

# Education for digital transformation

How to use digital technologies and media to enhance learning and teaching? How to develop digital literacy, critical thinking and media culture among children and young people?

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# Assessment of student work in synchronized and unsynchronized distance learning courses.



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**Education for digital transformation**

**Number of the paper: 114**

## **Abstract**

The task of any teacher/trainer/facilitator is to regularly assess and continuously monitor student progress. The assessment process itself is very complex and demanding as relevant data needs to be collected in order to evaluate student achievement. We believe that the said process is easier to carry out in contact teaching than in distance learning, as one is directly with the student, at the same "time" and in the same room. As students are individuals it is necessary to approach the assessment of each student individually and holistically. It is necessary to monitor daily their work, their commitment, the realization of their achievements and progress according to their abilities. In this article, we will present assessment tools for teaching that are suitable for use in synchronous and asynchronous distance learning.

**Key words:** *classroom assessment tools, Kirkpatrick assessment model, online communication, tools for e learning*

# Assessing AI readiness in education: A comprehensive analysis



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**Education for digital transformation**

**Number of the paper: 115**

## **Abstract**

Artificial Intelligence (AI) has gained significant global attention owing to its advancements and potential advantages across various sectors. The education sector stands out as an important domain actively reflecting the integration of AI approaches and recognizing its transformative potential. This research aims to assess the readiness of educational institutions, to adopt and leverage AI technologies effectively. The study employs a multidimensional framework, encompassing technological infrastructure, institutional policies, pedagogical strategies, and stakeholder perspectives. Through a combination of quantitative and qualitative methods, we will analyze the current state of AI readiness in a diverse sample of higher education institutions.

The research investigates the readiness of existing infrastructure to support AI applications, and the alignment of institutional policies with emerging AI trends. The study explores the integration of AI tools in teaching methodologies, examining how educators perceive and incorporate AI in their practices. The research also considers the perspectives of students, and educators to the overall acceptance and understanding of AI in the educational ecosystem.

Findings from this research contribute to a deeper understanding of the challenges and opportunities associated with AI in education. Recommendations based on the assessment aim to guide educational institutions in developing strategic plans for AI integration, ensuring a seamless transition toward a technologically advanced and pedagogically enriched learning environment. The study aims to inform researchers, educators, and stakeholders about the current landscape of AI readiness in education and foster discussions on the future role of AI in shaping the educational landscape.

## **Key words**

*artificial intelligence, digital transformation, educational landscape, higher education, research methods*

# Reading - writing and using digital tools in their acquisition



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**Education for digital transformation**

**Number of the paper: 116**

## **Abstract**

This paper aims to examine and analyze the strategies used for the acquisition of the first language (L1) based on two components, reading and writing. Learning to read and write is a crucial yet complex process that significantly contributes to students' intellectual development and lays a strong foundation for learning foreign languages. Therefore, exploring new methodologies and strategies can help in overcoming challenges in this area.

The traditional methodology of language learning (L1 or L2) often falls short of our expectations; therefore, there is a growing demand that technology, especially Artificial Intelligence, be included as much as possible in education and language learning in particular.

In recent years, there has been a significant shift in the application of AI concepts and mechanisms from higher education to the K-12 level. This transition appears to be a challenge for both teachers and students. If these concepts are more popular for learning foreign languages, we will try to assess the familiarity of Albanian language teachers with AI technologies. Are the teachers ready for the inclusion of AI in the teaching of the Albanian language? How well have they acquired digital skills? National strategies are prioritizing the use of technology in education, but how much are they used in the function of learning Albanian? How can we integrate AI in the first steps of mother tongue learning?

Through semi-structured interviews with teachers, students, and researchers, we will try to draw conclusions and provide recommendations.

