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# Impact of Technology on Teaching Performance

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**Abstract**

The aim of this paper is to highlight the importance of technology in education, and impact on the teaching staff of higher education institutions and their, necessary improvement of competencies and skills in use of technology in teaching. In support of the statement, the statement was also presented focusing on the teaching staff on the implementation of modern technology in teaching and its influence on motivation, gaining knowledge and increasing student satisfaction. Paper shows the relationship between these two variables technology and teaching performance and how modern technology support quality in education. The study also found that management's ability to formulate and implement policies for the provision of instructional materials for teaching and learning has a major role and leads to quality improvement.

**Key words:** technology, teaching performance, teaching methodology, quality education.

## 1. Introduction

The economy based on steady growth in consumption has no future. It also slows down the adaptation of the society to new technologies that seek new business-based on new profit principles. Contemporary technological development also requires a fast adaptation of the educational system, which must follow new knowledge and participate directly in their development because, it is the process of education slow and time consuming. It will affect occupations and employment, and recognize these trends will give guidance primarily to change education, but also to socio-economic relations [1].

Technology integration in education generally means technology-based teaching and learning process that closely relates to the utilization of learning technologies in schools. Due to the fact that students are familiar with technology and they will learn better within technology-based environment, the issue of ICT integration in schools, specifically in the classroom is vital. This is because, the use of technology in education contributes a lot in the pedagogical aspects in which the application of ICT will lead to effective learning with the help and supports from ICT elements and components [2].

The fast growth in technology today requires an appropriate level of knowledge and skill in order to operate and be able to manage the certain technological tools. Now days the following and being in the track of technological boom is demand not only for education but for all field of the individual life. Looking at development of education in United Arab Emirates, it is obvious that there is a lot of change in the way of teaching methodology and learning techniques of the students. In order to contribute more positive change in the sense of modern technology use in education sector, management is playing a key role in the supporting of the technology installation and attracting the teachers and students.

By covering all major teaching models plus the leadership of teaching, including planning, classroom management, assessment, motivation, and management of time and space, properly educated management helps future teachers master both the theory and application of successful teaching [3]. Learning to teach plays very important role in student centered and teaching centered learning. Now days educational institutions organizes a lot of training seminars and workshops in order to help teaching stuff to be able to transfer knowledge to the students in the proper way by using technological equipment.

## 2. Information technology and education

Information and communication technology is the technical equipment that is the basis for systematically collecting, storing, processing, disseminating and exchanging information of various forms (picture, sound, text and characters). The invention

of the printing machine can be considered as the beginning of the ICT era. The present form of technology emerges after the Second World War at the beginning of the 1950s. This discovery allowed the appearance of the first PCs in the market as a result caused a sudden development of computing.

The term microelectronics, computer technology and telecommunication are replaced by the name of information technology, and in recent times era by the name of information and communication technology. Today, communication technology is ubiquitous and benefits to over 3 billion people.

Today ICT is applied in almost every segment of human life so it is unquestioned to use it in the educational process. Traditional teaching more is not enough and it is replaced by various activities, multimedia content, virtual classrooms etc. For more than a decade, specialists point out the potential of education based on information and communication technologies. The computer is considered to be extremely effective teaching tool as the teacher helps transfer information directed to someone with the specific educational goal. Technologies make it easier to prepare classes in some areas, and allow for easier analysis of the teaching process through simulation performance, role play, and exercising decision-making.

In addition, they provide the opportunity for lifelong learning and professional development, because they offer distance learning courses, asynchronous learning and learning tailored to the specific needs of users. Information and Communication Technologies motivate teachers to suppress professional insulations because they easily come into contact with colleagues, mentors, professional centers and material sources, and additionally, they may have contact with students regardless of physical distance. Virtual technologies facilitate the process of exchange of information, ideas and experiences with the students and improve the collaboration with students and colleagues. Teaching that includes ICT is most often based on the Internet that offers a number of tools for carrying out various forms of teaching methods.

If properly used, it will enhance the learning outcomes, accelerating the transfer of knowledge and making this process more effective. In addition to accelerating and improving the teaching process, the proper use of ICT can be seen as to stimulate students to further research and developing ICT skills.

Under the conditions of frequent technological changes brought about by scientific research the revolution raises the question of what knowledge is needed and what needs to be education system under these conditions. High technology has brought with it a new goal of education to provide general persistent knowledge in a scientific way work in the function of applying and creating new knowledge. Contemporary science whose subject is scientific interest and studying education and its significance, educational system is divided into two parts: Formal school education system for children and young people (basic, secondary, and higher education and Permanent lifelong learning in which the global society is in the foreground of educational system (learning society).

At present, there is a scientific society and a whole new civilization which is based on the knowledge and new values contained in the collection, use, dissemination and production of information and knowledge. The new information science system provides knowledge that throughout life allows learning and creation within the scientific framework or research mode. That is why the strategies of society development and investment in the world direct knowledge generation.

### 3. Curriculum quality

Information technology has undoubtedly changed the technology of all subjects and represents an aspect of integrated learning in which IT is trying to be implemented in all the subjects of the educational process in order to improve the quality of receiving and acquiring knowledge. The use of a computer in teaching increases motivation for learning, logical thinking, success in schooling, ability self-expression, metacognitive abilities, collaboration, and sense of responsibility.

In traditional teaching, regardless main goal of today qualitative education process, a student being in the center education, dominates the frontal form of work with one - way communication between teachers and students. Such teaching is, often, bored to better students, and insufficiently understandable for the weaker, which means it does not provide the ability to advance in mastery

teaching contents at the pace that suits each student. In this way of teaching the instructor is transferring knowledge to the student with or without student interaction. In this way there is no mutual conversation between teacher and student.

Traditional teaching is insufficient interaction between students and teachers. Students tested in some of experiments in assessments with traditional approach were considered at risk of failure [4].

One of the most important prerequisites for quality higher education is the quality of teachers.

The teachers who have been teaching more than ten years usually have no experience to use the technology in the class [5]. The criteria for selecting teachers will be redefined, especially those relating to teaching activities. In choosing, the quality must first be evaluated, not merely the formal fulfillment of the individual activities. Today teachers face a lot of difficulties in teaching, learning how to teach is difficult for many pre-service teachers, because it requires learning process that are different from those they have typically engaged in during their other experience in higher education [6].

Continuous teacher education should be provided through specially designed courses that would be a prerequisite for taking over teaching obligations, and a condition for selection in scientific studies profession.

It is also necessary to address and enhance the content that requires constant updating. The needs of technical and technological development, economy and society in general determine the most effective form of education. It must be well designed and be ready to adapt to the development of sciences.

Computer-supported collaborative learning takes place when people communicate effectively [7]. Research so far shows that Computer-supported collaborative learning and learning is more efficient than traditional in terms of the quality and quantity of acquired knowledge, durability and applicability of these knowledge, especially in terms of student mobility, its motivation for learning, as well as faster humane and fair valuation and evaluation of work students. In the structure of computer teaching and teaching process, the teacher and the student gain new roles and positions. The teacher is no longer just a student of information and assessor of the student's knowledge, but becomes the controller and flow controller of information, organizer and leader of the entire process of learning content, and the student becomes an active participant, a teacher's assistant, and sometimes the creator of the teaching and learning process. In computer-supported collaborative learning, the teacher's function is transferred to his or her focus on preparing teaching work, student mobility, her work training, modeling teaching process, and exact control and records of night work.

Last decade of 20$^{th}$ century represented era of rapid growth in technology, generally in the sense of use of personal computing and information technology (ICT). Now days computers are easier available to use for everyone. Education also become highly equipped by technology. Many of the universities supply their students with lap top computers [8]. Many new teachers are still not ready to use integrated technology in their lessons, but by digitizing existing scripts or textbooks and publishing on the Internet, students could easily access the material. The ability to search throughout the text in essence increases the usability of the material. Students rarely use it because it takes a lot of time. With digital materials, students are relieved of routine rewriting and shaping jobs, because they can use software tools to concentrate on the essence of adoption.

## 4. Online learning

The technological environment for learning or education has been enriched in the last fifteen years with numerous educational projects on the largest communication network that is the Internet. In the literature and the public new terms get very popular and that is online learning, e-learning (eLearning), and on web-based learning, and more recently time and learning via mobile devices (m-learning). This is about different types of distance learning with technology support through the Internet, but using different methods and tools for transferring knowledge. So we have e-learning materials, lectures tailored for webinars, lectures and webcasts, e-books (online books), use of other web sites resources, use of social networks in education, etc. All these methods can be enriched with the various content that include text, image, audio, video, animation, etc. The creators of educational projects have at a range of simple and accessible tools for developing various multimedia elements

that can be embedded in e-learning materials or used in the purpose of education, regardless of the method (distance learning, traditional methods, self-study, etc.) Although all this provides educators with a range of options for creating the most diverse multimedia projects, and the opportunity for students to be educated at homes, as well as the ability to organize their own learning dependently about life or work needs, mental fitness, and educational aspirations, these insights and facts give traditionally understood distance education a completely new place in the context of lifelong learning. In addition, there are many practical questions that traditional didactics cannot provide satisfied answers. This is one of the reasons for the need for constitution and development a new scientific discipline - multimedia didactics.

The preparation of a multimedia education project is an extremely complex job which requires the teamwork of a number of experts - from material experts (professor, teacher, lecturer ...), through instructional designers whose role is adaptation classical methods of teaching for a new medium, respecting all of its advantages and disadvantages, to development experts of various profiles (graphic designers, experts for tools, developers, audio and video teams, etc.). In addition, the development of technology and tools goes into the direction of simplifying their use in such a way that they become available all a wider circle of people dealing with education, regardless of IT knowledge to learn with the help of computers and the Internet can be from the first days of compulsory schooling. Internet and multimedia projects on the web can help lifelong learning of the youngest and the eldest. One of the tasks of multimedia didactics is teaching and explaining the process learning in this new media environment and asking for answers to many questions, which in this context occur. Ther multimedia didactics will certainly rely on the knowledge of traditional didactics and didactics of the media. Teaching materials can be used very effectively in distance education in visual, auditory, audiovisual and multimedia content. Visual content may be in the form of text, drawings, pictures, graphic displays, models or models. Auditory content is oral presentation or speech, musical accompaniment, and various sounds. Audio visual content combines visual and audio content, and this most often in the form of television shows, movies or videos.

Using multimedia is extremely important in online education, because a lecturer usually is not physically present with the students in order to attract their attention, motivate them to learn, and explain or clarify the contents that the students tend to understand.

