

An Overview of the Characteristics of a Modern School

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Abstract

Education plays a key role in the development of human civilisation. Learning and teaching methods are still evolving and undergoing numerous changes as a result of scientific knowledge and revolutionary ideas of stakeholders in the education system, and the development of advanced technologies. We are all familiar with traditional ways of learning wherein educational process is conducted in such a way that the focus is primarily on content. Jan Amos Komensky, the alpha and omega of education science, laid out the class-subject-lesson traditional education system and designed, as early as the 17th century, the school as an institution capable of meeting the mass educational demands of the time. Because these traditional methods use repetition and memorisation of information as the principal means of acquiring knowledge, students are unable to develop their critical thinking, problem-solving and decision-making skills. In the 21st century, teaching should be focused on the effective cooperation between teachers and students who are actively participating in the teaching process, because such an approach ensures the training of innovative individuals who go on to become qualified professionals and responsible citizens, thus creating a more affluent and safer society in general. This paper provides an overview of the important characteristics of modern schools, as well as some modern teaching strategies.

Keywords: *modern teaching strategies, quality of teaching, teaching.*

Introduction

Education is a driving force that promotes economic development and social progress. Therefore, educational policy that is based on the development of a modern school has to take a prominent position in the development of society. According to Pivac (2008),

modern school, unlike traditional school, promotes creativity while emphasising the individual abilities of each student. Modern school is characterised by high-quality instruction and students who are engaged in active learning (Andersone, 2016). The same author asserts that the goal of the education system is to educate individuals who will be able to keep up with the demands of the 21st century economy and the labour market. In order to meet these demands, it is necessary to promote the development of students' competencies, knowledge and skills.

In modern school, learning is based on the philosophy of education that encourages the inclusion of real-life problems and their solutions in the course content and methods of teaching and learning, and on using the resources offered by new technologies, such as computer simulations and digital content (Andersone, 2016).

The process of active learning and teaching is designed to enable all students to realise their full potential and to acquire competencies that will ensure their competitiveness in the labour market and facilitate the right choice of professional interest. In this process, students play a key role within the framework of developing and shaping their knowledge, skills and values (Andersone, 2016). Modern school teachers should not hesitate to use new technologies and new forms of assessment to measure student progress. In addition, research conducted by Brewe et al. (2009) demonstrates all the advantages of the modern approach to the teaching process that motivates students to learn thus ensuring the quality of their future. The goal is to raise innovative citizens who will become equally qualified in both the individual and team or group-work (Tot, 2010). Therefore, the transformation of formal into modern teaching is inevitable.

The teaching approach in modern school should be aligned with the students' interests and abilities. Active learning through experience in a concrete, real-life situation, using experiments for example, increases the conceptual understanding of the course content, so it becomes central in modern teaching, instruction and learning. According to Johari (2017), experiential learning through field work, participation in projects as part of a team and conducting experiments is an effective method that stimulates students' interest and motivation. A study conducted in 2016 (Johari, 2017) examined how experimental work affects the interest of high school students in physics, and the results of the class test showed an 86.5% increase in the average score. This result shows that the impact of an experiential learning model by conducting simple experiments can improve students' attitudes towards physics education compared to committing the definitions to memory without understanding them.

Cooperative learning, as an essential component of the modern approach to the teaching process, encourages students to think about each phase of the research process, and to apply decision-making and logical reasoning skills by connecting the results into a meaningful whole (Sharan, 1990). In order for students to achieve optimal results and to correctly reproduce the acquired knowledge in new situations, it is necessary to achieve a satisfactory ratio of task difficulty and student abilities. The teacher plays the biggest role in the appropriate selection of course content and topics that the students solve and investigate. This is why the teacher needs to be well-

educated and have expert knowledge in the subject that he/she teaches, but it is also desirable that he/she be a good pedagogue. Educators who possess these qualities adapt their teaching to the students' needs and interests (Sharan, 1990). Such an approach to instruction has a motivating effect on students, and at the same time it encourages them to engage in additional work, which is ultimately the goal of modern school.

Vizek-Vidović et al. (2014) found that students were willing to participate in the work if they were sufficiently motivated. According to these authors, in order to stimulate the students' interests, teachers should, in their lectures, support and explain theoretical concepts with concrete examples from everyday life, because the students then see the meaning of learning. Active participation in instruction that puts the students in real-life situations in which they individually or as a group must find a solution using logical thinking, is the easiest way to achieve these goals. At the same time, the knowledge acquired in this way develops students' research skills and competencies necessary for the development of highly qualified individuals.

Teaching in modern school vs. traditional teaching

A key requirement for the future is the need to prepare students for participation in the information society, where knowledge is the most crucial factor in the social and economic development of a country (Spathis, 2004). The development of new information and communication technologies has led to significant changes in both the structure and the functionality of education. The introduction of new technologies into everyday teaching process has led to the development and dissemination of electronic learning (e-learning), thereby offering a new dimension to the provision and content of education (Spathis, 2004).

Learning is a social process that may occur as part of education, personal development, schooling or training. It is often defined as a lasting change in behaviour or a process of transforming information acquired in the experiential process into new competencies and knowledge (Olayide, 2015).

Unlike traditional teaching and passive learning, in active learning the emphasis is put on obtaining information through active participation in each research phase, during which the teacher and student constantly cooperate.

In such active research-based learning, students develop critical thinking and reasoning skills (Mirković, 2016). Instead of memorising a large number of facts that are not systematically organised or conceptually connected, the emphasis is put on understanding the phenomenon being observed. Expert associates, psychologists, pedagogues and special education teachers emphasise the educational effect of the teaching process. They believe that descriptive monitoring in the form of formative evaluation is essential for the systematic monitoring of student progress during the educational process. Thus, each student can be approached in a more adequate and individual way in order for his abilities to come to the fore (Kadum-Bošnjak and Brajković, 2007).

According to Mirković (2016), a modern school teacher should not only use traditional examination methods (oral or written examination) but also apply descriptive monitoring of students in terms of regularity of writing homework, seminar work, participation in project tasks and practical work, activities during lessons, etc. One reason for that is that research has shown there is a tendency on the part of the teacher to assess the students' knowledge during oral examination based on the opinion they had previously formed about the student, therefore subjectively (Munjiza, 2000). Since assessment as a positive reinforcement of operant conditioning stimulates students' additional engagement, providing that the teacher is fair in their assessment (Staddon, 2003), objectivity in assessment is of great importance. It is often the case that the student's general intelligence as well as his verbal ability obscures the actual knowledge, because he knows how to present the adopted course content well, while an introverted child, for example, receives a lower grade because of insufficiently developed communication skills (Brlas, 2004). All this speaks in favour of the proposal that modern school teachers should be well educated in pedagogy and psychology and should continue to develop through specialised professional training. The question that arises, however, is *What is it that motivates the pursuit of high grades as a learning objective?* Although grades are one of the main motivating factors in other European countries as well, the system of evaluation should be less concerned with grades and more focused on how to facilitate the process of learning and making it more transparent. Teachers play the biggest role here since they have the ability to make lessons interesting through their approach to the entire teaching process by way of choosing instructional methods and materials adapted to the age group and student interests.

Quality of teaching

The quality of the teaching process is one of the most important factors in modern school and it is therefore necessary to incorporate various ways and strategies that are motivating for students in that process. According to Konečnik (2002), in order for teaching to be motivating for students who are then able to find meaning in the subject matter being taught or a connection to real life, it is necessary to choose a teaching method that is appropriate, interesting and easy to apply in a concrete case and real environment. The same author believes that all of the above can be achieved by using computer simulations that faithfully illustrate real-life situations. It is therefore desirable for the teaching process in school practice to be held in a digital environment in which social networks, digital content, computer simulations and other information technology products are present.

The quality of teaching is described in terms of the clarity and purposefulness of the course content, the quality of the teacher-student dialogue, and care about the satisfaction of students' emotional, physical and social needs. It is promoted through the use of diverse teaching methods in which demonstrations alternate with questions and answers in the form of problem-based teaching, projects, practical assignments

and an emphasis on research and conceptual teaching (Andersone, 2016). This allows for a greater focus on specific course content and encourages an active participation of students in the teaching process. The characteristics of quality teaching are a good collaborative environment within a classroom and school in which students feel satisfied and where all the prerequisites for optimal development of student personality are met (Režek, 2014).

Likewise, the frontal method of teaching is replaced with a modern approach in which, in addition to quality communication between teachers and students, advanced technologies are used which make the teaching process more interesting to new generations focused on IT tools. In the framework of the self-determination theory (Deci and Ryan, 2017), the positive teaching quality refers to teacher behaviour that supports the students' need for autonomy, competence and relatedness. Specifically, autonomy refers to the feeling of performing activities without external pressures, whereby students spontaneously perform school activities, which are supposed to be aligned with their own interests (Wang and Eccles, 2013; León et al., 2017). Competence refers to the feeling of effective interaction with the environment and the students' belief that they are successfully accomplishing educational tasks (León et al., 2017). Finally, relatedness implies the need to build and maintain positive and meaningful relationships. In fact, when students feel they are receiving attention and that teachers respect them as equal stakeholders in the teaching process, then they usually feel closer and more connected to them (Reeve, 2006; Stroet et al., 2013). Various authors have highlighted many strategies that encourage student autonomy, such as providing students with meaningful and plausible explanations to questions raised (Guay et al., 2013; Stroet et al., 2013), nurturing students' internal motivational resources (Stroet et al., 2013; Cheon and Reeve, 2015), encouraging students' participation in teaching (Roth et al., 2007; Gillet et al., 2012) and preparing and structuring lessons so that as many students as possible are interested in the subject matter and willing to actively participate in the work process (Hospel and Galand, 2016).