## **Key words**

*artificial intelligence, language learning, mother tongue (L1), reading, writing*

# Draw a robot - pre-service teachers' conceptions



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**Education for digital transformation**

**Number of the paper: 117**

## **Abstract**

Technological advancements are reshaping the educational landscape, emphasizing the importance of digital competencies in the coming decade. Educational robots, leveraging artificial intelligence, play a pivotal role in shaping K-12 education and fostering computational thinking, a vital skill for today's youth and their educators. This research endeavors to reveal teachers' perceptions of robots and their pedagogical implications, aiming to refine teaching practices in educational settings. Specifically, the study seeks to determine whether teachers discern between robots and non-robots, identify prevalent features in robot depictions, understand the rationale behind specific robot choices, and uncover potential misconceptions. Employing a mixed-method approach, we used the Draw-A-Robot Test (DART) and open-ended inquiries to probe teachers' conceptions of robots. Our sample comprised 107 pre-service teachers from the University of Belgrade, Faculty of Education, Serbia. Through rigorous analysis conducted by two independent evaluators, we identified the bee bot as the prevailing representation of educational robots, often depicted with animal-like characteristics. Furthermore, our investigation uncovered prevalent misconceptions about robots, shedding light on critical areas for teacher development. The findings of this research carry significant implications for enhancing teacher competencies regarding integrating robots in educational settings. By addressing misconceptions and refining perceptions, educators can harness the potential of educational robots to advance learning and teaching experiences.

## **Key words**

*computational thinking, digital competences, education, misconceptions; mixed-method approach*

# Diversity of the digital environment in political education



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**Education for digital transformation**

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## **Abstract**

As they rapidly develop, digital technologies constantly and increasingly introduce novelties into everyday life and thus into the teaching environment. Long-term studies that follow development and progress of digital technologies and their successful implementation in the teaching process show that these changes are not necessarily always positive. This paper will review recent challenges in the teaching process of political education, such as, for example, distance learning and the use of artificial intelligence. The above mentioned will show advantages and disadvantages of innovations in educational digital technologies, suggesting a way to improve the teaching process of political education in a future time.

## **Key words**

*advantages and disadvantages of digital teaching technologies, artificial intelligence in digital media in political education, distance learning in political education, political education*

# Classroom education students to engage in productive discussions about elementary mathematics instructional videos using an online application



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## **Abstract**

Despite their availability, ease of use, and the benefits they provide, videos are still rarely used in the education of our future classroom teachers. Although students prepare and implement lessons within the framework of teaching methodology courses, we noticed that they rarely and reluctantly comment on the lessons of their colleagues. The purpose of this action research was to improve the existing methodological practice by involving students in a productive discussion about videos of the initial mathematics lesson. A new online application was used for the discussion, which allows linking comments to the corresponding parts of the video, as well as creating and using different protocols for systematic observation of classes. In order to participate in the discussion about teaching, the students received methodical instructions on the features of quality elementary mathematics teaching and examples of university teachers' teaching comments. Six teams of five students participated in three debates during one semester. After each discussion, the teams commented on what was written based on pre-agreed criteria. At the end, each student independently had to write a commentary on the teaching video according to the structure proposed by Hemmeter et al. (2011). The research showed that the discussions were successfully carried out using the new online application. Based on the analysis of online discussions, we found that it was difficult for the students to focus on the important aspects of the lesson in the beginning. However, by the end, they were able to discuss the features of quality elementary mathematics teaching and give suggestions for its improvement. Considering the observed advantages, we believe it is necessary to consider the training of students to participate in productive discussions about teaching videos within Mathematics Methodology, as well as in other teaching methodology areas.

## **Key words**

*elementary mathematics, teacher education, teaching observation, technology, video*

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**Odgoj i obrazovanje za digitalnu transformaciju**

