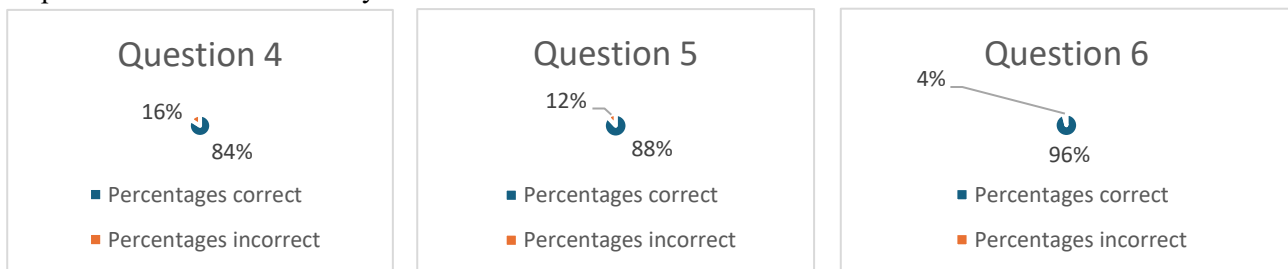


Figure 4: Answers to the fourth, fifth and sixth question

The question 5 that is related to the printer as an output peripheral device, i.e., its function, has the largest number of correct answers. 48 of the respondents answered this question correctly, and two respondents answered incorrectly. According to the gender division, 25 of the boys answered correctly, and among the girls, 23 answered correctly and 2 answered incorrectly.

The answers of the fourth, fifth and sixth question can be seen in Figure 4. If we group the questions from the second to the sixth of hardware as the first group of questions, we can notice that the results obtained are satisfactory. There are a total of 220 correct answers and 30 incorrect answers, which is quite a satisfactory result. If we divide again by gender, we have 125 answers from each gender. Among boys we have 113 correct answers. Among girls we have 107 correct answers, as we can see in Figure 5. The conclusion is that the knowledge of computer hardware is quite solid.

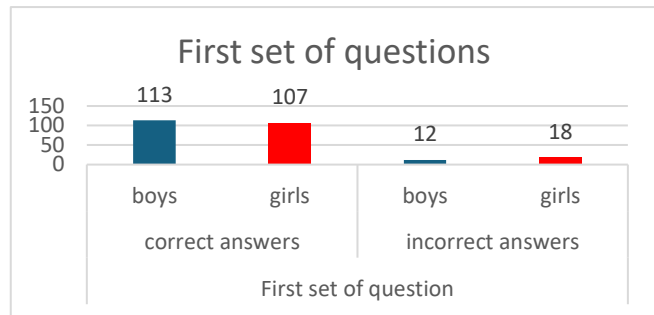


Figure 5: Answers of the first set of questions

The second group of questions is related to knowledge of the Internet and e-mail as an indispensable part of working with a computer and knowledge of information technology. And this group of questions is composed of 5 offered questions from 7 to 11.

The seventh question about how we measure Internet speed shows us that the number of correct answers is not much higher than the number of incorrect answers. Perhaps because the units of measurement for speed are similar to the units of measurement for data storage, students have trouble distinguishing between the corresponding correct units of measurement.

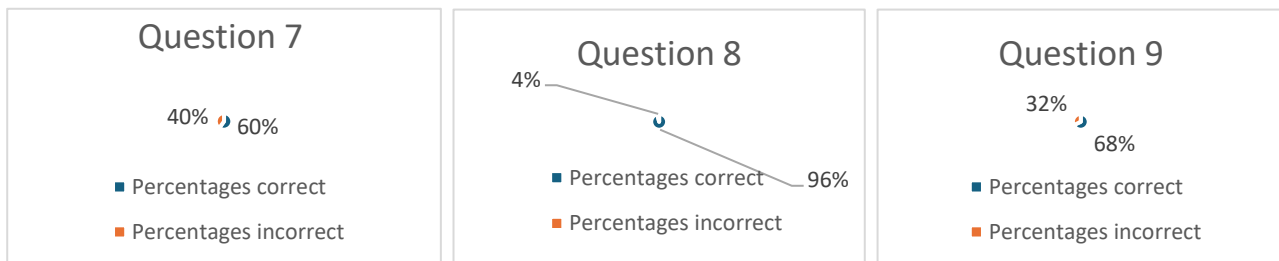


Figure 6. Answers to the seventh, eighth and ninth question

The eighth question is about the device that connects two or more networks, the router, which most students recognize because they have it in their homes.

The trend of difficulties in choosing the correct answer continues in the following questions. The ninth question was answered correctly by 34 respondents, and incorrectly by 16 respondents. Although most students use e-mail, this question causes difficulties for them. It happens because the email is created only once, and then users just log in. Figure 6 shows the answers of the seventh, eighth and ninth question.