A modern approach to teaching develops the skill of recognising causal connections between different tasks and teaching units. A study conducted by Hulleman et al. (2017) found that when students make logical connections with the course content, it helps them to apply the acquired skills in new situations easily, to connect the lesson content they are processing and learning in school with specific situations from everyday life, to comprehend the new material from a different perspective, to deeply process the information they receive and, as a final result, to improve the quality of their learning. Regarding Math, for example, a student may find it stimulating to connect percentages to the need of calculating the discounted price on sales, to understand the number of ingredients in a product or to calculate a basketball player's free throw percentage. Encouraging students to bring course content closer to their interests is especially beneficial and motivating for students with low performance expectations (Hulleman et al., 2010).

The improvement of students' learning is a global educational concern, and research conducted on this topic has shown that teaching quality plays a key role in improving learning outcomes (Wallace et al., 2016). In this regard, studies have confirmed (Maulana et al., 2015; Torrijos et al., 2018) that teachers significantly influence students' perception of the lesson content and that effective teachers make it easier for students to reach their full potential. A successful effort invested in school reform cannot ignore the fact that improving the quality of teaching is of the utmost importance for the emotional, physical and professional development of future generations. It is one of the most important factors in a modern school and it is therefore necessary, in order to improve the teaching standard, to use different strategies to motivate students.

Thus, modern teaching entails a student who is actively involved in the teaching process, who observes the phenomenon through a scientific lens, recognises the regularities according to which the process takes place, states and tests hypotheses, that is, draws conclusions and presents them to other students in his class. Throughout this process, he is monitored by a teacher in the role of a moderator. By applying modern teaching strategies, the teacher stimulates students' imagination, motivation and logical reasoning, which ultimately results in lasting knowledge.

Modern teaching strategies

Active learning engages students and helps them gain an in-depth understanding of the course through inductive learning in which the teaching unit begins with an experiment or a problem question (Adler, 1999). With the application of modern teaching strategies students draw logical conclusions on the basis of already existing mental constructions and knowledge about the stated topic when finding concrete solutions.

Bonwell and Eison (1991) have proposed several techniques to stimulate and promote active learning:

- the use of visual media during lectures (video, multimedia, slides);
- encouraging students to take notes during lectures;
- the use of computers during teaching;
- encouraging students to solve problems independently;
- the use of simulations and various graphics.

Regarding the key question about the criterion for choosing the *correct* active learning method, Bonner (1999) asserts that the teacher should decide which method is the most effective one at a given time, based on the student's interest. In problem-based teaching, we start from the concrete situation determined by the teacher, which students solve in groups using previously acquired knowledge on that topic. During instruction, the teacher leads a discussion, guides students through the process inductively and helps them get from a concrete case to a successful generalisation. Arquero-Montano et al. (2004) compared this teaching method with traditional teaching. They studied its

impact on the development of students' competencies and skills, such as communication skills and accounting problem solving. The experimental group looked into more difficult problem-solving tasks, such as a case-study, in which the focus was on the individual attitude of each student and his/her subjective thinking about the given problem, while the control group solved problems based on obtaining results using formulas. After processing the lesson content, they took a test and the results showed no significant differences between the groups, except for the fact that students from the experimental group were also able to explain their solutions conceptually. Cullen et al. (2004) used a questionnaire to examine students' attitudes about the mentioned methods. The results of the survey on the effectiveness of the proposed methods in terms of developing the students' research skills suggest that case studies are a useful method that should be included when teaching accounting courses. Hosal-Akman and Sigma-Mugan (2010) conducted a study on two groups of students: in the first group, case studies and problem-solving were studied in collaboration with the teacher, while in the second group numerical problems were solved by the teacher himself, without student involvement. They concluded that the collaborative group had slightly better test grades than the group attending traditional lectures.

Weil et al. (2004) found that this method facilitates the development of several significant competencies such as the ability to evaluate a situation from more than one perspective, the ability to find alternative solutions, the ability to distinguish relevant from irrelevant information on a given issue, and the ability to integrate knowledge gained into the already acquired knowledge. In addition, students develop self-confidence and communication skills, and learn to present their views providing arguments. Teamwork, cooperative learning and project-based teaching are only some of the modern methods and forms of teaching, which are discussed henceforth in this paper.

Cooperative learning

Cooperative learning is one of the modern teaching methods that is based on the theory that learning ensues from students working together and discovering the meaning of the course content themselves, with the teacher only there to guide them. Students learn to respect the opinions of their peers even when they contradict their own. Studies (Cohen et al., 1982) have shown that preparing students for participation in peer-work and for discussion on a particular topic implies the engagement of a more motivated student, which results in better collective knowledge. In this type of instruction, students should know how to actively listen, respect their peers and their arguments, and have good debating skills. These are all requisite qualities of modern education that are highly valued in the labour market. Information and communication technologies play an important role in supporting the application of cooperative learning methods such as student debate, peer tutoring, group research and problem-solving (Kadum-Bošnjak, 2012).

Teamwork

Teamwork is very popular among individuals today. However, this was not the case more than half a century ago. The transition from a typical production line to more modern organisational models with increasing amounts of teamwork first occurred during World War I and World War II, in an effort by countries to unite their people. The move towards teamwork was largely the consequence of the Hawthorne study, conducted in the 1920s and 1930s, which highlighted the positive aspects of teamwork in an organisational setting. Teaching that is centred around teamwork creates an environment that allows students to master not only the skills and abilities of interaction and cooperation, but also to develop the ability for critical thinking (Plotnikova and Strukov, 2019).

This approach includes the ability to think creatively and apply the acquired knowledge in practice. In teams, students share literature they have to study, as well as the subject of their research, which they have to present and describe in front of the group. Thus, the entire group works together to achieve a common goal in the most efficient way (Plotnikova and Strukov, 2019).

Project-based teaching

Project-based teaching involves students conducting research on a concept and defining its characteristics, finding similarities and differences in relation to other concepts and presenting their findings in the form of posters or presentations (Reece and Walker, 1994). This method of teaching, which is also focused on the student and not the content, entails self-organisation of learning in groups, teaching in the form of a project and self-evaluation of student achievement, thus enabling the integration of cross-curricular content within the curriculum. Project-based teaching is a method of instruction in which students acquire competencies by spending a longer period of time conducting research on real and complex issues, problems or challenges. This is a motivating and creative modern form of teaching that encourages active participation of students through the synergy of everyone involved in the project (Barkley, Cross and Major, 2005). It is a complex form of teaching in which students work together with a teacher on a subject by conducting various activities. Students can present the results of their research to other students or parents at a parent-teacher conference. In doing so, they develop communication skills as well as self-confidence, while the educational and psychological value of such student activities is far-reaching (Matijević, 1998). In addition, it encourages the development of cognitive and social skills such as self-motivation and taking responsibility, self-regulation of learning and social and communication skills.

Quality of the learning environment in modern teaching

The term *school climate* dates back to 1955 and it has remained an important component of the teaching process to this day. Throughout history, various countries

have sought to adapt their education systems to the social and political conditions prevailing at the time.

At the end of the 20th and the beginning of the 21st century, Bošnjak (1997), Bratanić (2002) and Cipek (1996) spoke and wrote about school quality and the characteristics of modern teaching, in search of the highest quality school system in Croatia. These authors noticed that the key characteristics of successful teaching tailored to each student are satisfactory communication between teachers and students, reduced burden of course content on students and a positive classroom climate.

Branko Bošnjak (1997) was the first to discuss the importance of a collaborative classroom and school climate, fostering a positive competitive environment. He connects collaborative relationships with the character of a school, which is what distinguishes it from other schools of the same rank. What Jurić (1993) means when he writes about the prevailing school climate are all interpersonal relationships that exist in a particular school, not only between teachers and students, but also among other stakeholders in that school. Therefore, the classroom environment, as well as the school environment, are of crucial importance for the successful operation of a school and the continued quality of the teaching process. Classroom climate in which more attention is paid to effort and learning leads to more positive behaviours, and to students being better equipped to cope with failure when they experience it (Elliot and Dweck, 1988; Hiemstra, 1991). Better learning outcomes are achieved through a greater connection of social, psychological and emotional factors (Eccles and Roeser, 2009), which is attained through quality interaction and communication between teachers and students. All this contributes to a better teaching environment, and vice versa (Bognar and Matijević, 2005).

The optimal atmosphere for learning, according to the constructivist paradigm in the educational context, is one in which the school is understood as a supportive community of students and teachers who care for each other, who participate in important decision-making and in which there are common goals, values and norms (Battistich, Schaps and Wilson, 2004).

A positive classroom and school atmosphere has a significant effect on the satisfaction of teachers with their workplace (Domović, 2000). Interpersonal relationships – interactions between teachers, between expert associates and teachers, as well as behaviours of headteachers towards educational workers, also significantly define school climate.