**Broj rada: 119**

## Sažetak

Unatoč dostupnosti, lakoj uporabi i prednostima koje pružaju, videozapisi se još uvijek rijetko rabe u obrazovanju naših budućih učitelja razredne nastave. Premda studenti pripremaju i ostvaruju nastavu u okviru metodičkih vježbi, uočili smo kako rijetko i nerado komentiraju nastavu svojih kolega. Ovo akcijsko istraživanje je imalo za svrhu unaprijediti postojeću metodičku praksu uključivanjem studenata u produktivnu raspravu o videozapisima početne nastave matematike. Za raspravu je korištena nova online aplikacija koja omogućuje povezivanje komentara s odgovarajućim dijelovima videozapisa te izradu i uporabu različitih protokola za sustavno promatranje nastave. Za sudjelovanje u raspravi o nastavi studenti su dobili metodičke upute o značajkama kvalitetne početne nastave matematike te primjere komentara nastave sveučilišnih nastavnika. Šest peteročlanih timova studenata sudjelovalo je u tri rasprave tijekom jednog semestra. Nakon svake rasprave timovi su međusobno komentirali napisano na temelju unaprijed dogovorenih kriterija. Na kraju je svaki student samostalno trebao napisati komentar videozapisa nastave prema strukturi koju predlažu Hemmeter et al. (2011). Istraživanje je pokazalo da su rasprave uspješno ostvarene pomoću nove online aplikacije. Na temelju analize online rasprava utvrdili smo kako je studentima u početku bilo teško usredotočiti se na bitne aspekte nastave. Na kraju su bili u stanju raspravljati o značajkama kvalitetne početne nastave matematike te navesti sugestije za njeno unapređenje. S obzirom na uočene prednosti smatramo potrebnim povesti računa o osposobljavanju studenata za sudjelovanje u produktivnim raspravama o videozapisima nastave u okviru Metodike matematike ali i u drugim metodičkim područjima.

## Ključne riječi

*obrazovanje učitelja, početna nastava matematika, promatranje nastave, tehnologija, videozapis*

# Tools for individualized education in inclusive classrooms / Alati za individualizaciju obrazovanja u inkluzivnim razredima



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**Number of the paper: 120**

## **Abstract**

The research explores the effectiveness of digital tools for individualizing education in inclusive classrooms through a five-year literature review. The goal is to identify the application of digital tools and evaluate their effectiveness and applicability in supporting inclusive practices. Through this process, the aim is to ensure optimal conditions for the progress of all students, regardless of individual differences and needs, and to encourage the continuous development of an inclusive educational system.

Building on existing knowledge of inclusive education, theoretical frameworks, and definitions of key constructs, the paper expands and refines the understanding of this area. Digital tools and artificial intelligence tools for education (AIED) show significant potential for personalizing the educational experience. AIED systems use emotional state recognition technology to tailor learning content to the student's emotional state, promoting engagement.

Despite the advantages, implementation requires careful planning and addressing challenges such as the need for a personalized approach and ensuring internet security. This research plays a crucial role in advancing the Croatian education system by providing a foundation for the development of policies that support optimal conditions for the progress of all students.

## **Key words**

*artificial intelligence, digital tools, education, inclusion*

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**Broj rada: 120**

### Sažetak

Rad istražuje učinkovitost digitalnih alata za individualizaciju obrazovanja u inkluzivnim razredima kroz pregled literature posljednjih pet godina. Cilj je identificirati primjenu digitalnih alata te razumjeti njihovu učinkovitost i primjenjivost u podršci inkluzivnim praksama. Kroz ovaj proces, cilj je osigurati optimalne uvjete za napredak svih učenika, neovisno o individualnim razlikama i potrebama, te potaknuti kontinuirani razvoj inkluzivnog obrazovnog sustava.

Polazeći od postojećih spoznaja o inkluzivnom obrazovanju, teorijskih okvira i definicija ključnih konstrukata, rad proširuje i precizira razumijevanje ovog područja. Digitalni alati i alati umjetne inteligencije za obrazovanje (AIED) pokazuju značajan potencijal za personalizaciju obrazovnog iskustva. AIED sustavi koriste tehnologiju prepoznavanja emocionalnih stanja za prilagodbu sadržaja učenja prema emocionalnom stanju učenika, potičući angažman.

Unatoč prednostima, primjena zahtijeva pažljivo planiranje i suočavanje s izazovima poput potrebe za personaliziranim pristupom i osiguravanjem internetske sigurnosti. Ovo istraživanje ima ključnu ulogu u unaprjeđenju hrvatskog obrazovnog sustava, pružajući temelj za razvoj politika za optimalne uvjete napretka svih učenika.