The positive effects of online learning are: attracting the attention of the trainee, higher level of interest, motivation and satisfaction of the participants, the ability to clarify more difficult concepts and principles, more complete understanding of content and more effective acquisition of new concepts, better memory of the content and the ability to apply knowledge in new situations.

## 5. State support of higher education and teaching stuff

Knowledge is treated as the basic resource of economics and every other development. It is inseparably linked to education. As the immediate result of science and scientific research, knowledge drives and directs all social flows, raises the overall level of society development, as it produces innovations and new information. It is constantly changing and progressing. In order to respond to rapid changes in society, it is necessary is to constantly acquire new knowledge and skills. Hence, education has a key role in these changes.

In most developed countries, a large share of achieved business results were based on knowledge industries (high technology, education and training, research and education) development, finance and investment sectors). New technologies move the boundaries in education (electronic communication, exchange of various activities in learning, etc.), lead to changes in workplaces and types of business. It is involved at all levels of education, which gives the opportunity for greater access to knowledge and learning for all. Further, this should have a result as reduction of class differences / division in society.

Increasing investment in human capital, or education, is one of the major priorities of economic policy of developed countries. Human capital is common place approximated with the average level of qualification or education population.

However, human capital other than psycho-physical abilities of individuals includes a component of their socio-medical readiness. Educational institutions and levels of education the population does not only affect the creation of human capital, but also the strengthening social capital.

Human capital is formed in the formal and informal education system. The informal system encompasses family upbringing and education, but also the opportunities that are available for informal use education (media, newspapers, television, public gatherings, availability of public libraries, public workshops, public campaigns, meetings and similar to).

Investing in education as an important resource (initiator and the foundation of development) of society, is a part of the policy of all developed countries. People with their intellectual and creative potential represent a strategic basis of society's development, as they are the bearers of ideas, knowledge and information. All developed countries and those who strive to do so, have noticed the importance of knowledge and its application in terms of development and overcoming the crisis. Investing in science, research and education should be understood as an investment, because they undoubtedly contribute to the development of society as a whole. In most developed countries knowledge based industries (high technology, education and training, research and education) development, financial and investment sectors) had a significant share in the business success. Developed countries invest significant resources in the knowledge economy, in public education, research, development, and computer development software. Even in these countries technology is in the process of growing and continuous change. [9] The countries with the low investment in education remain in trap of technological stagnation, low growth and low demand for education.[10]

Lack of adequate ICT equipment and internet access is one of the key problems that schools specifically in rural areas are facing now. For example, results of a research show that in Kenya, some schools have computer but this could be limited to one computer in the office only. Even in schools with computers, the student-computer ration is high. In addition, the report continues revealed that the schools with ICT infrastructure are supported by parents' initiative or community power [11].

Most keeping this in mind is an absolute imperative above all to educate teachers so they could really use the computer as a tool. Using a computer as a tool does not only apply to the teaching environment, but also to the extracurricular environment. It is important to train staff so that they of the teaching staff has not grown up using technology so they are not familiar to use it. Today, in the information era, the information literacy should be one of the main conditions to get employed. There is also evidence of the fact that many teaching staff are engaged independently in the training process in the use of smart technology in education.

## 6. Future and technology in education

By applying the latest e-learning technologies, personalization of learning is enabled, which cannot be provided by classical classes, as all students in the classroom listen to the same prediction and perform the same tasks. In personalized e-learning, the student gets to learn what is adapted to his previous knowledge and the style of learning that best suits him. Additionally, the inclusion of multimedia materials (video, audio, text) and interactive activities (exchange of messages between teachers and students, interaction of students among themselves, application of the discussion forum of subjects, interactive self-determination, etc.) provides a new dimension in the learning process which was not easily accomplished in classical teaching.

What is equally important, in addition to the application of modern technologies, is the application of an appropriate methodology of learning and customized pedagogical methods. This is an area that we will pay much more attention in the coming period. Student learning should be interesting, understandable and challenging. He should be pleased to learn and research what he does not know and what interests him, but also what is necessary for the job for which he is preparing.

The future of education in technology can be seen through several aspects: Technological aspect and Pedagogical - sociological aspect. The technological aspect refers to the fact that in the future, schools absolutely must accept new technologies

that facilitate learning, learning to distance, searching for encyclopedic knowledge bases, and improving communication between student-student, student-teacher, and teacher-teacher using the latest network and internet technology. Numerous studies have shown that learning through different multimedia (text, image, sound) content promotes greater interest and fosters concentration of students in general. Furthermore, schools will be institutions promoting knowledge and it will be necessary to accept the latest trends in the development of the knowledge base, because that is the most advanced and most practical way to quickly get to the requested information. The pedagogical - sociological aspect refers to the problem of implementation of the modern technology in the educational system. In this way use of technology in education does not turn into a mere tracking trend and latest fashion details in the world of computers and information technology only, but to be used exclusively in the improving quality of education.

New achievements in online learning, interactive textbooks and open educational content are strategically linked to educational institutions. Most of the people ask whether online learning can replace direct and direct education. However, the purpose of technology is not to replace traditional education, but to improve it. Communication tools such as e-mail and online discussion forums allow students to express their views as readers. Synchronous technologies such as webcam, interactive video content and chat rooms provide an approximate learning experience, while at the same time allowing students to learn at their own pace.[12]

Through the experimentation and monitoring of online educational platforms, better ways of teaching can be developed over time. As technologies develop, it is expected that the trend of translating online lectures into a number of world languages will continue to grow.

## 7. Conclusion

Developed countries realized that education and knowledge are the most important resources of a country. Without the development of technology, without new ones innovation has no progress in society. Each status quo is stagnation and decline. As soon as the economy enters in recession, it is necessary at all costs to increase investment in research and development because only that can pull the economy out of that crisis. It is equally important that high-tech people and doctors of science they come to business entities, because their most important role is work to improve the economy, and therefore the whole society.

The advanced countries realized that only lifelong learning is possible to keep pace with the development of science. It is not enough to understand it and to take specific action for its operationalization. It should be emphasized the role of higher education institutions in the process of lifelong learning that will have a positive impact on the student centered and teaching centered learning.

Obstacle in the Complete Implementation of Information Technologies in education creates the need for teaching staff and obsolescence curriculum, so it can be said that students have been given the possibility of more advanced development information and information literacy. Such a situation can be extremely problematic for the students who want continue further education.

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# Mechatronic system management of smart house

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**Abstract**

The mobile phone is a device for our everyday permanent use, whose immediate proximity provides the basis for developing remote control applications. Android smartphone applications develop in order to manage integrating systems; lighting, heating-cooling, as well as many other options for controlling and managing the object. The "smart house" model is a mechatronic concept of integrating an automated object management system functionality for the application and testing of mobile applications. The mobile application develops the functions of the object from different locations of its immediate vicinity. By using bluetooth communication and by integrating modern sensors, actuators using microcontrollers, preconditions have been created for the development of a mechatronic concept of management.Integral modules and communication elements of the "smart house" system are integrated in order to improve the functionality and comfort of the facility.

**Key words:** Smart House, Microcontroller, Sensor, Android application.

## 1. Introduction

A smart home is the concept of a modern household and living in it. The house is "smart" because it "adapts" to the current activity, mood, habits and lifestyle of every housewife, thereby achieving a comfortable space [1, 2]. The "smart home" model (Figure 1) features the mechatronic concept of system integration, built to test the mobile phone's Android application. In order to improve the functionality of an object, the Android application monitors and manages different functions of the object from different immediate locations. As the main management processes, we emphasize the lighting systems of the facility, the diagnostics and the control of the temperature and humidity of the premises, the heating-ventilation, the alarm system, and the manipulation of the garage door. The communication elements of the "intelligent house" built system must meet the demands of real-time work. Bluetooth technology plays a major role in communicating the device and highlights its advantages because of the wireless and automated process of connecting the device [3]. The wireless switching and turning-off options as well as the lighting level control of the room gives the confusion control concept. Also, the amount of natural light can be further controlled by the automation of various rolling shutters and curtains.

*Figure 1. Model - smart house*

## 2. Integration of mechatronic components of the system

The "intelligent house" constructed has been controlled by a microcontroller unit to which various mechatronic module systems are connected, which provide direct communication between sensors and actuators. The electronic schemes of "smart home" shown, consisting of; control units - Arduino platform, relay panels, Pir-motion sensor, DHT11 temperature sensor, fan, LED strip and Bluetooth module (HC-06). Supervising and managing the smart home intelligent system is based primarily on the capabilities of an Arduino platform. The modularity of the platform itself and the upgrade of the integration modules provide great possibilities for executing a program-style Arduino platform that meets the requirements of the