According to Domović (2003), a school environment in which teachers respect each other, nurture friendly relationships, collaborate and enjoy the support of the headteacher in implementing their decisions and applying the chosen approach to the teaching process, is motivating for all those who participate in the organisation and work of a school.

According to Kearney, Smith and Maikac (2016), a positive collaborative environment between teachers and students, an amicable relationship and mutual respect encourage

greater engagement resulting in better student performance. The same authors suggest that students appreciate it when a teacher points to their mistakes in a well-argued manner, and encourages and helps them in solving them. According to Bognar and Matijević (2005), high quality of modern teaching is a necessary precondition for achieving educational goals.

We can conclude that the role of teachers in schools and the education system at large is undeniable.

The role of teachers in modern school

In the old paradigm, a teacher is someone who teaches by giving instructions and defining norms. Teacher knowledge is transferred to passive students. While the teacher is giving lectures – students listen. Students are quiet, passive and without creative ideas. They are able to reproduce the facts learned in class with very little conceptual understanding and negligible applicable procedural knowledge on the subject. In the new paradigm, teaching takes place through the interaction between students and teachers. The teacher is focused on the development of student competencies and talents (Johnson et al., 1998), he/she defines cooperative relationships and a positive classroom climate and discipline during the lecture.

As is the case with any other person, teachers also react to the phenomena they encounter in their work environment, in accordance with their beliefs. According to Domović (2017), these beliefs include implicit theories about the goals of the education system, teachers' personal views on the processes of learning and teaching, and students' competencies and skills which they need to achieve as learning outcomes. Therefore, in addition to teachers' expertise and education, beliefs become fundamental components of their professional identity (Domović, 2017).

In inquiry-based teaching, the teacher's main role is that of providing expert guidance to students. In this process, students are encouraged to think independently and identify causal connections, and are supported and guided in the process of choosing the correct perspective on the situation under investigation and in seeking alternative solutions. The teacher, therefore, assumes the role of a mediator who guides the student and provides support through the learning process (Domović, 2017). Problem and inquiry-based learning is a student-centred approach, as students have an active and participatory role in their own learning process (Grasha, 1996). Cooperative learning refers to the method of teaching and classroom management that emphasises group work and a strong sense of community. This model encourages the academic and social growth of students and includes teaching techniques such as *Think-Pair-Share*. This method rests on the belief that students learn best when working with their peers (Grasha, 1996). Teaching quality is ensured by encouraging the intellectual development of students, providing an inspiring environment, modern classroom equipment and raising students' awareness of the importance of their participation in the teaching process (Ayres et al., 1998). Rapid technological development forces teachers to be

creative, follow a digital lifestyle and master new skills that enable them to manage the educational process in a more efficient way.

Inclusive education expects modern teachers to be highly professional and able to understand students with different cultural, socio-economic, language and family backgrounds, and who have a wide range of abilities, including students with different kinds of developmental disabilities (Domović et al., 2017).

Teacher competence is also important for achieving an optimal work quality, as indicated by many studies which found that teachers and their competence have a significant and positive impact on the quality of student achievement, which is much greater than the impact of school organisation, school management and other material conditions (Darling-Hammond, 1997; Rivkin, Hanushek and Kain, 2005).

Since information and communication technologies are assuming a leading role in everyday life, it is necessary to also incorporate it in the teaching process. Training of teachers in e-learning, thus, becomes an essential condition for achieving the goals of modern schools.

Teachers, as main drivers of the creative process of education, are therefore responsible for their own development and the development of their students, and are called to create an educational process in which the student will not be a passive listener, but a researcher and creator. The link between teacher autonomy and teachers' professional development and educational creativity in teaching is a fact that has been convincingly confirmed by pedagogical theory and practice. Interactive professionalism (Stoll and Fink, 2000) should therefore be an integral part of modern educational activities.

According to Ivanek and Musić (2012), a teacher is both a lecturer and an educator, whose personality is a characteristic that affects students' perception of the teaching process. It is therefore preferable for a teacher of the new school to have high moral principles, to nurture friendly relations between students and their mutual cooperation, to love the work he/she does and to exhibit a diligent attitude to work.

Technology in modern school

In the pre-technological era, teachers did not have many tools to enhance the teaching process. They depended mostly on the blackboard and the chalk to make the learning process easier and more enjoyable for the students. Being the primary source of information, teachers were at the centre of the teaching process, delivering lectures, while students passively received the information. In the technological era, however, the traditionally teacher-centred classrooms transformed into student-centred classrooms (Bajraktari, 2020). This came as a result of the need for a more active student engagement. In modern teaching, the learning responsibility is put on the students with the intention of teaching them to become independent. Technology has revolutionised the field of education. Not only has it changed the way teachers deliver their lessons and how students learn, but it has also made education in general more accessible to millions of students through online teaching and online resources

(Raja and Nagasubramani, 2018). No two students are alike. They all have different styles of learning. This is why it is difficult for teachers to create a lesson plan that would be suitable for everyone. With the help of technology, this has become possible. Some students learn best by listening, so they can benefit from audio recordings, while others are visual types who prefer using pictures or mind maps or videos. Since most students have grown up with technology, they find it interesting and it can increase their motivation for learning. Regardless of financial ability or geographic location, all students can access resources, experiences, interactive learning tools and information that can make it easier for them to acquire knowledge from any field, which was inconceivable for previous generations (Bajraktari, 2020).

New technologies improve cooperation between students and include different learning styles. They also boost motivation and allow students to learn independently. They shorten learning time, train students to learn new technology skills that they can later use in the workplace, reduce paper and photocopying costs and promote the concept of *green revolution* (Raja and Nagasubramani, 2018).

Technology increases student motivation and encourages students who are not interested in the subject being taught to find something that will make the learning process easier and more entertaining for them (Bajraktari, 2020). Schools still have rigid schedules that students must adhere to. However, technology is reducing that rigidity. It makes it possible for students to study at a pace that best suits them. Self-paced learning has opened the door to education to many individuals around the world. Through self-paced online learning, many people who do not have time and resources to attend the university get to earn degrees online, such as online MBAs (Master's in Business Administration).

Over the past decade, the Internet has grown in importance by many folds. Its significance in the world of education cannot be denied. Despite possible abuses and fraud, the use of the Internet has been a blessing for students because it allows them to find various kinds of helpful strategies, like tutorials, video lessons, instructions and interactive computer simulations (Raja and Nagasubramani, 2018). When teachers use technology tools they have at their disposal, they make the learning process easier for students. It then becomes fun, interactive, informative, more engaging and gives them a sense of independence.

Given that physics is the subject area that studies nature and everything that surrounds us, online content has brought the real world much closer to students in classrooms. Below are examples of some interactive online content in physics that are very useful for both teachers and students:

- PhysPort – offers video labs, teaching, evaluation and assessment guides;
- Khan Academy – is an online resource that offers instructional videos, practice exercises and worksheets as well as other teaching materials;
- The Physics Classroom – explains teaching material in a conceptual manner, and offers computer simulations suitable for independent learning;

- PBS LearningMedia – offers interactive teaching content, experiments and lectures;
- HyperPhysics – enables a deductive approach to learning because it deals with topics from physics education ranging from general concepts to specific ones.

Here is a list of examples of general research-based learning platforms that provide teachers and students with structured research activities:

- Go-Lab – is an online system for STEM learning. The platform and all tools (including laboratories and applications) are freely available.
- Ark of Inquiry – is a project on teacher training, oriented towards raising science awareness, particularly that of youth aged 7 to 18, including responsible research and innovation.
- SCY-Lab – the central idea of SCY-Lab is science learning by investigating and creating products such as visualisations, concept maps and reports. These products are called ELOs, which stands for Emerging Learning Objects.

It can be said that the application of technology has greatly facilitated and enriched the teaching process. In the educational context, information and communication technologies (ICT) have the potential to increase in application in primary and secondary schools, and at university level. Tinio (2002) asserted that ICT has a tremendous impact on education in terms of acquisition and absorption of knowledge for both teachers and students in the form of various approaches to learning. In active learning, ICT tools help in the calculation and analysis of information obtained from examination. In contrast to memorisation-based or rote learning, ICT promotes learner engagement, as learners choose what to learn at their own pace and work on specific problem situations they encounter in real life (Tinio, 2002). In collaborative and cooperative learning, ICT encourages interaction and cooperation among students and teachers regardless of the distance between them. It also provides students with the chance to communicate with peers from different cultures, from around the world, thus broadening their horizons and increasing awareness about equality of all people, while also developing their communication skills (Grégoire et al., 1996). In creative learning, ICT promotes inventiveness and originality in students who thus develop skills to create new things. Creating new things therefore brings together all levels of learning in order to properly plan, design and practically apply the new product, concept or function (Raja and Nagasubramani, 2018). The application of ICT in integrative learning promotes the fusion of teaching and learning, and eliminates the synthetic separation between theory and practice, unlike the traditional approach where emphasis is placed only on a particular aspect.

The use of information and communication technologies allows students to self-evaluate their work because many platforms have video exercises that give students feedback after solving a task. The use of new technologies in the new school is therefore indispensable and educational.