### Ključne riječi

*digitalni alati; inkluzija; obrazovanje; umjetna inteligencija*

# Digital competences of teachers for developing pupils' algorithmic thinking / Digitalne kompetencije učitelja za razvoj algoritamskog načina razmišljanja učenika



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**Education for digital transformation**

**Number of the paper: 121**

## **Abstract**

Developing children's algorithmic thinking is closely related to the principles of constructivism and it should start at preschool and early school age. In Serbia, the subject Digital World was introduced in the 2020/2021 school year as a compulsory subject in the first cycle of primary education. This subject aims to develop pupils' digital competencies in order to train them for the safe and proper use of digital devices, communication, cooperation, and the development of algorithmic thinking. Primary school classroom teachers are responsible for teaching the subject Digital World within the first cycle of primary education. The aim of this paper is to detect the readiness of the educational system to support classroom teachers in the implementation of Digital World teaching. Using the 4C method, a syllabus analysis of the initial education courses at Teacher Education Faculties in Serbia, as well as professional training and development programs for educators was carried out. Our findings indicate that, within the initial education of future classroom teachers, their digital competencies are being developed through different teaching subjects and at different levels of student knowledge. However, it has been detected that insufficient attention is paid to the development of students' algorithmic thinking. Additionally, the number of professional development programs specifically focused on this topic is insufficient. Therefore, we conclude that it is necessary to introduce dedicated teaching subjects at Teacher Education faculties to equip teachers with the necessary skills for implementing the subject Digital World, with a special emphasis on the development of algorithmic thinking. Furthermore, it is necessary to introduce a larger number of quality seminars for permanent professional development.

## **Key words**

*initial teacher education, professional development of teachers, subject Digital World*

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**Odgov i obrazovanje za digitalnu transformaciju**

**Broj rada: 121**

### Sažetak

S razvojem algoritamskog načina razmišljanja kod dece, koje je tesno povezano sa konstruktivističkim učenjem, treba početi još na predškolskom i ranom školskom uzrastu. U Srbiji je od školske 2020/2021. godine u okviru prvog ciklusa osnovnog obrazovanja po prvi put uveden obavezni nastavni predmet Digitalni svet, čiji je cilj razvijanje digitalnih kompetencija učenika radi osposobljavanja za bezbednu i pravilnu upotrebu digitalnih uređaja, komunikaciju, saradnju i razvoj algoritamskog načina razmišljanja. Nastavu predmeta Digitalni svet u okviru bazičnog obrazovanja izvode profesori razredne nastave (učitelji). Cilj ovog rada je detekcija spremnosti obrazovnog sistema da podrži profesore razredne nastave u realizaciji nastave Digitalni svet. Metodom 4C, izvršena je analiza silabusa nastavnih predmeta inicijalnog obrazovanja u okviru fakulteta u Srbiji koji obrazuju buduće profesore razredne nastave, kao i programa profesionalnog razvoja i stručnog usavršavanja zaposlenih u obrazovanju. Rezultati ukazuju da se u okviru inicijalnog obrazovanja budućih profesora razredne nastave kroz različite nastavne predmete i na različitim nivoima znanja razvijaju njihove digitalne kompetencije. Uočeno je da se razvoju algoritamskog načina razmišljanja kod studenata ne poklanja dovoljna pažnja, kao i da, na ovu temu, ne postoji dovoljan broj obuka u okviru stručnog usavršavanja zaposlenih. Možemo zaključiti da je neophodno uvesti nastavne predmete na fakultetima koji metodički obrazuju učitelje za realizaciju nastavnog predmeta Digitalni svet, sa posebnim akcentom na razvoju algoritamskog načina razmišljanja. Također je potrebno uvesti veći broj dodatnih kvalitetnih seminara permanentnog stručnog usavršavanja.