The results for the tenth question can be seen in Figure 7. The next question 11 covering working with e-mail shows a different picture, most students work well with e-mail and can reply to an e-mail as we can see in Figure 7.

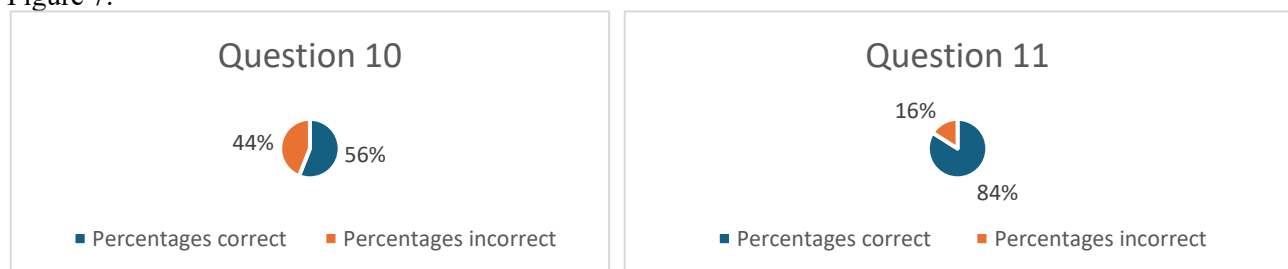


Figure 7. Answers to the tenth and eleventh question

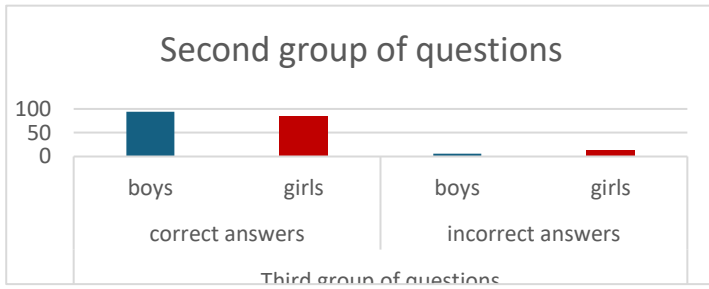


Figure 8. Answers of the second group of questions

If we summarize the questions from the second group from 7 to 11, we get that there are a total of 250 answers to all 5 questions from this group, 182 correct answers and 68 incorrect ones, as we can see in Figure 8. We can conclude that in the second group of questions there are more incorrect answers compared to the first group of questions.

The third group of questions is related to the Windows operating system, the company that produces IT, as well as computer applications that are part of the Office package, MS Word, MS Power Point and MS Excel. The correct answers to this group of questions are the most important because working in the Office program package students encounter a lot not only during their education but also afterwards during their work. There are four questions in this group.

We can see the correct versus incorrect answers in percentages for questions 12, 13, 14 and 15 in Figure 9.