Conclusion

Teaching in modern school encourages students to actively participate in the process of instruction. It puts students in contexts that correspond with real-life situations. Through creative work using new technologies, this approach to teaching enables students to experientially understand the very process of finding concrete solutions to given problems. They thus participate in each phase of research which helps them build logical thinking skills. The teacher helps them by choosing the right teaching strategy, taking into account individual abilities of each student and respecting their interests. The pedagogical aspect of the teaching process is reflected in cooperative learning, teamwork and project-based learning, where students work with their colleagues to solve a particular problem, learn to respect the opinions of their peers, take responsibility for their decisions and actions and develop communication skills through discussions encouraged by the teacher. The process of active learning and teaching is designed so that all students realise their potential to the fullest extent possible and acquire a high degree of competencies and knowledge.

A positive classroom environment in which students are not afraid to express their opinion is stimulating. Students like it when teachers and their peers respect them. Modern instruction teaches students tolerance and develops their self-confidence.

A qualified and competent teacher is the linchpin of a successful education system. Teachers have to develop professionally to meet the 21st century teaching needs, which include the skills of mastering new technologies without which modern school is not possible. In addition, they should implement an inclusive approach to teaching as much as possible, because such instruction allows students to express their full potential and discover new ones.

Modern digital content and various educational strategies increase the quality of teaching because new generations of students have been raised with such content, they find it interesting and it provides additional motivation for learning. Although the presence of technology in schools does not guarantee the quality of knowledge, it provides a more equitable access to knowledge for everyone interested. All the above mentioned contributes to an increase in students' abilities, knowledge and skills. The new teaching strategy is becoming increasingly important when it comes to training and educating future generations, because it allows the students, by confronting them with specific current issues, to acquire competencies they need to effectively face the challenges of the future.

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Nastava u suvremenoj školi

Sažetak

Obrazovanje ima ključnu ulogu u razvoju ljudske civilizacije. Metode učenja i poučavanja još uvijek se neprestano razvijaju i prolaze kroz brojne promjene zahvaljujući znanstvenim spoznajama, revolucionarnim idejama osoba uključenih u obrazovni sustav kao i razvoju naprednih tehnologija. Svi smo dobro upoznati s tradicionalnim načinima učenja u kojima se obrazovanje provodi tako da je fokus usmjeren na sadržaj. Jan Amos Komensky, alfa i omega pedagoške znanosti, tvorac razredno-predmetno-satnoga tradicionalnog sustava obrazovanja, već je u 17. stoljeću osmislio školu kao instituciju primjerenu zahtjevima tadašnjega vremena za masovnim obrazovanjem. Budući da te tradicionalne metode koriste ponavljanje i pamćenje informacija kao temeljni način stjecanja znanja, učenici ne razvijaju svoje kritičko razmišljanje, vještine rješavanja problema i donošenja odluka. Nastava u 21. stoljeću treba biti usmjerena na učinkovitu suradnju nastavnika i učenika koji su aktivno uključeni u nastavni proces jer takav pristup osigurava osposobljavanje inovativnih pojedinaca koji postaju kvalitetni stručnjaci i odgovorni građani te na takav način stvaraju bogatije i sigurnije društvo u cjelini. U ovom radu dan je pregled bitnih obilježja suvremene škole, kao i nekih suvremenih nastavnih strategija.

Ključne riječi: kvaliteta nastave, nastava, suvremene nastavne strategije.

Uvod

Obrazovanje je pokretačka snaga koja pospješuje razvoj gospodarstva i društveni napredak. Stoga, obrazovna politika koja se temelji na razvoju moderne škole mora zauzeti važno mjesto u razvoju društva. Prema Pivcu (2008) suvremena škola za razliku od tradicionalne potiče kreativnost naglašavajući individualne sposobnosti svakog učenika. Modernu školu karakterizira visoka kvaliteta poučavanja nastavnika kao i aktivno učenje učenika (Anderson, 2016). Isti autor navodi da je cilj odgojno-obrazovnoga sustava odgajanje pojedinaca koji će biti sposobni pratiti zahtjeve ekonomije i tržišta rada u 21. stoljeću. Kako bi ispunili te zahtjeve, nužno je kod učenika potencirati razvijanje kompetencija, znanja i vještina.

Učenje u suvremenoj školi temelji se na filozofiji obrazovanja koja potiče uključivanje svakodnevnih životnih problema i njihovih rješenja u nastavne sadržaje te metode poučavanja i učenja, kao i korištenje resursa koje nude nove tehnologije, poput računalnih simulacija i digitalnih sadržaja (Anderson, 2016).

Proces aktivnoga učenja i poučavanja oblikuje se tako da omogući svim učenicima da u što većoj mjeri ostvare vlastite potencijale i steknu kompetencije koje će im osigurati konkurentnost na radnom tržištu te olakšati ispravan odabir profesionalnoga interesa. U tom procesu učenik ima središnju ulogu u okviru razvoja i oblikovanja svojih znanja, vještina i vrijednosti (Anderson, 2016). Nastavnici u modernoj školi se ne bi trebali ustručavati koristiti nove tehnologije i nove oblike ocjenjivanja za mjerenje napretka učenika. Istraživanje koje su proveli Brewe i sur. (2009), također ukazuju na sve prednosti modernoga pristupa nastavnom procesu koji motivira učenike na učenje koje će im osigurati kvalitetnu budućnost. Cilj je razvoj inovativnih sudionika društva koji će biti jednako kvalitetni u individualnom radu kao i u timu ili grupi (Tot, 2010). Dakle, transformacija formalne nastave u modernu je neizbježna.

Nastavni pristup u suvremenoj školi trebao bi biti u skladu s učeničkim interesima i sposobnostima. Aktivno učenje kroz iskustvo u konkretnoj, realnoj situaciji, npr. kroz eksperimente, povećava konceptualno razumijevanje nastavnih sadržaja pa ono postaje centar moderne nastave, poučavanja i učenja. Prema Johariju (2017) iskustveno učenje kroz terenski rad, sudjelovanje u projektima u timskom radu te izvođenje pokusa, učinkovita je metoda koja potiče interes i motiviranost učenika. U studiji provedenoj 2016. godine (Johari, 2017) ispitivalo se kako eksperimentalni rad utječe na interes srednjoškolskih učenika prema fizici te je uočen porast prosječne ocjene učenika od 86,5 %. Ovaj rezultat pokazuje da utjecaj modela iskustvenoga učenja izvođenjem jednostavnih eksperimenata može poboljšati stav prema nastavi Fizike u usporedbi s učenjem definicija napamet bez razumijevanja.

Suradničko učenje kao bitna sastavnica modernoga pristupa nastavnom procesu potiče učenike na razmišljanje o svakoj fazi istraživačkoga procesa te odlučivanje i logičko zaključivanje povezujući dobivene rezultate u smislenu cjelinu (Sharan, 1990). Kako bi učenici postigli optimalan učinak i usvojeno znanje mogli ispravno reproducirati u novim situacijama, neophodno je postići zadovoljavajući omjer težine zadatka i učeničkih mogućnosti. Najveću ulogu u pravilnom odabiru sadržaja i tema koje učenik rješava i istražuje, ima nastavnik. Zato nastavnik treba biti dobro educiran i stručan u predmetnom području koje poučava, ali je poželjno da je ujedno i dobar pedagog. Odgojno-obrazovni djelatnici s ovim osobinama nastavu prilagođavaju učeničkim potrebama i interesima (Sharan, 1990). Ovakav pristup radu na učenike djeluje motivirajuće, a ujedno ih potiče na dodatan angažman u radu, a što je u konačnici cilj moderne škole.

Vizek-Vidović i sur. (2014) smatraju da su učenici voljni sudjelovati u radu, ako su dovoljno motivirani. Prema navedenim autorima, kako bi potaknuli interes učenika, nastavnici trebaju u svojim predavanjima konkretnim primjerima iz svakodnevnoga života potkrepljivati i objašnjavati teoretske pojmove jer tada učenici vide smisao učenja. Aktivnim sudjelovanjem učenika u nastavi koja ih stavlja u realne situacije u kojima sami ili u grupi moraju logičkim razmišljanjem iznaći rješenje najlakše ostvarujemo te ciljeve. Ujedno, tako stečeno znanje razvija istraživačke vještine i kompetencije učenika neophodne za razvoj kvalitetne ličnosti.

Nastava u suvremenoj školi vs. tradicionalna nastava

Ključni uvjet za budućnost je potreba za pripremanjem učenika za sudjelovanje u informacijskom društvu, gdje je znanje najvažniji čimbenik društvenoga i ekonomskoga razvoja jedne zemlje (Spathis, 2004). Razvoj novih informacijskih tehnologija i komunikacija doveo je do značajnih promjena kako u strukturi tako i u funkcionalnosti obrazovanja. Uvođenje novih tehnologija u svakodnevni nastavni proces dovelo je do razvoja i širenja elektroničkoga učenja (*e-learning*) nudeći novu dimenziju poučavanja nastavnih sadržaja (Spathis, 2004).

Učenje je društveni proces koji predstavlja dio obrazovanja, osobnoga razvoja, školovanja ili obuke. Često se definira kao trajna promjena ponašanja ili kao pretvorba činjenica stečenih u iskustvenom procesu u nove kompetencije i znanja (Olayide, 2015).