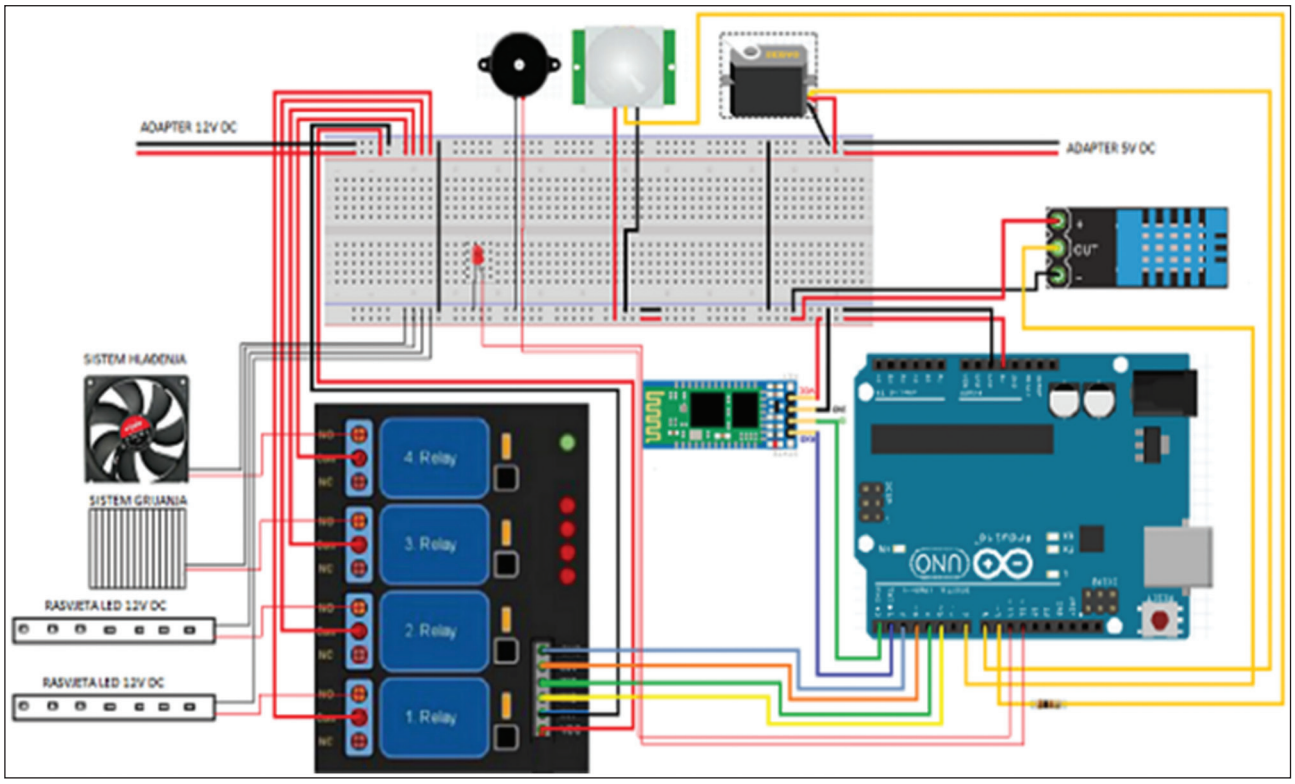


*Figure 2. Schematic of the system of a smart home system*

functionality of the facility. Connecting an Arduino platform with LEDs represents an integrating lighting module divided into two segments (the upper or upper floor). A full 12-volt fan was used in the scheme of a complete system for displaying the cooling system. Also used is the digital sensor DHT-11, which is used to diagnose the state of temperature and humidity of the room on the basis of which the user receives the diagnostics, and through the application it can further activate the correction of the condition, Figure 2. Connecting an Arduino platform with motion sensor and siren, is an integrating alarm system module. The electronic circuitry shown in the circuit diagram is activated via the PIR sensor-HC-SR501. Activating the motion sensor moves the microcontroller, activates the alarm, and security systems warning that security or breakage has occurred in the object [4, 5]. A servomotor control module is shown as a garage door control and manipulation system.

It is apparent from the scheme that all the integration modules are connected to the relay board, whose relays are dependent on the output device voltage, connected to the appropriate power supply. The relay board voltage terminals are connected to the power supply sources of the output devices, while the other pins are connected to the digital control signals of the Arduino platform, which continues to activate or deactivate all output devices by programming mode.

## 3. Android application

The mobile device application has been developed to improve the functionality of the facility, that is, the developmental android application achieves control and management of the various functions of the facility. The mobile application uses its program mode to turn on or off all the output devices, or use a Bluetooth module, to control the individual functions of the object from its immediate distance. Through App Inventor, there has been a development of the graphic and logical part of the Android application [6, 7].

### 3.1. Communication and communication protocol

The first step in Bluethooth Communications is to pairing two devices that want to share data. It is therefore necessary to check if the Bluetooth device that wants to pairing is on and physically

available, ie in the range of the control module. If Bluetooth communication with your mobile device is not turned on, the application gives notice that you need to turn Bluetooth on for communication. At the first pairing of the mobile device with the HC-06 module, the application searches for the PIN of the identification device, which is part of the user protection when paired with the device (Figure 3). Namely, once a bluetooth connection is established between mobile phones and bluetooth modules, through which Arduino and android applications perform an automated wireless communication process.

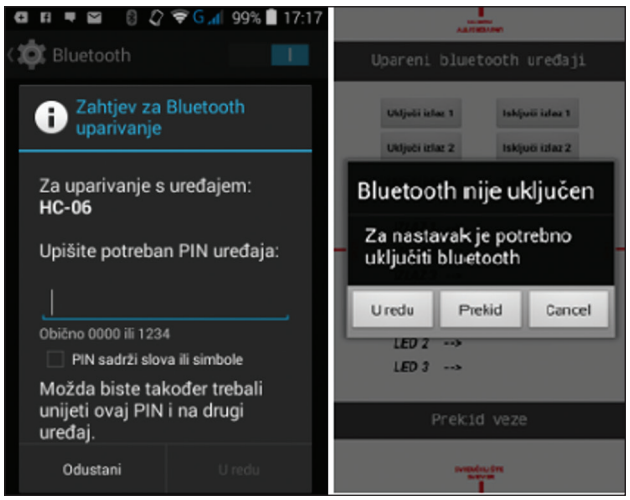


*Figure 3. Bluetooth notification*

The Bluetooth module is a communication medium between android applications and Arduino platforms [3,1]. In the device connection, a connection is made between the master in this case the device that initializes the communication - the mobile device (master) and subordinate Bluetooth module (Slave) device. The Bluetooth module used through the wireless connection allows serial communication between Arduin and a mobile device. The Bluetooth module communicates with the android device and so on, the Arduino platform ensures the control and management of all devices.

The relay release command starts with a user of an Android application that walks through a bluetooth module via a digital signal on an Arduino platform [7, 8]. Depending on programmed program execution conditions, it is an Arduino platform for managing its digital outputs, which through the relay controls output devices (LED1, LED2, LED3), (Figure 4).

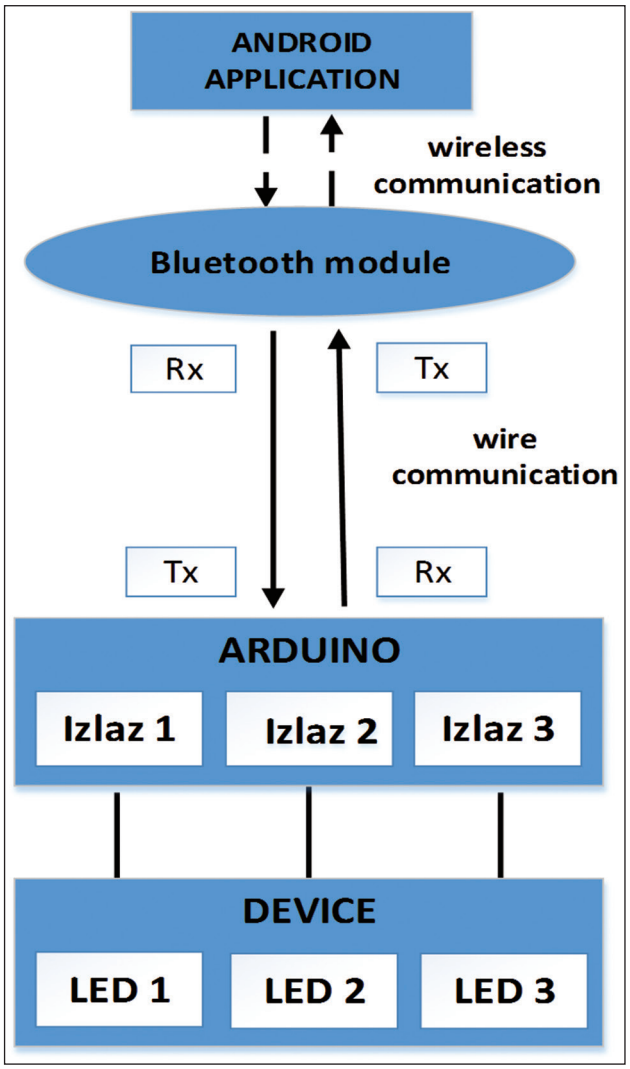


*Figure 4. Communication protocol*

### 3.2. Application graphic environment

Program logic of the application is developed based on the needs of users, conditions of operation and management of individual object functions, while the visual component of the application provides the possibility of direct inclusion of individual module objects as well as the possibility of alarming their parameters. The management of the "smart house" system output modules is displayed through the activation of the control button of the application, (ON / OFF). In terms of changing the status of individual outputs, the user of the Android application by switching on the button transmits the request to the Arduino platform and, based on the scripted code, controls the outputs. Similarly, reverse communication, Arduino reading of the state of the output from the individual

sensors, is constantly sent to the application, and based on them the application presents the status of the parameters (temperature, humidity). The app's display shows the name of the paired Bluetooth control module, and the temperature and humidity of the room. (Figure 5).

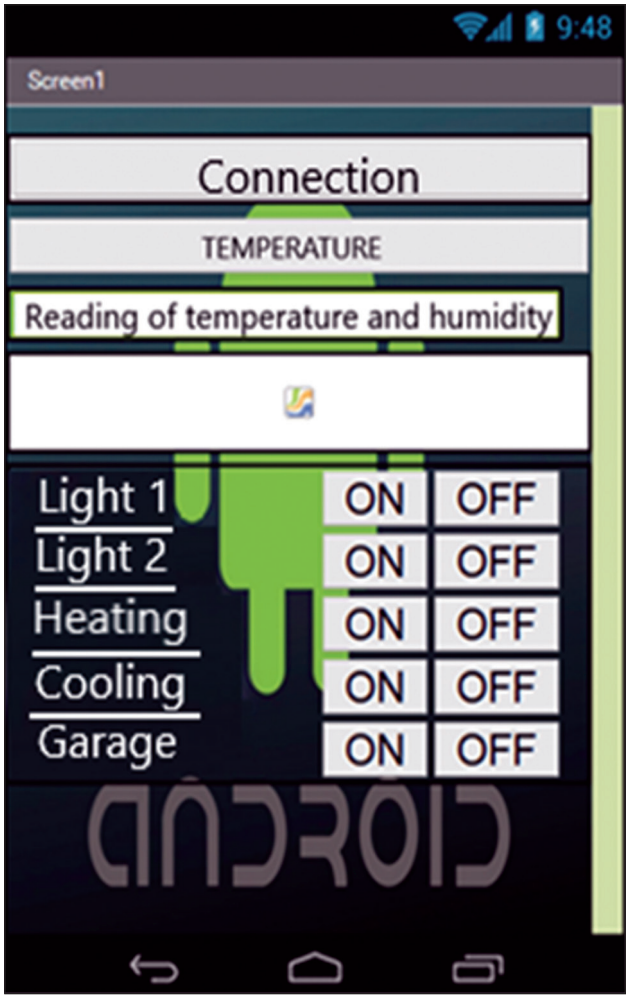


*Figure 5. Graphic view of applications*

This management principle can be further developed on the principle of distributed architecture with multiple separate bluetooth control modules. The application can be installed on multiple mobile devices, or it can be paired with multiple Bluetooth control modules by one mobile application.