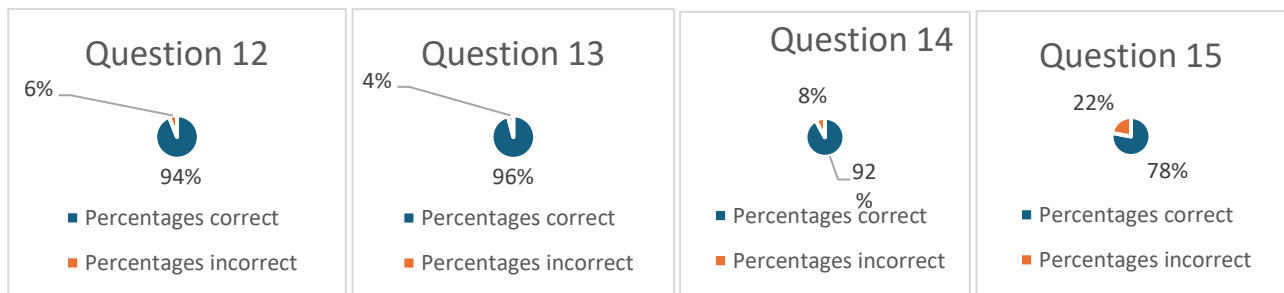


Figure 9. Answers to the twelfth, thirteenth, fourteenth and fifteenth question

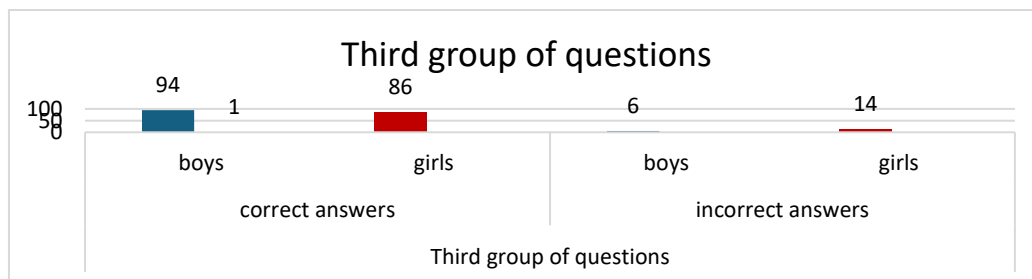


Figure 10. Answers of the third group of questions

From the results, we can notice that the question 15 has the most incorrect answers. The reason should be sought in the complexity and weaker representation of the Excel program in primary education. Students create presentations and write textual research, but they rarely use Excel to make a graph or table. This is more pronounced and evident among girls, which may be a conclusion that boys are more involved in creating projects for various subjects in Excel. In Figure 10, we can see the results of the third group of questions.

#### 4 DISCUSSION

From the analysis we can see that most students have a laptop and there are only boys who do not have a computer of any kind. This means that most of the students are closer to technology and this can significantly help them during their education, and also in their further career. According to the fact that we live in a digital age, investing in computers and technology can significantly help students in carrying out their daily activities and gaining new knowledge. The schools should follow the trends and invest in computer equipment and new technologies. This can increase the interest of the students and their motivation to learn Informatics.

According to the three group of questions, we can notice that the boys have more correct answers than the girls. Perhaps this is due to the fact that boys are more interested in learning Informatics, and have more knowledge of basic concepts than girls. This may indicate to us that in the future special attention should be

paid to increasing girls' interest in Informatics. For this purpose, campaigns, seminars and workshops for promotion of new computer technologies can be organized.

Regarding our research, we could say that we have a limitation in the number of covered classes and respondents. In the future, we will direct our research on the analysis of more schools in order to obtain more results, to make a comparison and give directions for increasing the motivation of students to learn Informatics.

## 5 CONCLUSION

As a conclusion of our research on informatics, carried out in the primary school of St. Cyril and Methodius from St. Nikole, among students in the 9th grade, the need for greater inclusion of informatics and contents related to the use of computer applications in teaching is clearly seen. This need is most evident in the use of the Excel program as perhaps the program with the least representation in education, but also in terms of the Internet and work with electronic mail. In further secondary education, a large number of students will face questions related to previously studied content in the field of computer applications, and their readiness to successfully implement this content will largely depend on how much of the material they have mastered and how much their knowledge can be increased by introducing new techniques and strategies in primary education. Greater activity in creating projects with tables and graphs in the Excel program in other subjects, the usage of email in Macedonian language, English language classes, etc. can help to make up for the omissions in informatics. This will give students a greater opportunity to be ready to face the challenges during their further education.

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## APPENDIX A: QUESTIONNAIRE - A LIST OF QUESTIONS AND SUGGESTED ANSWERS

**Questionnaire on knowledge of Information Technology intended for students from Basic education**

Circle one of the answers offered:

1. What computers do you use at home?

- a) Desktop                      b) Laptop                      c) Both

2. Hardware is:

- a) the machine part of the computer system  
b) the program part of the computer system  
c) the machine and program part of the computer system

3. The keyboard has function keys from:

- a) F1-F10                      b) F1-F11.                      c) F1-F12

4. The first hand calculator was called:

- a) Computer                      b) Telephone                      c) Abacus

5. Which base number system has 0 and 1?

- a) decade number system  
b) binary number system  
c) hexadecimal number system

6. A device for displaying computer data on paper or foil is:

- a) Scanner                      b) Printer                      c) Speakers

7. In what measurement unit is the internet speed measured:

- a) Mbit/s                      b) MB                      c) GB

8. A device that allows several local networks to be connected into one is called:

- a) Modem                      b) Router                      c) Scanner

9. Internet service provider (ISP) is:

- a) a company that provides internet by connecting the user to other providers from other countries of the world.  
b) a company that manufactures computers  
c) the program for opening, viewing and moving through different web pages

10. The user to create a new web-based e-mail address through the page of the selected e-mail server should choose:

- a) Sign up\ Register                      b) Sign in\ Log in                      c) Sign out

11. Reply when working with electronic messages means:

- a) to send a reply only to the sender  
b) to send a reply to the recipients specified in the CC  
c) to delete the message

12. What is the most commonly used operating system for personal computers in the world:

- a) Windows                      b) Mac OS                      c) Linux

13. Which company produces the Windows operating system?

- a) IBM                      b) HP                      c) Microsoft

14. What is the name of the program for creating and editing presentations:

- a) Power Point                      b) Excel                      c) Word

15. What is the most popular charting program:

- a) Power Point                      b) Excel                      c) Word