Za razliku od tradicionalne nastave i pasivnoga učenja, u aktivnom učenju naglasak je na dobivanju informacija aktivnim participiranjem u svakoj fazi istraživanja, tijekom kojeg cijelo vrijeme surađuju nastavnik i učenik.

U takvom aktivnom učenju zasnovanom na istraživanju, razvija se učeničko kritičko mišljenje i zaključivanje (Mirković, 2016). Umjesto pamćenja velikoga broja činjenica koje nisu sustavno organizirane niti konceptualno povezane, naglasak je na razumijevanju pojave koja se promatra. Školski stručni suradnici, psiholozi, pedagozi i defektolozi, naglašavaju odgojni učinak nastavnoga procesa. Smatraju da je opisno praćenje u vidu formativnoga vrednovanja bitno radi sustavnoga praćenja napretka učenika tijekom obrazovnoga procesa. Na taj način može se adekvatnije individualnije pristupiti svakom učeniku kako bi njegove sposobnosti došle do izražaja (Kadum-Bošnjak i Brajković, 2007).

Prema Mirkoviću (2016), nastavnik u suvremenoj nastavi ne bi trebao samo koristiti metode tradicionalnoga ispitivanja (usmeno ili pisano ispitivanje) nego primjenjivati i opisno praćenje učenika u redovitosti pisanja domaćih zadaća, izradi seminarskih radova, sudjelovanju u projektnim zadacima i praktičnim radovima, aktivnosti u nastavi itd. Jedan od razloga su rezultati istraživanja koja su pokazala da postoji tendencija nastavnika da prilikom usmenoga ispitivanja učenikovo znanje ocjenjuju prema mišljenju koje o tom učeniku imaju otprije, dakle subjektivno (Munjiza, 2000). Kako ocjena kao pozitivno potkrepljenje operantnoga uvjetovanja stimulira učenike na dodatni angažman uz uvjet pravednosti nastavnika u ocjenjivanju (Staddon, 2003), objektivnost u ocjenjivanju od velike je važnosti. Često se dogodi da učenikova opća inteligencija kao i njegova verbalna sposobnost prikriva pravo znanje jer zna dobro prezentirati usvojene nastavne sadržaje dok npr. introvertirano dijete dobije nižu ocjenu jer nema dobro razvijene komunikacijske vještine (Brlas, 2004). To sve govori u prilog prijedlogu da nastavnici u suvremenoj školi moraju biti dobro pedagoški i psihološki obrazovani i u tome se permanentno usavršavati. Međutim, postavlja se pitanje *Koje to potrebe stvaraju motivaciju da je visoka ocjena cilj učenja?* Iako je ocjena jedan od glavnih motiva i u drugim europskim zemljama, u sustavu evaluacije treba

se manje brinuti o ocjenama, a više se usredotočiti na to kako olakšati proces učenja i učiniti ga transparentnim. U tome najveću ulogu imaju nastavnici koji kroz svoj pristup cjelokupnom nastavnom procesu, u vidu odabira nastavnih metoda i materijala prilagođenih dobnoj skupini i interesu učenika, mogu poučavanje učiniti zanimljivim.

Kvaliteta nastave

Kvaliteta nastavnoga procesa jedan je od najbitnijih faktora u modernoj školi, stoga je neophodno u nju inkorporirati razne načine i strategije za motivaciju učenika. Prema Konečniku (2002) da bi nastava bila motivirajuća za učenike tako da vide smisao u tematici koju obrađuju ili vezu sa stvarnim životom, potrebno je odabrati nastavnu metodu koja im je primjerena, zanimljiva i koju lako mogu primijeniti i sami u nekom konkretnom slučaju u realnom okružju. Isti autor smatra da se sve navedeno može postići upotrebom računalnih simulacija koje vjerno dočaravaju situacije iz stvarnoga života. Stoga je poželjno održavati nastavni proces u školskoj praksi u informacijskom okružju u kojem su prisutne društvene mreže, digitalni sadržaji, računalne simulacije kao i drugi produkti informacijske tehnologije.

Kvaliteta nastave opisuje se jasnoćom i svrhovitosti sadržaja učenja, kvalitetom dijaloga nastavnik-učenik, brigom za zadovoljavanje učeničkih emocionalnih, fizičkih i društvenih potreba. Ona se promiče raznolikom uporabom nastavnih metoda u kojima se demonstracije izmjenjuju s pitanjima i odgovorima u vidu problemske nastave, projektima, praktičnim zadacima te stavljanjem akcenta na istraživačku i konceptualnu nastavu (Anderson, 2016). To omogućuje veći fokus na konkretne nastavne sadržaje te potiče aktivnu uključenost učenika u nastavni proces. Karakteristike kvalitetne nastave su dobro suradničko okružje unutar razreda i škole u kojima se učenici osjećaju zadovoljno i gdje su ispunjeni svi preduvjeti za optimalan razvoj učeničke osobnosti (Režek, 2014).

Također se frontalni način izvođenja nastave zamjenjuje modernim pristupom u kojem se uz kvalitetnu komunikaciju između nastavnika i učenika koriste napredne tehnologije koje nastavni proces čine zanimljivijim novim generacijama usmjerenim na informatička pomagala.

U okviru teorije samoodređenja (Deci i Ryan, 2017), pozitivna kvaliteta poučavanja odnosi se na ponašanje nastavnika koje podržava potrebe učenika za autonomijom, kompetencijom i povezanošću. Točnije, autonomija se odnosi na osjećaj obavljanja aktivnosti bez vanjskih pritisaka, pri čemu učenici spontano obavljaju školske aktivnosti te da su one u skladu s njihovim vlastitim interesima (Wang i Eccles, 2013; León i sur., 2017). Kompetencija se odnosi na osjećaj učinkovite interakcije s okolinom i na uvjerenje učenika da uspješno ostvaruju odgojno-obrazovne zadatke (León i sur., 2017). Konačno, povezanost aludira na potrebu za izgradnjom i održavanjem pozitivnih i smislenih odnosa. Upravo, kada učenici osjete da dobivaju pozornost te da ih nastavnici uvažavaju kao ravnopravne dionike nastavnoga procesa, tada se obično osjećaju bližima i povezanim s njima (Reeve, 2006.; Stroet i sur., 2013). Kako

bi potaknuli autonomiju učenika, različiti autori istaknuli su mnoge strategije kao što je pružanje učenicima smislenih i objašnjavajućih obrazloženja na postavljena pitanja (Guay i sur., 2013.; Stroet i sur., 2013), njegovanje unutarnjih motivacijskih resursa učenika (Stroet i sur., 2013; Cheon i Reeve, 2015), poticanje učeničkoga sudjelovanja u nastavi (Roth i sur., 2007; Gillet i sur., 2012) te pripremanje i strukturiranje lekcija kako bi se što više učenika zainteresiralo za tematiku i kako bi što više njih aktivno sudjelovalo u radu (Hospel i Galand, 2016).

Moderan pristup nastavi razvija vještinu uočavanja uzročno-posljedičnih veza između različitih zadataka i nastavnih cjelina. U istraživanju koje je proveo Hulleman i sur. (2017) uočeno je da učeničko logičko povezivanje nastavnih sadržaja dovodi do toga da učenici lako prilagođavaju stečenu vještinu u novim situacijama, da povezuju nastavne sadržaje koje obrađuju i uče u školi s konkretnim situacijama iz svakodnevice, da shvate nove nastavne sadržaje iz drugačije perspektive, da smisleno obrađuju informacije koje dobivaju te kao konačan rezultat poboljšavaju kvalitetu svojega učenja. Na primjer, učeniku može biti poticajno povezivati postotke s potrebom izračunavanja sniženih cijena na rasprodaji, razumjeti broj sastojaka u proizvodu ili izračunati postotak slobodnoga bacanja košarkaša. Poticanje učenika da nastavne sadržaje približe svojim interesima, posebno je korisno i motivirajuće za učenike s niskim očekivanjima (Hulleman i sur., 2010).

Poboljšanje učenja učenika široko je rasprostranjen interes odgojno-obrazovnoga sustava, a istraživanja provedena o toj temi pokazuju da kvaliteta poučavanja igra ključnu ulogu u unapređivanju ishoda učenja (Wallace i sur., 2016). S tim u vezi, studije (Maulana i sur., 2015; Torrijos i sur., 2018) potvrđuju da učitelji značajno utječu na učeničku percepciju nastavnih sadržaja te da učinkoviti učitelji olakšavaju učenicima ostvarivanje njihova punog potencijala. Uspješan napor u reformi školstva ne može zanemariti činjenicu da je poboljšanje kvalitete nastave od najveće važnosti za emocionalni, psihološki i profesionalni razvoj budućih generacija. Ona je jedan od najbitnijih faktora u modernoj školi, stoga je za povećanje nastavnoga standarda neophodno koristiti različite strategije za motivaciju učenika.