## 4. Conclusion

Smart house is a mechatronic concept of the integration of a modern automation system that integrates the management of certain object functions using a Bluetooth connection. Diagnostics and control of heating, cooling, alarm system, alarm system, garage doors and a number of other functional extension features represent a mechatronic concept of object control. The built-in "smart house" is a confirmation of the mechatronic integration of system elements designed to test applications of mobile devices. With the integration of modern sensors, actuators and the use of microcontrollers, the management of certain object functions has been achieved by using smart phones. In essence, the development of a mobile application has been monitored and managed by certain functions of the facility from its immediate distance. Integral modules and communication elements of the built-in smart home system respond to real-time working requirements with the highest stability of all components.

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# Evaluation of antibacterial and antioxidant activity of methanol needle extracts of Larix Decidua Mill., Picea Abies (L.) H. Karst. and Pinus Nigra J. F. Arnold

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**Abstract**

Many studies have shown that coniferous tree extracts have a high antioxidant, antimicrobial and antiproliferative effect. This study examined the content of bioactive components, antioxidant and antimicrobial activity of *Larix decidua* Mill., *Picea abies* (L.) Karst. and *Pinus nigra* J.F. Arnold methanol extracts. Antioxidant activity was determined using FRAP and DPPH methods while antimicrobial activity was tested by diffusion technique on following bacterial strains: *Staphylococcus aureus*, *Enterococcus faecalis*, *Escherichia coli* and *Salmonella enteritidis*. The largest content of bioactive components, and therefore the largest antioxidant capacity, showed the sample of *P. abies* while the lowest was observed in the sample of *P. nigra*. *P. nigra* extracts only showed some antimicrobial activity.

## 1. Introduction

The European larch (*Larix decidua* Mill.) is the most common representative of the genus *Larix* in Europe, and is highly regarded as one of the rarest coniferous, but deciduous species. The European larch is an endemic European species, mostly present in Central Europe. Its natural habitat is scattered and represented in various geographical subspecies and ecotypes, resulting in significant differences in the rate of growth and other characteristics of the tree. The core of the European larch tree is composed of about 39% cellulose, 30% hemicellulose, 28% lignin, and the rest is ash and extracts. In 1973, Mills carried out an oleoresin analysis of several species of larch in England and discovered that the European larch contains large amounts of larixil acetate, as well as a smaller amount of free diols larixol and epimanol. The neutral fraction was made up of aldehydes, including dehydroabietal and isopimaral. The European larch has also recorded examples of medical use. Its bark can be considered a good source of antioxidants and phytoconstituents, with possible use in cosmetic and nutritional products [1]. The bark is used as astringent, balm, diuretic, expectorant, and stimulant, for wound treatment, as well as eczema and psoriasis. The resin is extracted from the wood and used directly (dried and powdered) and can be used for the synthesis of turpentine [2]. The tree contains phenolic components like lignans and flavonols [3]. These compounds have antioxidant and anti-inflammatory effects [4, 5]. Specific activity of four antioxidant enzymes has been determined in the needle extract of the European larch: superoxide dismutase, catalase, ascorbate peroxidase, and glutathione reductase [6].

European or Norwegian spruce (*Picea abies* (L.) Karst.) is the most common conifer in Europe. It is widespread and dominant in the boreal conifer forests of northern and north-eastern Europe, where it replaces *Pinus sylvestris* L. in wet places. It occurs at an altitude of up to 2000 m [7]. Norway spruce is more plastic and can handle shallow lands and droughts [8]. It shows a relatively large amount of genetic variability and a little distinction among populations [9]. All of the constituents

necessary for the SOD-ascorbate-GSH detoxification pathway [10] have been determined in spruce needles, and those are superoxide dismutase, ascorbate, ascorbate peroxidase, several types of reductase, glutathione and glutathione reductase. In spruce, glutathione and glutathione reductase show periodic seasonal variations, with significantly higher levels during winter. It is assumed that glutathione and glutathione reductase play an important role in the winter firmness of the leaves of plants [11]. *Picea abies* is mainly used to relieve coughing. Its essential oils are often found in the syrup used in the treatment of cough or as a part of the throat pastille. An oil or spray resin was used externally to treat wounds or skin infections [12]. The antioxidant activity of 92 phenolic samples, of both edible and non-edible plant material, was examined by autoxidation of methyl linoleate, including the extract of spruce needles that showed strong antioxidant activity [13]. Research has also led to the finding that spruce resin, as well as the extracts of its bark and tree, exhibit antimicrobial activity [3, 14].

Austrian pine or black pine (*Pinus nigra* J.F. Arnold) is a tree, up to 30 m high, with dark grey to black bark and dark green needles. It is very widespread on the Balkans [15]. The black pine turpentine has been used in folk medicine for many years because of its antiseptic effect on the respiratory system and urinary tract disorders. The application is also found to be useful by back pain, for dermatological and analgesic purposes [16]. By the percentage of black pine content, the proportion of essential oil was determined at 0.35%, 7.71% proteins and 7.19% total lipids. Certain quantities of elements, such as copper, zinc, sodium, iron and a slightly higher percentage of potassium and calcium have been determined [17]. The black pine extract showed the inhibitory effect on the development of many bacteria, with the exception of *E. coli*, according to which black pine did not exhibit any inhibitory effect [18]. The results of DPPH and ABTS methods have shown that essential black pine oils have poor antioxidant activity [19]. The *Pinus nigra* resin demonstrates the potential to be used as a natural antioxidant [20], while the methanol extract of black pine is shown as a good antioxidant, according to the results of FTC and TBA methods [21].

## 2. Material and methods

### 2.1. Preparation of the samples

Chopped needles of the tested samples (25 g) were transferred into 250 ml balloons and covered with 100 ml of methanol. So prepared samples were stirred for five days at room temperature, filtered and used for testing of antioxidant activity, contents of total phenols and flavonoids. A second set of samples for antimicrobial analysis was prepared in the manner described. After filtration, the samples were evaporated on a rotavapor to remove solvents. The isolated pure extract was dissolved in 10 ml of dimethyl sulfoxide.

### 2.2. Antioxidant activity determination

*DPPH method*. Before the analysis, the extracts of *Larix decidua* and *Picea abies* were diluted in a ratio of 1:50, while the dilution for *Pinus nigra* extract was 1:10. Appropriate dilution series (around 10-550 µl) were further prepared for each sample, after which the test tubes were supplemented with methanol up to 2 ml. 500 µl of 0.5 mM DPPH solution were added and the samples were left to incubate for 30 minutes in a darkened room at a room temperature. The absorbance was measured at 517 nm with methanol as a blank sample. 500 µl of 0.5 mM DPPH dilution, diluted with 4 ml methanol, was used as a control sample. Inhibition of DPPH radicals was calculated according to the equation:

$$I\,(\%) = \frac{A_k - A_x}{A_k} \cdot 100$$

where the Ak is absorbance of the control and Ax is absorbance of the sample. The results are expressed as an $IC_{50}$ value.

*FRAP method*. To prepare the calibration curve, solutions of $FeSO_4$ x $7H_2O$ were prepared in the concentration range of 200-1000 µmol/l. A 3 ml FRAP reagent was measured in five tubes and 0.1 ml of standard solutions were added thereto. The absorbance was measured in a relation to a blank sample (3 ml FRAP reagent and 0.1 ml of water). For the analysis of methanol extracts, the same dilution of samples was prepared in the manner

described in DPPH method. In each tube, 0.2 ml of extract and 6 ml of FRAP reagent were added. The samples were incubated in an aqueous bath for 30 minutes at 37 °C, and the absorbance was measured at 593 nm relative to a blank sample (6 ml FRAP reagent and 0.2 ml methanol).

### 2.3. Total phenol content determination

Dilutions in a ratio of 1:40 were prepared for all of the samples. The analysis was done in triplicate. 200 µl of the sample were mixed with 2500 µl FC reagent and 420 µl of 10% sodium carbonate. The samples were then incubated for an hour in a dark place. 910 µl distilled water was added to each sample prior to measuring. The measurement was performed at 765 nm.

### 2.4. Flavonoids determination

For the determination of flavonoids, a calibration curve of quercetin with a concentration range of 0.025-0.600 mg/ml was constructed. Dilutions in a ratio of 1:10 were prepared for the methanol extracts of *Larix decidua* and *Pinus nigra*, while dilution for *Picea abies* was 1:25. The analysis was done in triplicate. The volume of the diluted sample of 1 ml was transferred into a tube into which 0.3 ml of 5% sodium nitrite was added. 5 minutes after, 0.3 ml of 10% aluminium trichloride was added into the tube and after 6 minutes 2 ml of 1M sodium hydroxide. The tube was then supplemented with distilled water up to 10 ml, strongly shaken and the absorbance was measured at 510 nm, with methanol as a blank sample.

### 2.5. Testing antimicrobial activity by diffusion method

Antimicrobial activity was investigated by diffusion method on reference bacterial strains (from the ATCC collection) from the group of Gram-positive (*Staphylococcus aureus* and *Enterococcus faecalis*) and Gram-negative bacteria (*Escherichia coli* and Salmonella *Enteritidis*) as prescribed by Clinical and Laboratory Standards Institute, 2009. 0,5 McFarland turbidity standards (density 107-108 CFU/ml, depending on the strain) were prepared from overnight cultures of bacterial strains. The strains were then applied to the surface of the nutrient medium Mueller-Hinton agar (MH), diffused in sterile Petri dish, where the thickness of the medium was 4 mm. The agar wells were made using sterile drillers and 50 µl of extract solution were added. After the plates were left at a room temperature for 15 minutes for the substance to diffuse into the agar, they were left to incubate at 37°C/24 hours. After the incubation period, the size of the inhibitory zone was measured and the sensitivity of the microorganisms was expressed as follows: if the inhibitory zone of the microorganism growth was greater than 20 mm, it was marked with three pluses (+++), which is the highest sensitivity of microorganisms. If the inhibitory zone was in the range of 16-20 mm it was marked with two pluses (++). Very low sensitivity is indicated with one plus (+), if the inhibitory zone is 10-15 mm in diameter. The minus (-) mark is used for an inhibitory zone of less than 10 mm or if it's absolutely absent [22].

## 3. Results and discussion

The content of total phenols in methanol extracts of *P. abies*, *L. decidua* and *P. nigra* is shown graphically in Figure 1.