### Ključne riječi

inicijalno obrazovanje učitelja; predmet Digitalni svet; stručno usavršavanje učitelja

# Games for developing algorithmic thinking in Digital World textbooks for the first grade of primary education



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**Education for digital transformation**

**Number of the paper: 122**

## **Abstract**

Playing games with the aim of developing algorithmic thinking can create various teaching situations for active learning. Games enable learning through experience and discovery, they can be adapted to the pupils' needs, their prior knowledge, and interests. Digital games and devices can provide instant feedback and can contribute to the development of innovative teaching and learning methods. The introduction of the subject "Digital World" into the primary school education system of Serbia, as part of the new Prescribed Curriculum for the first grade, occurred three years ago. One of the key teaching domains of the subject is algorithmic thinking. New textbooks, in accordance with the Prescribed Curriculum, have been prepared and published by numerous authors and publishers. The aim of this paper is to detect the presence and analyze the quality of games for developing pupils' algorithmic thinking in seven accredited textbooks for the subject Digital World in the first grade of primary school. The paper first analyses the Prescribed Curriculum, specifically the outcomes, contents, and instructions for developing algorithmic thinking. The methodological analysis included the textbook program framework, concept, and functionality for developing algorithmic thinking through educational games with a special reference to the quality of digital games and digital devices such as educational robots. Through a systematic analysis, we conclude that the current Prescribed Curriculum does not contain detailed instructions for developing algorithmic thinking through educational games, and different textbook concepts for this teaching domain significantly differ.

## **Key words**

*developing algorithmic thinking, educational games, Prescribed Curriculum, pupil, textbooks*

# The correlation between teachers' perceptions of digital textbooks and their use in teaching Croatian language in primary education



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**Education for digital transformation**

**Number of the paper: 123**

## **Abstract**

Digital methodological templates facilitate student engagement in the process of learning and enhance the development of linguistic competence (Budinski & Kolar Billege, 2015). Digital textbooks also enable a methodological approach in the process of mastering reading, and digital methodical instruments facilitate the understanding of the main term (Gazdić-Alerić, Alerić, Budinski & Kolar Billege, 2016). Croatian language teaching can benefit from incorporating new ICT tools in structured methodological acts, especially the methodological procedures that are assumed, within an optimal timeframe and with the use of suitable content, to facilitate student learning and competence acquisition more efficiently in comparison to usual media (Kolar Billege, 2020). The goal of this research was to determine if the teachers' perceptions of the effectiveness of digital textbooks have an impact on their employment in teaching the Croatian language in primary education. This research involved 301 primary school teachers from all counties of the Republic of Croatia. This original survey questionnaire was created using the Microsoft Forms tool and distributed to the teachers through social networks. The research goal was achieved, and the analysis confirmed that the employment frequency of Croatian language digital textbooks in primary education increases as their effectiveness is perceived. Alongside the effectiveness of Croatian language digital textbooks, future research should examine the advantages and disadvantages of their usage in the teaching process as well as the methodological arrangement of the content that reaches students through digital textbooks.

## **Key words**

*Croatian language, primary education, teaching methodology*

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**Odgoj i obrazovanje za digitalnu transformaciju**

**Broj rada: 123**

## Sažetak

Digitalni metodički predlošci omogućuju aktivno sudjelovanje učenika u procesu učenja te omogućuju razvoj jezične kompetencije (Budinski i Kolar Billege, 2015). U procesu ovladavanja čitanjem metodički je pristup omogućen i s pomoću digitalnih udžbenika, a digitalni metodički instrumentarij omogućuje spoznavanje ključnoga pojma (Gazdić-Alerić, Alerić, Budinski i Kolar Billege, 2016). Za poučavanje hrvatskoga jezika u strukturiranom metodičkom činu moguće je primijeniti nova sredstva IKT-a, osobito u metodičkim postupcima za koje se pretpostavlja da će u optimalnom vremenu i s implementacijom optimalnoga sadržaja omogućiti učenicima učenje ili stjecanje kompetencija bolje nego uobičajeni mediji (Kolar Billege, 2020). Cilj je istraživanja bio utvrditi utječe li percepcija učitelja o korisnosti digitalnih udžbenika na njihovu upotrebu u nastavnom predmetu Hrvatski jezik u primarnom obrazovanju. U istraživanju je sudjelovao 301 učitelj razredne nastave iz svih županija Republike Hrvatske. Originalni anketni upitnik oblikovan je u alatu Microsoft forms te je upućen učiteljima pomoću društvenih mreža. Cilj je istraživanja ostvaren te je analizom potvrđeno da učestalost korištenja digitalnih udžbenika Hrvatskoga jezika u primarnom obrazovanju raste s percepcijom njihove korisnosti. Osim korisnosti digitalnih udžbenika hrvatskoga jezika, buduća bi istraživanja trebala obuhvatiti prednosti i nedostatke njihove upotrebe u nastavnome procesu, ali i metodičko strukturiranje sadržaja koji dolazi do učenika s pomoću digitalnih udžbenika.