Dakle, moderna nastava podrazumijeva učenika koji je aktivno uključen u nastavni proces, koji kroz znanstveni pristup promatra pojavu, uočava pravilnosti u skladu s kojima se proces odvija, postavlja i testira hipoteze, donosi zaključke koje prezentira drugim učenicima u svojem razredu. Cijelo vrijeme prati ga nastavnik koji ima ulogu moderatora. Nastavnik primjenom suvremenih nastavnih strategija potiče učeničku maštu, motivaciju i logičko zaključivanje koje u konačnici rezultira trajnim znanjem.

Suvremene nastavne strategije

Aktivno učenje uključuje učenike i pomaže im u stjecanju dubinskoga razumijevanja problematike kroz induktivno učenje u kojem se nastavna jedinica započinje s eksperimentom ili problemskim pitanjem (Addler, 1999). Primjenom suvremenih nastavnih strategija učenici na osnovi već postojećih mentalnih konstrukcija i znanja o navedenoj temi logički zaključuju pri iznalaženju konkretnih rješenja.

Bonwell i Eison (1991) predložili su nekoliko tehnika za poticanje i promoviranje aktivnoga učenja:

- korištenje vizualnih medija tijekom predavanja (video, multimedija, projektori)
- poticanje učenika na vođenje bilješki tijekom predavanja
- korištenje računala tijekom nastave
- poticanje učenika na samostalno rješavanje problema
- korištenje simulacija i raznih grafika.

Što se tiče ključnoga pitanja o tome kakav bi trebao biti kriterij za odabir *prave* metode aktivnoga učenja, Bonner (1999) navodi da nastavnik treba zaključiti po interesu učenika koja metoda je u danom trenutku najučinkovitija. U problemskoj nastavi kreće se od konkretne situacije koju određuje nastavnik, a koju učenici rješavaju u grupama koristeći se već stečenim znanjima o toj tematici. Tijekom nastave, nastavnik vodi raspravu, usmjerava učenike da kroz proces idu induktivnim putem te da od konkretnoga slučaja dođu do uspješne generalizacije. Arquero-Montano i sur. (2004) komparirali su ovu nastavnu metodu s tradicionalnom nastavom. Promatrali su njihov utjecaj na razvoj kompetencija i vještina kod učenika, kao što su komunikacijske vještine i rješavanje računskih zadataka. Eksperimentalna skupina rješavala je teže problemske zadatke kao studiju slučaja u kojoj je u fokusu bio individualni stav svakog učenika i njegovo/njezino subjektivno promišljanje o zadanoj problematici, dok je kontrolna skupina rješavala zadatke zasnovane na dobivanju rješenja primjenom formula. Nakon obrađenih nastavnih sadržaja pisali su test, a rezultati testa pokazuju da su ga podjednako dobro riješile obje skupine, s tim da su učenici iz eksperimentalne skupine mogli objasniti svoja rješenja i konceptualno. Cullen i sur. (2004) anketno su ispitali stavove učenika o navedenim metodama. Rezultati ankete o učinkovitosti predloženih metoda u smislu razvoja učeničkih istraživačkih vještina sugeriraju da je studija slučaja korisna metoda koju treba uključiti u poučavanje predmeta koji koriste matematički alat u rješavanju zadataka. Hosal-Akman i Sigma-Mugan (2010) proveli su istraživanje na dvije skupine učenika: u prvoj je primijenjena studija slučaja i rješavanje problema u suradnji s učiteljem, dok je u drugoj skupini numeričke problema rješavao sam nastavnik, bez uključivanja učenika. Zaključili su da je suradnička grupa imala bolje ocjene na testovima od skupine koja je pohađala tradicionalna predavanja.

Weil i sur. (2004) smatraju da ova metoda olakšava razvoj nekoliko značajnih kompetencija kao što su sposobnost promatranja problema iz više perspektiva, pronalaženje alternativnih rješenja te mogućnost razlikovanja bitnih od nebitnih informacije o danom pitanju kao i integriranje novoga u već postojeće stečeno znanje. Također, dolazi do razvoja samopouzdanja učenika, vještina komunikacije i argumentiranoga iznošenja svojih stavova. Samo neki od suvremenih metoda i oblika nastave bili bi timski rad, suradničko učenje i projektna nastava, o kojima je riječ u daljnjem dijelu rada.

Suradničko učenje

Suradničko učenje jedna je od suvremenih metoda poučavanja koja se temelji na stajalištu da učenje proizlazi iz zajedničkoga rada učenika, koji sami otkrivaju smisao sadržaja, a nastavnik ih samo usmjerava. Učenici uče uvažavati mišljenja svojih kolega iako su suprotstavljena njihovim. Istraživanja (Cohen i sur., 1982) pokazuju da učenička priprema za sudjelovanje u radu s kolegama i za raspravu o određenoj temi podrazumijeva angažman motiviranijega učenika što rezultira kvalitetnijim ukupnim znanjem. U ovoj vrsti nastave učenici trebaju znati aktivno slušati, uvažavati svoje kolege i njihove argumente te znati vještine dobrog debatiranja. Sve su ovo kvalitete koje predstavljaju zahtjev suvremenoga obrazovanja i izuzetno su cijenjene na tržištu rada. Veliku ulogu u pružanju podrške primjeni metoda suradničkoga učenja poput učeničke rasprave, vršnjačkoga poučavanja, grupnoga istraživanja i rješavanja problema, imaju informacijsko-komunikacijske tehnologije (Kadum-Bošnjak, 2012).

Timski rad

Timski rad među pojedincima danas je vrlo popularan. Međutim, to nije bio slučaj prije više od pola stoljeća. Prelazak s tipične proizvodne trake na suvremenije organizacijske modele koji sadrže sve brojniju primjenu timskoga rada prvi se put dogodio tijekom Prvoga i Drugoga svjetskog rata, u nastojanju da zemlje ujedine svoj narod. Kretanje prema timskom radu uglavnom je bilo posljedica studije Hawthorne, provedene dvadesetih i tridesetih godina prošloga stoljeća koji su isticali pozitivne aspekte timskog rada u organizacijskom okružju. Timskim radom u nastavi stvara se okružje koje učenicima omogućuje svladavanje ne samo vještina, sposobnosti interakcije i međusobne suradnje, već i formiranje kritičkoga mišljenja (Plotnikova i Strukov, 2019).

Ovaj pristup uključuje sposobnost kreativnoga razmišljanja i primjene stečenoga znanja u praksi. Unutar timova učenici dijele literaturu koju moraju proučiti kao i tematiku koja je predmet istraživanja, a koju trebaju pred grupom izložiti i opisati. Pri tome cijela grupa radi u svrhu ostvarivanja zajedničkoga cilja na najučinkovitiji način (Plotnikova i Strukov, 2019).

Projektna nastava

Projektna nastava podrazumijeva učeničko istraživanje o nekom konceptu te definiranje njegovih karakteristika, određivanje sličnosti i različitosti u odnosu na druge pojmove te prezentiranje zaključaka u vidu plakata ili referata (Reece i Walker, 1994). Ova nastava koja je također usmjerena na učenika, a ne na sadržaj, podrazumijeva samoorganizaciju učenja u skupinama, nastavni rad u obliku projekta, samovrednovanje postignuća učenika te omogućuje povezanost međupredmetnih sadržaja unutar kurikula. Projektna nastava je metoda poučavanja u kojoj učenici stječu kompetencije radeći duži vremenski period na istraživanju stvarnoga i kompleksnoga pitanja, problema ili izazova. Ovo je motivirajući i kreativni suvremeni oblik nastave u kojem se potiče

aktivno sudjelovanje učenika kroz sintezu svih uključenih u projekt (Barkley, Cross i Major, 2005). To je složeni oblik nastave u kojoj učenici zajedno s nastavnikom obrađuju neku temu kroz različite aktivnosti. Rezultate istraživačkoga rada učenici mogu prezentirati drugim učenicima ili roditeljima na roditeljskom sastanku. Pri tome razvijaju komunikacijske vještine kao i svoje samopouzdanje, a pedagoška i psihološka vrijednost takvih učeničkih aktivnosti je dalekosežna (Matijević, 1998). Također, potiče razvoj kognitivnih i socijalnih vještina poput samomotiviranja i preuzimanja odgovornosti, samoregulacije učenja te socijalnih i komunikacijskih vještina.

Kvaliteta nastavnoga okružja u suvremenoj nastavi

Pojam *školsko ozračje* datira iz 1955. i sve do danas ostao je bitna sastavnica nastavnoga procesa. Kroz povijest, odgojno-obrazovni sustavi raznih zemalja nastojali su se prilagoditi socijalnim, društvenim i političkim uvjetima koji su prevladavali u to vrijeme.

Na tragu što kvalitetnijega školskog sustava u Hrvatskoj, krajem 20. i na početku 21. stoljeća o kvaliteti škole i karakteristikama moderne nastave govorili su i pisali Bošnjak (1997), Bratanić (2002), Cipek (1996). Ovi su autori uočili da je vodeća karakteristika uspješne nastave po mjeri svakoga učenika, zadovoljavajuća komunikacija između nastavnika i učenika, smanjenje opterećenja učenika nastavnim sadržajima te pozitivna razredna klima.