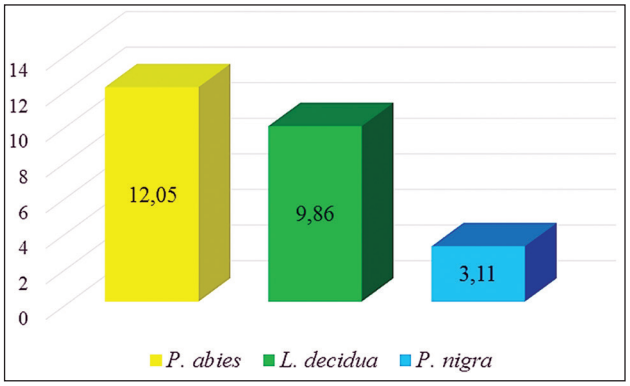


*Figure 1. Content of total phenols*

The highest content of polyphenols was recorded in the *P. abies* sample and is amounted to 12.05 mg GAE/g of dry sample. The results obtained [23] indicate a higher content of polyphenols ranging from 58-81 mg $g^{-1}$. The reason for the higher content of these bioactive components may be the preparation of the sample (the sample is frozen in liquid nitrogen and then exposed to the action of hot methanol), the location from which the sample was taken, the physical-chemical properties of the

soil and the method of sample treatment before the analysis. The lower content of total phenols compared to the *P. abies* sample was found in *L. decidua* extract. Sillero et al. [24] had analyzed the content of *L. decidua* polyphenols, where similar values were obtained ranging from 6.26-10.79 mg GAE/g of dried bark extract, depending on the method used (conventional extraction, ultrasound assisted extraction and microwave assisted extraction). It should be mentioned that ethanol and water, in 50/50 volume ratio, were used as the extraction solvents in this research. The assumption is that the *L. decidua* bark extract would exhibit a higher content of polyphenols than the needle extract, if methanol was used as a solvent, as it proved to be more effective. The methanol extract of *P. nigra* showed the lowest content of polyphenols compared to the remaining two extracts. The content of total phenols for *P. nigra* samples recently published Fkiri et al. [25] is significantly higher than the values obtained by our research. The reason for this can primarily be the time of collecting the needles, since they were collected in April in the previous study.

The content of flavonoids for the methanol extracts of analysed needles is shown graphically in Figure 2.

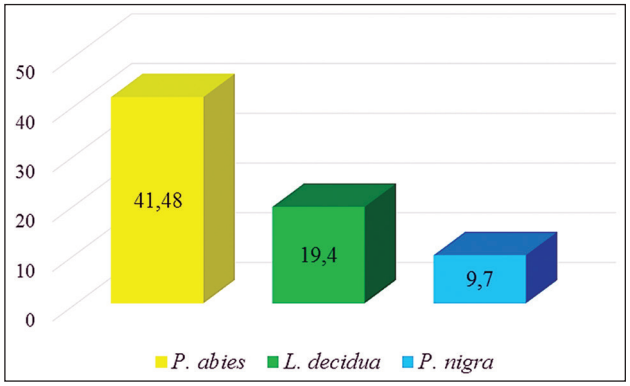


*Figure 2. Contents of flavonoids*

The highest content of flavonoids was recorded in *P. abies* extract and the lowest in the *P. nigra* sample. An insight into the literature for *L. decidua* [24] notes that the content of flavonoids is greater in needle extracts. For the *P. nigra* extracts, a previous study implemented by Fkiri et al. [25] showed a lower content of flavonoids (1.69 to 3.97 mg RE/g) compared to the values obtained by our study (9.7 mg QE/g).

Figure 3 shows the $IC_{50}$ values obtained by the DPPH method, while Figure 4 shows the results obtained by the FRAP method.

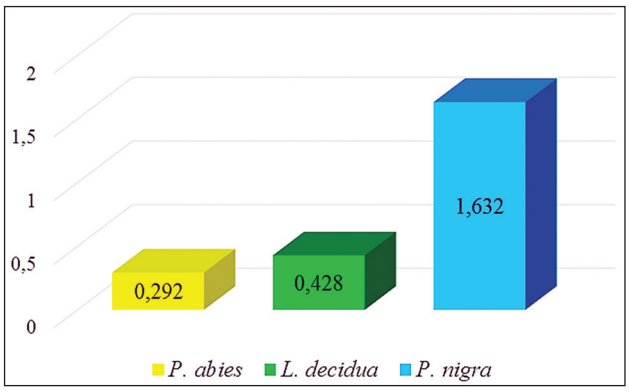


*Figure 3. $IC_{50}$ values obtained by DPPH method*

According to $IC_{50}$ values, the highest antioxidant capacity has methanol extract of *P. abies* (0.292 mg/ml) and the lowest has *P. nigra* extract with a significantly higher concentration to inhibit 50% DPPH radical from 1.632 mg/ml. These results wholly follow the content of polyphenols and flavonoids. Vitamin C, which is used as a control, has a significantly higher antioxidant capacity with an $IC_{50}$ value of 0.0052 mg/ml.

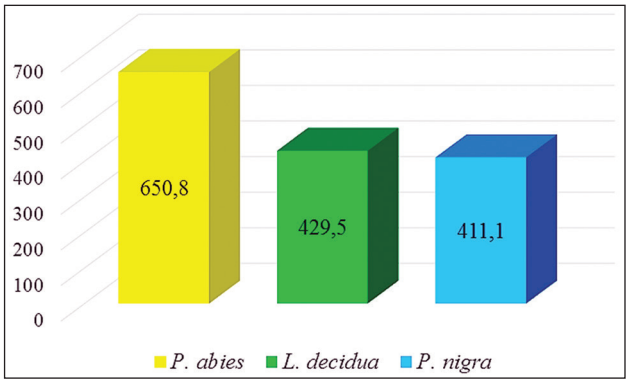


*Figure 4. Results obtained by FRAP method*

The values obtained by the FRAP method are wholly followed by those obtained by the DPPH method. The results shown, indicate a lower antioxidant capacity compared to control antioxidant (vitamin C) for which the FRAP value is 285 µmol/l ($\gamma$ = 0.02 mg/ml). Table 1 shows the values of the polyphenols and flavonoids content and also the results of the antioxidative capacity, which are converted to an initial concentration of 250 mg/ml, except in the case of FRAP method where the values are expressed for dilution.

*Table 1. Summary results of the content of bioactive components and antioxidant activity*

| Extract | Phenols (mg GAE/g) | Flavonoids (mg QE/g) | DPPH (mg/ml) | FRAP (µmol/l) |
|---|---|---|---|---|
| ***P. abies*** | 9.86 | 41.48 | 0.2922 | 650.8 |
| ***L. decidua*** | 12.05 | 19.40 | 0.4283 | 429.5 |
| ***P. nigra*** | 3.11 | 9.70 | 1.6321 | 411.1 |

**Antimicrobial activity *in vitro***

The diffusion method has determined that the extracts of *P. abies* and *L. decidua* have shown to have no antimicrobial activity against the tested strains of Gram-positive or Gram-negative bacteria. The *P. nigra* extract showed poor antimicrobial activity in the case of Gram-positive bacteria *S. aureus* and *E. faecalis* with inhibition zones of 12 and 11 mm, respectively.

## 4. Conclusions

This research has confirmed that methanol is very suitable as a solvent for the extraction of bioactive components. The largest content of bioactive components, and therefore the largest antioxidant capacity, has a sample of *P. abies* and the lowest has *P. nigra*. Antimicrobial screening has determined the complete lack of antimicrobial activity in the extracts of *P. abies* and *L. decidua* while the weak antimicrobial effect was established in *P. nigra*. This confirms that the content of bioactive components is not closely related to the antimicrobial effect of the extracts.

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# Learning Styles of High School Students and Attitudes towards Physics

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**Abstract**

The main purpose of this study is a relationship between learning styles and attitudes. Learning styles with the attitudes that each high school student has will be discussed. Elaborated indicators for learning style are: visual learning styles, auditory learning styles, and kinesthetic learning styles and attitude indicators namely the adoption of scientific attitudes, interest in learning physics, interest in increasing the time to study physics, and interest in a career in physics.

**Key words:** learning style, attitude towards physics, student senior high school

## Introduction

Visual learning style is a learning style that uses the sense of sight to absorb information in learning, such as reading, writing and learning to study well. Visual learning style is a learning style that uses the sense of sight to absorb information in learning such as reading, writing and learning to study well. Visual learning can use graphics, diagrams, and images [1]. Students who have the ability to learn visually prefer to learn by demonstration. Therefore, when class conditions are not conducive those who have visual learning abilities will not be disturbed by their class conditions [2].

Auditory learning style is a learning style by listening. This learning style is the opposite of a visual learning style, such as being easily disturbed by noise when studying, likes to hear with presentations and likes to listen to music. The auditory learning style gains knowledge from reading loud in class and may not have a full understanding of the information written [3]. An individual find it easier to remember what was discussed than what he saw while learning. The one who has this learning style will be rhythmic or patterned when speaking. Kinesthetic learning style is a learning style by moving his body to get information in learning. Individuals with this learning style are more easily caught learning when moving, feeling or taking action [4]. And also the individual will move a lot to get attention while studying. Learning that is preferred in this learning style is like practicing or demonstrating. Then the way a person memorizes learning by walking around the classroom.

In addition to learning styles, attitudes can also influence student learning outcomes. Attitudes can be defined as "feelings, beliefs and values held about school science efforts, school science and the impact of science on society" [5]. Students are expected to have a good attitude towards physics. It is very important for students to have the right attitude because apathy can cause students to appear negative attitudes and make little or no effort to be involved in the learning process [6]. If this phenomenon is not handled and ignored, students who are not interested or not motivated will cause negative attitudes and perceptions of learning physics. Attitudes towards subjects are one of the factors that can affect student learning outcomes. The positive attitude of students towards Physics has a positive integration with student achievement [7]. Attitudes towards physics have several indicators, namely the adoption of scientific attitudes, pleasure in learning physics, interest in increasing the time to study physics, and an interest in a career in physics.

The adoption of scientific attitude is the attitude of students who have a high level of curiosity. Usually, in attending practicums or demonstrations, students are very diligent in learning. Students can be attentive, diligent, resilient, and earnest in investigating scientific attitudes. Conducting demonstration activities can have a positive effect on students, one of which is an increase in students' enjoyment. Fun in learning physics is a step that is often found among students [8]. We already know that physics learning is very difficult to understand. If students have a happy attitude

towards learning physics, it will have a positive impact on their learning outcomes in school. [9] Students who like to study physics can have an effect on the department period. Then students like to study physics, giving rise to attitudes that are truly true in their teaching [10].