Branko Bošnjak (1997) prvi govori o važnosti suradničke klime u razredu i školi, kao poticaju za pozitivno natjecateljsko okružje. Suradničke odnose dovodi u vezu s karakterom škole prema kojem se ona razlikuje od drugih škola istoga ranga. Jurić (1993) pod klimom koja vlada u školi podrazumijeva sve međuljudske odnose koji vladaju u dotičnoj školi, ne samo između nastavnika i učenika već i drugih dionika škole. Dakle razredno okružje, kao i školsko okružje od velike je važnosti za uspješan rad škole i kvalitetan tijek nastavnoga procesa. Razredna klima u kojoj se više pažnje polaže na trud i učenje vodi pozitivnijim ponašanjima i boljem suočavanju s neuspjehom kada ga učenici dožive (Lliot i Dweck, 1988; Hiemstra, 1991). Bolji ishodi učenja postižu se većom povezanošću socijalnih, psiholoških te emotivnih faktora (Eccles i Roeser, 2009), što se ostvaruje kvalitetnom interakcijom i komunikacijom između nastavnika i učenika. Sve to doprinosi boljem nastavnom okružju, i obrnuto (Bognar i Matijević, 2005).

Optimalno ozračje za učenje po konstruktivističkoj paradigmi u odgojno-obrazovnom kontekstu, jest ono u kojem se škola shvaća kao podupiruća zajednica učenika i nastavnika u kojoj se oni brinu jedni za druge, sudjeluju u donošenju važnih odluka i u kojoj postoje zajednički ciljevi, vrijednosti i norme (Battistich, Schaps i Wilson, 2004).

Pozitivna atmosfera u razredu i školi znatno utječe na zadovoljstvo nastavnika svojim radnim mjestom (Domović, 2000). Međuljudski odnosi- interakcije nastavnika, odnosi stručnih suradnika i nastavnika te ravnatelja prema odgojno-obrazovnim djelatnicima, također, znatno definiraju školsku klimu.

Prema Domović (2003), školsko okružje u kojem se nastavnici međusobno uvažavaju, njeguju prijateljske odnose, surađuju i imaju potporu ravnatelja u provođenju svojih odluka te primjeni odabranoga pristupa nastavnom procesu, motivirajuće je za sve sudionike organizacije i rada jedne škole.

Prema Kearney, Smith i Maikac (2016) pozitivno suradničko okružje između nastavnika i učenika, prijateljski odnos i međusobno uvažavanje, potiče na veći angažman što rezultira boljim školskim rezultatima učenika. Isti autori sugeriraju da učenici cijene kad im nastavnik argumentirano ukazuje na greške uz poticaj i pomoć oko rješavanja istih. Prema Bognaru i Matijeviću (2005), kvaliteta suvremene nastave nužan je uvjet za ostvarivanje ciljeva odgoja i obrazovanja. Možemo zaključiti da je uloga nastavnika u školama i cijelom obrazovnom sustavu neupitna.

Uloga nastavnika u modernoj školi

Nastavnik u staroj paradigmi je onaj koji poučava dajući upute i definirajući norme. Znanje nastavnika prenosi se na pasivne učenike. Dok nastavnik drži predavanja, učenici slušaju. Učenici su šutljivi, pasivni i bez kreativnih ideja. Dobivene činjenice na satu, umiju reproducirati s vrlo malim konceptualnim razumijevanjem i neznatnim primjenjivim proceduralnim znanjem o toj temi. U novoj paradigmi, poučavanje se odvija kroz interakciju između učenika i nastavnika. Nastavnik je usmjeren na razvoj učeničkih kompetencija i talenata (Johnson i sur., 1998), on definira suradničke odnose i pozitivnu razrednu klimu te disciplinu tijekom sata.

Kao i svaka druga osoba, nastavnik također reagira u svojem radnom okružju na pojave s kojima se susreće, u skladu sa svojim uvjerenjima. Prema Domović (2017), ova uvjerenja podrazumijevaju implicitne teorije o ciljevima obrazovnoga sustava, osobne stavove nastavnika o procesima učenja i poučavanja te o učeničkim kompetencijama i vještinama koje učenici trebaju ostvariti kao ishode učenja. Dakle, uz stručnost i educiranost nastavnika, uvjerenja postaju temeljne komponente njihovoga profesionalnog identiteta (Domović, 2017).

U istraživačkoj nastavi glavna nastavnička uloga je stručno vodstvo učenika, tijekom kojeg ga potiče na samostalno razmišljanje i uočavanje uzročno-posljedičnih veza, podupire i usmjerava ga u odabiru ispravne perspektive promatranja situacije koja se istražuje te traženje alternativnih rješenja. Dakle, nastavnik preuzima ulogu medijatora koji vodi učenika i pruža mu podršku kroz proces učenja (Domović, 2017). Učenje temeljeno na postavljanju problemsko-istraživačkoga pitanja pristup je usmjeren na učenika jer učenici imaju aktivnu i participativnu ulogu u vlastitom procesu učenja (Grasha, 1996). Kooperativno učenje odnosi se na metodu poučavanja i upravljanja razredom koja naglašava grupni rad i snažan osjećaj zajedništva. Ovaj model potiče akademski i društveni rast učenika i uključuje tehniku poučavanja kao što je *Think-Pair-Share*. Ova metoda počiva na uvjerenju da učenici najbolje uče kada rade sa svojim vršnjacima (Grasha, 1996). Kvaliteta poučavanja osigurava se kroz poticanje intelektualnoga razvoja učenika, osiguravanje inspirirajućega okružja i moderno

opremljene učionice te osvještavanje učenika o važnosti njihova sudjelovanja u nastavnom procesu (Ayres i sur., 1998). Brzi razvoj tehnologije tjera učitelje da budu kreativni, slijede digitalni način života te da ovladavaju novim vještinama koje im omogućuju upravljanje obrazovnim procesom na učinkovitiji način.

Inkluzivno obrazovanje nameće visoki profesionalizam suvremenih učitelja koji su u stanju razumjeti učenike različitoga kulturnog i sociološko-ekonomskoga statusa, jezičnoga okružja i obiteljskih struktura, uključujući one koji su na različitom razvojnom stupnju pa i sa određenim invaliditetom (Domović i sur., 2017).

Kompetentnost nastavnika bitna je i za ostvarivanje optimalne kvalitete rada na što su upozorila i mnoga istraživanja kojima se utvrdilo da postoji značajan i pozitivan utjecaj nastavnika i njegove kompetentnosti na kvalitetu učeničkoga dostignuća, koji je mnogo veći nego utjecaj školske organizacije, upravljanje školom te drugi materijalni uvjeti (Darling-Hammond, 1997; Rivkin, Hanushek i Kain, 2005).

S obzirom na to da komunikacijsko-informacijska tehnologija preuzima glavnu ulogu u svakodnevici, neophodno ju je inkorporirati i u nastavni proces. Zato osposobljenost nastavnika za e-nastavu postaje nužan uvjet za ostvarivanje ciljeva suvremenih škola.

Nastavnici su, dakle, kao osnovni pokretači stvaralačkoga procesa odgajanja, odgovorni za vlastiti razvoj i razvoj svojih učenika te su pozvani da kreiraju odgojni proces u kojem učenik neće biti pasivni slušač, već istraživač i kreator. Povezanost autonomije učitelja i njihova profesionalnoga razvoja s odgojnim stvaralaštvom u nastavi činjenica je koju uvjerljivo potvrđuje pedagoška teorija i praksa. Interaktivni profesionalizam (Stoll i Fink, 2000) stoga treba biti sastavni dio suvremenoga odgojno-obrazovnoga djelovanja.

Prema Ivaneku i Musiću (2012), nastavnik je predavač i odgajatelj čija je osobnost karakteristika koja utječe na učeničku percepciju nastavnoga procesa. Zbog toga je poželjno da nastavnik nove škole ima visoko moralna načela, da njeguje prijateljske odnose između učenika kao i njihovu međusobnu suradnju, da voli posao koji radi i primjenjuje kvalitetan odnos prema radu.

Tehnologija u suvremenoj školi

Učitelji u predtehnološkoj eri nisu imali mnogo alata za poboljšanje nastavnoga procesa. Najviše su ovisili o ploči i kredi kako bi učenicima olakšali i učinili proces učenja ugodnijim. Kao primarni izvor informacija, nastavnici su predstavljali centralni dio nastavnoga procesa i držali predavanja dok su ih učenici pasivno promatrali. Međutim, u tehnološkoj eri, tradicionalna nastava usmjerena na nastavnika transformira se u onu koja je usmjerena na učenika (Bajraktari, 2020). Do promjene je došlo zbog potrebe za aktivnijim angažmanom učenika. U suvremenoj nastavi odgovornost za učenje preuzima učenik s namjerom da postane samostalan. Tehnologija je revolucionirala područje obrazovanja. Ona nije promijenila samo način na koji nastavnici izvode svoje lekcije i kako učenici uče, već je obrazovanje općenito učinila dostupnijim milijunima učenika putem *online* nastave i mrežnih resursa (Raja i Nagasubramani, 2018). Ne postoje dva identična učenika. Svaki učenik ima različite stilove učenja.