Students who like to study physics will be interested in adding physics lessons at school or at home. A positive attitude toward physics learning refers to the participants' interest in learning physics [11]. In this case, students like to join the physics club at school. During the holidays they usually read books about physics. If students like to study physics, they will have no difficulty when doing physical exercises or assignments at school. Interest in a career in physics is one reason why students will try to achieve their goals. Because students who have the desire to pursue careers in physics have very positive achievements in learning outcomes in physics [12]. In addition, careers in physics can also add insight and high curiosity to study physics. Therefore, to be able to improve students in careers in physics, it is necessary to pay attention to student interests, where interest greatly influences career and personal life achievements [13].

The learning indicators mentioned above have an important role in the learning process. By finding a good student learning style, it will have a positive impact on physics subjects. Learners can choose a learning style that suits their individual. Learning styles are important characteristics of various traits that affect the way students learn [14]. One example is when doing the learning process with presentations. Students who have a visual learning style will observe and see what is presented by their classmates. However, for students who have a hearing learning style, they will only be able to absorb information correctly using their sense of hearing. On the other hand for students who have kinesthetic learning styles, they can only receive information well by moving their bodies. Therefore, students must have their own learning styles. If a student does not have a learning style, it will have a negative impact in receiving knowledge and can later damage learning achievement.

Learning styles have three indicators, namely indicators of visual learning style, indicators of auditory learning styles, and indicators of kinesthetic learning styles and attitudes that have four indicators, namely adoption of scientific attitudes, pleasure in learning physics, interest in increasing time studying physics, and interest in a career in physics. In this study the research questions are as follows:

1. How to describe a learning style ?
2. How to describe attitude toward physics?
3. Is there a relationship between learning styles and student attitudes?

The results of this study can contribute to further research also for the schools that we studied so that teachers in the school are able to improve students' attitudes in learning physics.

## Methods

### Research design

The research design used is the Associative Quantitative research method with a correlational research design. According to Creswell (2015) "Correlational Design is a procedure in quantitative research that is used by researchers to measure the degree of association (relationship) between two or more variables using statistical analysis correlation procedures".

### Research sample

The study sample was 451 students. Samples are designed and determined by sampling techniques in the form of *total sampling*. Total sampling is a technique of determining samples that uses all populations as a sample [15].

Learning styles were measured using an open questionnaire with a number of 28 items. For the learning style interviews were also used. Furthermore, for the attitude 54 questionnaires were used as well as interviews. Learning style questionnaire criteria are visual learning style, auditory learning style and kinesthetic learning style. For the criteria for attitude questionnaire, namely the adoption of scientific attitudes, pleasure in learning physics, interest in increasing the time to study physics and a career in physics.

Data analysis

Data analysis of research using inferential statistics consisting of mean, median, minimum, maximum and correlation test.

**Results**

Based on the results of the visual, auditory and kinesthetic learning styles in general can be seen in the table below:

***Visual Learning Style***

The results of data processing description of visual learning styles on physics subjects are seen in the table below:

*Table 1. Visual Learning Style*

| Category Visual | Mean | Mode | Min | Max |
|---|---|---|---|---|
| 55 % | 9.5344 | 10:00 | 5.00 | 14.00 |

Table 1. shows that the visual learning style of physics subjects is 451 respondents. Visual category of 55 % whereas the standard deviation is 2.26383, the mean is 9.5344, mode 10.00, minimum 5.00 and maximum 14.00.

***Auditor's Learning Style***

The results of data processing description of auditory learning styles are seen in the table below:

*Table 2. Auditor's Learning Style*

| Category Auditor | Mean | Mode | Min | Max |
|---|---|---|---|---|
| 20% | 3.3769 | 3.00 | 0.00 | 6.00 |

Table 2 shows that auditory learning styles for physics subjects are 451 respondents. Auditory category of 20 % whereas standard deviation is 1.42978, the mean is 3.3769, mode 3.00, minimum 0.00 and maximum 6.00.

***Kinesthetic Learning Style***

The results of data processing description of kinesthetic learning styles are seen in the table below:

*Table 3. Kinesthetic Learning Style*

| Category Kinesthetic | Mean | Mode | Min | Max |
|---|---|---|---|---|
| 25% | 4.2239 | 4.00 | 2.00 | 8.00 |

Table 3 shows that kinesthetic learning styles for physics subjects are 451 respondents. The kinesthetic category is 25 % whereas the standard deviation of 1.35678, a mean of 4.2239, mode 4 .00, minimum 2.00 and maximum 8.00.

***Adoption of a scientific attitude***

The results of data processing adoption values of the scientific attitude are seen in the table 4.

In table 4, obtained from 451 respondents from high school and processed using the SPSS program, obtained indicators of adoption of scientific attitudes in very good categories at 13.3% for a total of 60 of 451 students. Good at 57.2% for a total of 258 out of 451 students. Enough at 27.7% for a total of 125 out of 451 students. Not good at 1.8% for a total of 8 out of 451 students. Very bad at 0% for total of no 451 students.

***Fun in learning physics***

The results of processing data on the value of a Fun in learning physics are seen in the table 5.

In table 5, obtained from 451 respondents from high school and processed using the SPSS program, obtained indicators of pleasure in learning physics in a very good category at 5.1% for a total of 23 of 451 students. Good at 33.9% for a total of 153 out of 451 students. Enough at 47.9% for a total of 216 out of 451 students. Not good at 11.8 % for a total of 53 out of 451 students. Very bad at 1.3 % for a total of 6 out of 451 students.

***Interest increases when studying physics***

The results of processing data on the value of interest in increasing the time to study physics are seen in the table 6.

In table 6, obtained from 451 respondents from high school and processed using the SPSS program, obtained indicators of pleasure in learning physics in the very good category at 2.2% for a total of 10 from 451 sis wa. Good at 2 3.9% for a total of 108 out of 451 students. Enough at 59.4% for a total of 268 out of 451 students. Not good at 12.2 % for a total of 55 of 451 students. Very bad at 2.2 % for a total of 10 out of 451 students.

***A career interest in physics***

The results of processing data on the value of a career interest in physics are seen in the table 7.

*Table 4. Adoption of a scientific attitude*

| Classification | | | Mean | Mode | Min | Max | % |
|---|---|---|---|---|---|---|---|
| Renting | Attitude | Amount | | | | | |
| 7 - 12.6 | Very bad | 0 | 25,6052 | 25 .00 | 14 .00 | 35.00 | 0% |
| 12.7-18.2 | Not good | 8 | | | | | 1.8 % |
| 18.3-23.8 | Enough | 125 | | | | | 27.7 % |
| 23.9-29.4 | Good | 258 | | | | | 57.2 % |
| 29.5-35.0 | Very good | 60 | | | | | 13.3 % |
| TOTAL | | 451 | | | | | 100% |

*Table 5. Fun in learning physics*

| Classification | | | Mean | Mode | Min | Max | % |
|---|---|---|---|---|---|---|---|
| Range | Learning Style | Total | | | | | |
| 10.0-18.0 | Very bad | 6 | 32.9091 | 33 .00 | 12 .00 | 48 .00 | 1.3 % |
| 18.1-26.0 | Not good | 53 | | | | | 11.8 % |
| 26.1-34.0 | Enough | 216 | | | | | 47.9 % |
| 34.1-42.0 | Good | 153 | | | | | 33.9 % |
| 42.1-50.0 | Very good | 23 | | | | | 5.1 % |
| TOTAL | | 451 | | | | | 100% |

*Table 6. Interest increases when studying physics*

| Classification | | | Mean | Mode | Min | Max | % |
|---|---|---|---|---|---|---|---|
| Range | Learning Style | Total | | | | | |
| 8.0-14.4 | Very bad | 10 | 24,9800 | 25.00 | 8.00 | 39.00 | 2.2% |
| 14.5-20.8 | Not good | 55 | | | | | 12.2% |
| 20.9-27.2 | enough | 268 | | | | | 59.4% |
| 27.3-33.6 | Good | 108 | | | | | 23.9% |
| 33.7-40.0 | Very good | 10 | | | | | 2.2% |
| TOTAL | | 4 51 | | | | | 100% |

*Table 7. A career interest in physics*

| Classification | | | Mean | Mode | Min | Max | % |
|---|---|---|---|---|---|---|---|
| Range | Learning style | Total | | | | | |
| 10.0-18.0 | Very bad | 3 | 31.8914 | 30.00 | 1.00 | 49.00 | 0% |
| 18.1-26.0 | Not good | 52 | | | | | 8.6% |
| 26.1-34.0 | Enough | 273 | | | | | 64.2% |
| 34.1-42.0 | Good | 110 | | | | | 24.5% |
| 42.1-50.0 | Very good | 13 | | | | | 2.6% |
| TOTAL | | 451 | | | | | 100% |

In Table 7, were obtained from 451 respondents from high school and are processed using SPSS, obtained indicators pleasure to study physics in a category that's very good at 2.6% for a total of 13 from 451 students. Good at 24.5 % for a total of 110 out of 451 students. Enough at 64.2% for a total of 273 out of 451 students. Not good at 8.6 % for a total of 52 out of 451 students.

***Relationship between learning styles and attitudes in physics learning***

The relationship between learning styles and attitudes in physics learning can be seen with the correlation test results as in the table 8.

*Table 8. Relationship between learning styles and attitudes in physics learning*

| Correlations | | | |
|---|---|---|---|
| | | **attitude** | **style** |
| attitude | Pearson Correlation | 1 | .095 * |
| | Sig. (2-tailed) | | .044 |
| | N | 451 | 451 |
| style | Pearson Correlation | .095 * | 1 |
| | Sig. (2-tailed) | .044 | |
| | N | 451 | 451 |

Table 8. shows that learning styles with attitudes in physics learning have a correlation of 0.044. [16] The correlation requirement is if sig <0.05 then there is a relationship between learning styles and student attitudes in physics lessons. Based on table 8. obtained sig 0.044, because the condition of the existence of a relationship is if the sig is found to be small from 0.05. Because 0.044 < 0.05 then there is a relationship between student learning styles and student attitudes in physics lessons.

**Discussion**

Learning styles can be defined as an individual's activity to achieve his learning goals. Finding learning style will allow students to determine their own personality strengths and weaknesses and learn from them [3]. Students can recognize the learning styles that fit the individual characteristics of each. That indeed forces us to do it conceptualizing classes differently by focusing on various ways students learn [1]. [17]; learning styles can be classified into three types of styles, namely visual, auditory and kinesthetic.

***Visual learning style***

Based on the results obtained from the questionnaire as many as 82.50% of students are within the category of visual learning styles.

This can be seen also from the results of interviews which show that students are categorized very well in a visual learning style. This can be seen from the results of the interview below:

*Question: do you like to read and write while studying?*

*Answer: yes I like writing and reading. The reason is to better understand the learning*

*Question: then do you like learning like videos, pictures and so on?*

*Answer: yes I'm happy, because it's cool to learn*

These students prefer to read while studying, are not bothered by noise, and are skilled in learning. Positive things obtained from students' visual learning styles are more likely to be active in learning. Students who like visual perception will be most comfortable with instructors who use charts, pictures, and film [18]. The findings showed that students preferred to learn by seeing, reading physics books, being active in answering questions in front of the class and while learning always sat neatly. They depend on non-verbal cue from the instructor or facilitator such as body language to help understand learning [3]. Usually, students and visuals like to sit in front of the class while studying.

***Auditory learning style***

Results obtained from the questionnaire on auditory learning style indicates 42.60% students categorized in having this learning style. This can be seen from the results of the interview below:

*Question: do you like listening to the teacher explain in front of the class?*

*Answer: I usually pay attention to the teacher explaining, because let us understand the lesson in front of the class when the teacher explains.*

*Question: When you learn when there is a friend next to your bench, do you feel disturbed?*

*Answer: i yes I am very easily disturbed by the commotion. Especially` making my learning concentration disappear.*

These students prefer to learn with presentations because they use a sense of hearing tool. They are easily disturbed by noise. Also they speak rhythmically and bitterly while remember much of what they hear. They get a lot of discussion, prefer verbal explanations and learn effectively by explaining something to others [18]. When studying in the classroom students usually have a lazy auditory learning style but prefer to discuss.

***Kinesthetic learning style***

Based on the results obtained from the questionnaire data indicates 40.40% of kinesthetic learning

style. The results of the interview said students were categorized well in having a learning style. This can be seen from the results of the interview below:

*Question: Do you like to learn practice like practicum and demonstration?*

*Answer: Yes, I like to learn that I practice like a demonstration.*

*Question: Try to mention examples of learning practices that have been followed before?*

*Answer: For example, when studying physics, we learn practicum in the laboratory about measuring temperatures that are hot, and cold.*

This learning style is very active in moving to get attention. Students who like to work with demonstrations prefer kinesthetic learning styles [20]

***Adoption of a scientific attitude***

Based on the results obtained from the questionnaire data on attitude indicators, namely the adoption of scientific attitudes, is 57.2%. The results of the interview said that students' attitudes were categorized as well known that students like to exchange opinions of others and look for something new in learning. This can be seen from the results of the interview below:

*Question: if you don't understand the material explained by the teacher what do you do?*

*Answer: I will ask if I didn't understand described material.*

*Question: Then there are your friends who disagree when explaining learning, how do you think?*

*Answer: Yes, I will understand the opinions of my friends, and maybe if the opinion is correct we will exchange opinions.*

On the indicator of adoption of scientific attitudes is that students are very capable and understand the opinions of others, and want to look for new methods that have never been used before. This scientific attitude is very important in learning a broader concept of science later. Students who have a better scientific attitude are always eager to explore new science ideas that will ultimately lead to better achievement in the content field [21]. Students also like to look for new things in conducting experiments. This scientific attitude can develop student character that is useful in shaping the life of the scientific community [22].

***Fun in learning physics***

Based on the results obtained from the questionnaire data on attitude indicators, namely pleasure in learning physics by 47.9%. The results of the interview said that students' attitudes were categorized quite well. This can be known that students enjoy learning physics. For example, during the learning process students diligently take notes on learning, pay attention to the teacher in front of the class and actively ask questions in class. This can be seen from the results of the interview below:

*Question: do you like to study physics?*

*Answer: not too happy to learn physics.*

*Question: what is the reason? explain the reason!*

*Answer: I like to study physics when I learn very well about the material explained by the teacher, if I don't understand the lesson I will be lazy to learn and feel bored.*

*Question: besides what else do you not like learning physics?*

*Answer: learning physics is mostly the formula that makes headaches. And the concept of physics is very difficult to understand.*

On the indicator fun in physics learning the most dominant category is 47.9% of students who don't like learning physics because physics learning is less interesting. Findings are students do not like to study longer in class because it is difficult to understand physical formulas and material. For students physics is a boring subject. Other factors such as the atmosphere of learning in the classroom, classmates and teachers who teach it include influencing the attitude of happy students [23]. But not all students are unhappy with learning physics. There are students who like to study physics and feel happy while studying. For example, students in the classroom look active in learning. When they go home from school they do the assignments and study again at home.

***Interest increases when studying physics***

Based on the results obtained from the attitude questionnaire, indicators showed a good category of 59.4% of interest increasing physics learning time. This can be seen from the results of interviews with students, that students who like to

study physics will increase their study time. For example, during the learning process at school, students will learn again at home like private and so on. This can have a positive impact on student learning outcomes. This can be seen from the results of the interview below:

*Question: are you happy if the physics learning at school hours is added?*

*Answers: yes I am happy, but I do not agree karen a learning physics is difficult, no friends who agree that his clock was added.*

*Question: what difficulties make the hours of physics learning added?*

*Answer: I and my friends will feel bored if they study physics. There are students who like to study physics will increase their study hours at home.*

The indicator of interest increases the amount of physics learning time has a good dominant category, which is 59.4%. Students who love to study physics will also be interested in increasing the time to study physics. After school students study physics and read books. Students also like to do lab work or experiments at school or at home. With a positive attitude that will improve good learning outcomes. Learning concepts must be taught in the daily lives of students, along with simulations, animations to keep students' attention active in learning [24].

***A career interest in physics***

Based on the results of the attitude questionnaire on indicators of career interest in the dominant physics field, it was quite good at 64.2%. It can be seen that students who enjoy learning physics will be interested in careers in their fields. For example, when studying in a laboratory, students will not feel bored, and students will feel interested in learning while practicing physics. This can be seen from the results of the interview below:

*Question: do you like studying in a laboratory?*

*Answer: yes I like and like to study in the laboratory.*

*Question: what is the reason?*

*Answer: there I found many new things that I have never seen, such as measuring instruments such as micrometers, screws and others.*

*Question: if you graduate later are you interested in a career in physics?*

*Answer: if I can, I want to have a career in physics, like that is an interesting thing*

The indicator of interest in a career in physics have a category dominant is good of 64.2%. For students, a career in physics is interesting and not boring, moreover, there are many experiments or practicums that are carried out. In addition to attract students' interest in a career in physics the learning environment must be designed in such a way that allows students to gain knowledge and get a more positive attitude towards physics [25].

***Relationship between learning styles and attitudes in physics learning***

The relationship between learning styles and attitudes toward physics learning has a correlation value of sig 0.044 in accordance with the requirements if the value of sig <0.05 then there is a relationship. Therefore, if students have the right learning style, they will be able to improve students' positive attitudes towards physics. If students have a good and appropriate learning style, it will have a positive impact on students' attitudes towards their subjects. in the attitude aspect it is used as an indicator of learning that is interconnected and reacts to the learning environment [26]. And attitudes have factors that can influence social and internal conditions in themselves [27].

Because of these different learning styles, it is important for teachers to join in their curriculum activities related to each of these learning styles so that all students can succeed in their classes [1]. Accommodating teaching into learning styles improves overall student learning outcomes, increases motivation and efficiency and enables positive attitudes towards language being studied [28]. The purpose of using a learning style is to find the best way for both students to study effectively and the teacher to teach efficiently [3].

Obstacles to students' attitudes toward physics subjects on the indicator of adoption of scientific attitudes of students are very dislike to exchange opinions with others, so do not like to find new methods in learning. For indicators of pleasure in learning physics, students are very unhappy when learning formulas and understanding concepts.

For students who study physics, it is very difficult and not interested and very boring. In the indicator of interest in increasing the time to study physics, if students do not like learning physics, students will not add hours in school, especially at home. With this problem will have a negative impact on student learning outcomes in school. And for indicators of interest in a career in physics, students also have problems in continuing their interest in learning because physics is difficult. Attitudes help us achieve the desired goals and avoid undesirable results [29]. We will tend to show a positive attitude towards a certain attitude object if it is considered beneficial, on the contrary, we will show a negative attitude towards certain attitude objects if it is considered to bring harm [30].

## Conclusions and suggestions

Based on the results and discussion above the learning style is very important in the learning process in order to receive learning well. Visual learning style is very much owned by each individual by getting information or learning correctly. Students say that the initial knowledge on something influence the way students learn to adapt and reinforce its strategy to learn, including how students develop study habits. In addition to attitude learning styles are also very important things in the learning process. In the attitude there is an adoption of scientific attitudes, pleasure in learning physics, an interest in increasing the time to study physics, and an interest in a career in physics. There is a relationship between learning styles and attitudes toward physics subjects.

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# Influence of individual fireplaces on enviroment in town Banovici

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**Abstract**

This paper describes first activities in establishment of central heating system in town Banovići and connection of first living establishments on this system. Nowdays, the capacity in distant heating is in maximum capacity of 11,5 MW in heating source and heating capacity of connected heat consumentent in Banovići is cca 19 MW.

Detailed analysis of living and bussines premisses connected to central heating system was conducted including those which are not. However, values of $CO_2$ emmisions from living premisses not connected to central heating system were displayed as well as suggestions for decreasing of $CO_2$ emmision in atmosphere.

**Key words:** $CO_2$ emmision, heating plants, Influence of individual fireplaces, Efficiency.

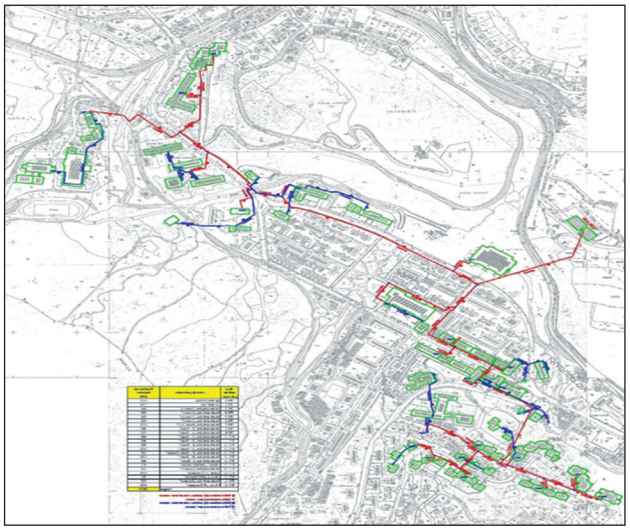
## 1. Introduction

This paper used data relevant for calculation of $CO_2$ emmision from individual fireplaces (surface of obkects which are being heated), also displayed in tebels. Suggestions were also given for decrease of greenhouse effects. Observed region is urban part of Banovići.