Zato je učiteljima teško izraditi nastavni plan koji bi bio prikladan za sve učenike. Pomoću tehnologije to je postalo moguće. Neki učenici najbolje pamte ono što čuju, pa mogu koristiti audiozapise dok su drugi vizualni tipovi pa radije koriste slike ili umne mape ili videouratke. Budući da je većina učenika odrasla uz tehnologiju, ona im je interesantna te im može povećati motivaciju za učenje. Bez obzira na financijske sposobnosti ili geografsku lokaciju, svi učenici mogu pristupiti resursima, iskustvima, interaktivnim alatima za učenje te informacijama koje im mogu olakšati put prema stjecanju naobrazbe iz bilo kojeg područja što je bilo nezamislivo ranijim generacijama (Bajraktari, 2020).

Nove tehnologije poboljšavaju suradnju među učenicima i uključuju različite stilove učenja. Također podižu motivaciju i omogućuju učenicima samostalno učenje. Skraćuju vrijeme učenja, osposobljavaju učenike da nauče nove tehnološke vještine koje mogu kasnije koristiti na radnom mjestu, smanjuju troškove kupnje papira i fotokopiranja te promoviraju koncepta *zelene revolucije* (Raja i Nagasubramani, 2018).

Tehnologija povećava motivaciju učenika, dok oni koji nisu zainteresirani za temu koja se obrađuje, također mogu pronaći nešto što će im proces učenja učiniti lakšim i zabavnijim (Bajraktari, 2020). Škole i dalje imaju krute rasporede kojih se učenici moraju pridržavati. Međutim, tehnologija smanjuje tu krutost. Učenici mogu usvajati onaj opseg nastavnih sadržaja koji im najviše odgovara. Samostalno učenje otvorilo je vrata obrazovanju mnogim pojedincima diljem svijeta. Samostalnim *online* učenjem mnogi ljudi koji nemaju vremena i resursa za pohađanje sveučilišta stječu diplome putem *online* nastave, poput online MBA-a (Master's in Business Administration).

Tijekom desetljeća, važnost interneta je mnogostruko porasla. Njegova važnost u svijetu obrazovanja ne može se osporiti. Unatoč mogućim zlouporabama i prijevarama, korištenje interneta je blagoslov za studente jer im omogućuje pronalaženje raznih oblika pomoćnih strategija, poput tutoriala, videolekcija i instrukcija te interaktivnih računalnih simulacija (Raja i Nagasubramani, 2018). Uporabom tehnoloških alata koje nastavnici imaju na raspolaganju, učenicima se olakšava proces učenja te on postaje zabavan, interaktivan i informativan, angažirajući ih i dajući im osjećaj neovisnosti.

S obzirom na to da je fizika predmetno područje koje istražuje prirodu i sve ono što nas okružuje, *online* sadržaji su uvelike realni svijet približili učenicima u učeničkim klupama. Primjeri nekih interaktivnih *online* sadržaja iz fizike koji su od velike koristi i nastavnicima i učenicima:

- PhysPort - sadrži videolaboratorije te upute o načinu poučavanja, vrednovanja i ocjenjivanja
- Khan Academy – *online* stranica koja sadrži videolekcije, dodatne primjere i radne listiće kao i druge nastavne materijale
 - The Physics Classroom – na konceptualan način objašnjava gradivo koje se obrađuje, sadrži računalne simulacije pogodne za samostalno učenje
 - PBS LearningMedia – sadrži interaktivne nastavne sadržaje: pokuse i predavanja
 - HyperPhysics – omogućava deduktivni pristup učenju jer obrađuje teme iz nastave Fizike od općih pojmova prema konkretnim.

Primjeri općih platformi za učenje temeljene na istraživanjima koja pružaju nastavnicima i učenicima strukturirane aktivnosti za istraživanje:

- Go-Lab - sustav za mrežno učenje STEM-a. Platforma i svi alati (uključujući laboratorije i aplikacije), dostupni su besplatno.
- Ark of Inquiry - projekt je za osposobljavanje učitelja, usmjeren na podizanje svijesti o znanosti, odgovornom istraživanju i inovacijama posebno kod mladih u dobi od 7 do 18 godina.
- SCY-Lab – središnja ideja SCY Laba je naučiti znanost proučavanjem i stvaranjem proizvoda poput crteža, konceptijskih mapa i izvještaja. Ti se proizvodi nazivaju ELO, što je skraćenica od Emerging Learning Objects

Možemo reći da je primjena tehnologije uvelike olakšala i obogatila nastavni proces. U obrazovnom kontekstu, informatička i komunikacijska tehnologija (IKT) ima potencijal rasta u primjeni na osnovnoškolskom, srednjoškolskom te na sveučilišnom nivou. Tinio (2002) je ustvrdio da IKT ima ogroman utjecaj na obrazovanje u smislu stjecanja i apsorpcije znanja kako kod nastavnika tako i kod učenika u vidu raznih pristupa učenju. Kod aktivnoga učenja IKT alati pomažu u računanju, obradi i analizi informacija dobivenih u nekom istraživanju. Za razliku od učenja temeljenoga na pamćenju ili učenja napamet, IKT promiče angažman učenika jer oni biraju što će učiti i to vlastitim tempom te im omogućuju rad na konkretnim problemskim situacijama koje susreću i u stvarnom životu (Tinio, 2002). U suradničkom i kooperativnom učenju, IKT potiče interakciju i suradnju između učenika i nastavnika bez obzira na udaljenost koja je između njih. Studentima također pruža priliku da komuniciraju s vršnjacima iz različitih kultura, iz cijeloga svijeta, te im na taj način širi svijest o jednakosti između svih ljudi, a pri tome razvijaju i komunikacijske vještine (Grégoire i sur., 1996). Kod kreativnoga učenja, IKT promiče inventivnost i originalnost kod učenika koji tako razvijaju vještinu stvaranja noviteta. Pri tome stvaranje novoga, objedinjuje sve razine učenja kako bi se ispravno planirao, dizajnirao i u praksi primijenio novi proizvod, koncept ili funkcija (Raja i Nagasubramani, 2018). Primjena IKT-a u integrativnom učenju promiče fuziju poučavanja i učenja te eliminira sintetičko razdvajanje između teorije i prakse za razliku od tradicionalnoga pristupa u kojemu se naglasak stavlja samo na određeni aspekt.

Uporaba informatičko-komunikacijskih tehnologija omogućava učenicima samoprocjenu svojeg rada jer mnoge platforme imaju videovježbe koje učenicima daju povratnu informaciju nakon riješenoga zadatka. Stoga je uporaba novih tehnologija u novoj školi neizostavna i edukativna.

Zaključak

Nastava u suvremenoj školi potiče učenike na aktivno sudjelovanje u nastavnom procesu. Učenike stavlja u kontekste koji odgovaraju realnim životnim situacijama. Ovaj pristup nastavi omogućava učenicima da kroz kreativan rad uz uporabu novih tehnologija, iskustveno razumiju sam proces pronalaženja konkretnih rješenja za zadane

probleme. Pri tome, sudjeluju u svakoj fazi istraživanja što im pomaže u izgrađivanju vještine logičkoga razmišljanja. U tome im pomaže i nastavnik pravilnim odabirom odgovarajuće nastavne strategije, vodeći računa o individualnim sposobnostima svakoga učenika i uvažavajući njihove interese. Pedagoški aspekt nastavnoga procesa ogleda se u suradničkoj nastavi, timskom radu i projektnoj nastavi tijekom koje učenici zajedno sa svojim kolegama rade na rješavanju određenoga problema, uče se uvažavanju tuđega mišljenja, preuzimanju odgovornosti za svoje odluke i postupke te razvijaju komunikacijske vještine kroz rasprave na koje ih potiče nastavnik. Proces aktivnoga učenja i poučavanja oblikovan je tako da svi učenici u što većoj mjeri ostvare vlastite potencijale i kvalitetno oblikuju svoje kompetencije i znanja.

Pozitivno razredno okruženje u kojem se učenici ne boje iznijeti svoje mišljenje djeluje stimulativno. Učenici vole kada ih nastavnici uvažavaju, a kolege poštuju. Moderna nastava učenike uči toleranciji i razvija im samopouzdanje.

Kvalitetan i kompetentan nastavnik je okosnica uspješnoga nastavnog sustava. Nastavnici se trebaju profesionalno razvijati kako bi odgovarali potrebama nastave dvadeset prvog stoljeća što podrazumijeva i vještine ovladavanja novim tehnologijama bez kojih moderna škola nije moguća. Također, trebali bi u što većoj mjeri provoditi inkluzivni pristup nastavi jer u takvoj nastavi učenici mogu maksimalno izraziti sve svoje potencijale, ali i otkriti nove.

Suvremeni digitalni sadržaji i razne odgojno-obrazovne strategije povećavaju kvalitetu nastave jer su učenici novih generacija odrasli na takvim sadržajima te su im zanimljivi i dodatno ih motiviraju. Iako prisutnost tehnologije u školama ne garantira kvalitetu znanja, ona omogućava pravedniji pristup znanju svima koji su za to zainteresirani. Sve navedeno doprinosi povećanju sposobnosti, znanja i vještina učenika. Nova nastavna strategija poučavanja poprima veliku važnost kada su u pitanju planovi osposobljavanja i edukacije budućih generacija jer učenicima omogućava da kroz konfrontiranje s konkretnim aktualnim problemima stječu kompetencije koje su im neophodne za učinkovito suočavanje s izazovima budućnosti.