## 2. Capacity of city heating plant in Banovići

Heating plants in system of district heating process can be used for heating consument but also for preparation of technical water for industrial purposes. Heating plant in Banovići is explicitly used for purposes of cosument heating. Primary energetic fuel for heating of Banovići is black coal from Banovići coal mine (excavated coal milled in proper granulation with heat value of 14000-15000 kJ/kg). [1]

Currently, heating plant in Banovići is equiped with 11,6 MW boiler manufactured by Đuro Đaković company. Most of buildings in city core is connected to central heating system and it represents the first phase of city heating process i.e. there is not available capacity for additional connections on heating system.



*Picture 1. Current network of central heating system connected consument [1]*

Present condition of town heating includes only certain households and constructions with insufficient heat source capacity and most of living and bussines premisses in zone I, II and III are heated with individual capacity mostly with stoves in coal and wood as well as oil, gas and electricity stoves. [1]

## 3. Overlook of heating consumentent connected to central system heating

According to heating system plan of Banovići, only the I phase of it is built at the moment and central heating system connection includes only premises and households in city core area. Table 1. shows households and premises connected on central heating system.

*Table 1. Overlook of heating consument which is connected on central heating system [1]*

| No. | Location | Present capacities [kW] | Planned capacities [kW] |
|---|---|---|---|
| 1. | Sport center | 2500 | 2500 |
| 2. | Radnički dom and building „Neboder“ | 1569 | 1600 |
| 3. | Living premisse centar 1a | 966 | 1000 |
| 4. | Living premisse centar 1 | 933 | 1000 |
| 5. | Living premisse centar 2a | 969 | 1000 |
| 6. | Living premisse centar 2 | 930 | 1000 |
| 7. | Living premisse „Hanke“ (primary school and kindergarden) | 1570 | 1300 |
| 8. | Living premisse „A“ | 333 | 300 |
| 9. | Living premisse „B“ | 400 | 400 |
| 10. | Living premisse „C“ | 400 | 1000 |
| 11. | Living premisse „D“ | 400 | 1000 |
| 12. | Living premisse „E“ | 400 | 400 |
| 13. | Living premisse „F“ | 350 | 1000 |
| 14. | Living premisse „G“ | 1232 | 1300 |
| 15. | Living premisse „H“ | 1030 | 1000 |
| 16. | Living premisse „I“ | 800 | 1600 |
| 17. | Police building and building of „social standard“ | 915 | 1000 |
| 18. | New living premisse | 250 | 500 |
| 19. | Coal mine directive building | 581 | 600 |
| 20. | premisse „Samačka“ | 1046 | 1000 |
| 21. | Living premisse „Zvjezdara“ | 950 | 1600 |
| 22. | Premisse of secondary school MSŠ, premisse of Komunalno preduzeće | 2500 | 2500 |
| **Σ** | **TOTAL** | **21024** | **24600** |

*Table 2. Overlook of city core not connected to central heating system [1]*

| No. | Location | Present capacity [kW] | Planned capacity [kW] |
|---|---|---|---|
| 1. | Living premisses in Rudarska and Habetova street | 0 | 2100 |
| 2. | Living premisses in 7.Novembra and Alije.I. street | 0 | 1600 |
| 3. | Living premisses 119 MBB and Litva street | 0 | 1600 |
| 4. | Living premisses “Kule” | 0 | 1600 |
| 5. | Living and bussiness premisses in „zanatski centar“ | 0 | 500 |
| 6. | Dom penzionera | 0 | 250 |
| 7. | Living premisses in Željeznička street | 0 | 250 |
| 8. | Islamic centre | 0 | 600 |
| Σ | Total | 0 | 8500 |

### 3.1 Overlook of heating capacity consument

Current condition of hetaing plant in Banovići can satisfy needs of temporary connected premisses on central heating system. However, there is also a fact that central heating system operates with many problems and it is on the line of profitability.

Table 2. shows city i.e. town centre which is not connected to central heating.

### 3.2 Calculation model in influence of individual fireplaces on enviroment and overlook of total emissions

As model for calculation of individual fireplaces influence on enviroment we chose Habetova street. Other streets and premisses from Table 2. were analysed according to same principle.

Living premisses in Habetova street are first in line objects along main pipeline from heating plant to heating substations in town, having in mind the fact that the main pipeline goes right next to buildings which have the best conditions for connection on central heating system. Total square surface of living premisses (appartmets) which are heated in Habetova street is 10000 $m^2$ .

Only one building out of ten in this street is termally isolated with 10 cm thick styrofoam and with changed doors and windows. The rest of living premises are with partially changed doors and windows. Four appartments are heated with electrical boilers while others use coal as most economical fuel and out of technical reasons.


*Picture 2. Residential buildings in Habetova street*

90 % of living premisses in Habetova street consumentent black coal from coal mine Banovići as fuel for heating. The reasins for it is close range of delivery which has direct influence on economic factor.

Consumption of coal for one season is cca. 520 tons i.e. 2,8 tons per day. Coal is being delivered by trucks from point of separation to living premisses. Heating system filling and refilling water is taken from town water line. There is no evidence of water and antifreeze liquid outlet in river and creek systems.

Most of living premisses are equiped with "weso" ovens manufactured in Helios company. Conduction of questionaire showed that average ammount of charcoal slag per day is 15 kg. There are 180 appartments in Habetova street and total ammount of charcoal slag per day is cca 2700 kg and 486 tons per heating season. Charcoal slag is taken off by „Komunalno" company. After being stored in special containers, it is taken off to location of surface mine area for disposal. The fact that needs to be mentioned is that transportation of charcoal slag demands additional fuel expenses, maintenance etc., which is another dissadvantage of individual fireplaces if we consider the fact that transportation of charcoal slag from heating plant is focused on single place.

Emission factor values for $CO_2$ coal burning is 27,6 kg C/GJ, i.e. calculated in $CO_2$ 101,3 $kgCO_2$ / GJ, while according to some new rules it is 108 kgCO2/GJ or 0,94 $CO_2$ for 1kWh. [2]

Emission limit values are calculated as follows:

- For every large combustion plant
- For SO2, NOxi solid particles
- For each year from 2018 to 2027[3]

Components of black coal Banovići with power in calories 14-16 MJ/kg:

*Table 3. Components of black coal Banovići with power in calories 14-16 MJ/kg*

| Fuel component | Share |
|---|---|
| Carbon | 0,421 % |
| Hydrogen | 0,325 % |
| Oxygen | 0,116 % |
| Nitrogen | 0,008 % |
| Sulphur | 0,0135 % |
| Humidity | 0,194 % |
| Ash | 0,2125 % |

Burning of solid fules (coal) is source of emission of different components in atmosphere. Process of burning involves several fuel elements such as: carbon, hydrogen, and sulfur in which during of burning process of fuels and oxidants, solid, liquid and gas burning products are produced[3].

Based on fuel consumentption in Habetova Street, $CO_2$ emission values in atmopsphere is 22,56 tons of $CO_2$ per day i.e. 4060,8 tons for heating season.

Overlook of total $CO_2$ emission from individual fireplaces in urban town area

Table 4. displays values of total fuel consumption and emission of $CO_2$ from individual fireplaces for observed area.

*Table 4. Overlook of fuel consumentption and emission from individual fireplaces*

| No | Street/premisse | Fuel consumentption [t/season] | Emissions of $CO_2$ [t/season] |
|---|---|---|---|
| 1. | Habetova | 520 | 4060,80 |
| 2. | Rudarska | 610 | 4466,67 |
| 3. | 7. Novembar i A. Izetbegović | 212 | 6497,28 |
| 4. | 119. MBB, Litva i Kule | 1925 | 12994,56 |
| 5. | Zanatski centar, Željeznička, Dom penzionera | 235 | 1835,17 |
| Σ | TOTAL | 3502 | 29854,48 |

**Suggestion for decreasment of $CO_2$ emission from individual fireplaces**

Connection of urban town area on central heating system could reduce emission of $CO_2$ for 29854,48 tones per heting season which is a large amount in longterm perspective. Therefore, some of suggestions and measures for improvement of heating plant operation and increasment of heating capacity will be given in this paper with aim to connect observed area of town on central heating system and directly reduce CO2 and SO2 emissions and other gases in atmosphere.

**Suggestion I**

Heating plant is equiped with boiler manufactered by Đuro Đaković company with power of 11,5 MW which uses primary air in burning grid for burning of coal that is separated by detachment of hot water that goes toward heating substations. During this process of heating the problem of temperature decreasing in line that leads from power plant is evident. Installation of air heater i.e. dissipating of thrust in hot water line we can get major savings in energy. Increasment of boiler efficiency in power plant requires automatisation of boiler which would provide regulation of air intake and secondary air for additional burning of nonburnt particles. This would increase enthalpy of smoke gasses as 37 heat carriers as well as more complete combustion which would result in less emission of harmful gasses in atmosphere. Also, one of measures mentioned in first suggestion is optimisation of alternator of heat operation. Heating plant is equiped with one tube alternator with decreased capacity due to damadge in alternate tube and installation of plate alternator in operation would increase efficiency percentage in heat exchange. This suggestion could produce additional 9MW of heat energy which is sufficient for connection of urban town area in central heating system.

**Suggestion II**

In short future, Banovići municipality could be supplied with heat energy from power plant Banovići. Final negotiations are in progress and in 4 years of time additional 25 MW could be avalilable. New 25 MW from power plant could cover needs for urban town area and more than 50 % of III phase of town heating system project of suburban town area. In this way emission of greenhouse gasses would be reduced for about 25%.

**Suggestion III**

Third suggestion is actual building of second stage of egzisting heating plant i.e. instalation of new boiler which would cover the difference and dissipate egzisting boiler in heating plant. Nearest sollution is suggestion I and II with the fact that building of power plant would cover realisation of suggestion I.

## 5. Conclusion

Emission of $CO_2$ is 0,94 $CO_2$ for 1 KW of actual energy if we consider the fact that ammount of heating energy, which is result of fuel burning, is 8,5 MW. According to this fact, we have 29854,48 tons of $CO_2$ per hour during heating season. Temporary situation reflects the fact that overaged equipment and incompetent handling decreases capacity of heating plant for 30% and instead of 30 MW of heating energy only 20 MW is produced what is sufficient only for supplying of currently connected consumers. Conclusion is

that second zone of heating process connects on central heating system by optimatisation of boiler unit with contribution to decreasment of harmfull gasses in atmosphere.

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