## Ključne riječi

*hrvatski jezik, metodika, razredna nastava*

# Teachers' views on the use of digital technologies to enhance the teaching and learning process/ Mišljenje nastavnika o upotrebi digitalnih tehnologija u cilju postignuća nastavnog procesa



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**Number of the paper: 124**

## **Abstract**

Digital technologies in education encompass the utilization of various digital tools, software, and online resources to support learning and teaching. The pivotal role of digital technologies lies in transforming the traditional teaching model to enable more dynamic, adaptable, and comprehensive learning. The research aims to gain a deeper understanding of the role of digital technologies in the teaching process by examining the attitudes and opinions of teachers in natural and social sciences regarding the use of digital technology in teaching. Additionally, the research assesses teachers' self-perceived digital literacy and competencies. A descriptive research method was employed, and data were collected through a survey of 105 subject teachers from primary schools in the Novi Pazar region. The survey included questions about the frequency of digital technology use, types of media used in the teaching process, learning outcomes through digital technology application, teachers' competencies in information literacy, and the level of interaction in classes where digital technologies are present. The results indicate widespread use of digital technologies in the teaching process, with a significant number of teachers opting for its implementation to enrich the teaching process and enhance students' knowledge. Teachers of natural sciences perceive their level of digital literacy to be higher compared to teachers of social sciences. Further research is needed to identify specific subject areas where the application of digital technologies can most effectively contribute to the improvement of the teaching process.

## **Key words**

*digital competencies, digital technologies, teachers' attitudes, traditional model*

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**Odgoj i obrazovanje za digitalnu transformaciju**

**Broj rada: 124**

## Sažetak

Digitalne tehnologije u obrazovanju obuhvataju upotrebu različitih digitalnih alata, softvera i online resursa za podršku učenju i nastavi. Ključna uloga digitalnih tehnologija je transformacija tradicionalnog modela nastave kako bi se omogućilo dinamičnije, prilagodljivije i sveobuhvatnije učenje. Cilj istraživanja je dublje razumevanje uloge digitalnih tehnologija u nastavnom procesu kroz ispitivanje stavova i mišljenja nastavnika prirodnih i društvenih nauka o upotrebi digitalne tehnologije u nastavnom procesu i samoproceni informatičke pismenosti i digitalnih kompetencija istih. U istraživanju je primenjena deskriptivna metoda, a podaci su prikupljeni anketiranjem 105 predmetnih nastavnika osnovnih škola sa područja Novog Pazara. Za potrebe istraživanja konstruisana je anketa, koja je obuhvatila pitanja o učestalosti korišćenja digitalnih tehnologija i o vrstama medija koje koriste u nastavnom procesu, kao i pitanja o ishodima učenja primenom digitalnih tehnologija, kompetencijama nastavnika u vezi sa informatičkom pismenošću i nivou interakcije u nastavi kada su prisutne digitalne tehnologije. Dobijeni rezultati ukazuju na rasprostranjenu upotrebu digitalnih tehnologija u nastavnom procesu, pri čemu se značajan broj nastavnika odlučuje za njenu implementaciju radi obogaćivanja nastavnog procesa i unapređivanja znanja učenika, nastavnici koji predaju predmete prirodnih nauka procenjuju svoj nivo informatičke pismenosti na većem stepenu u odnosu na nastavnike društvenih nauka. Potrebno je kroz dodatna istraživanja identifikovati oblasti u okviru nastavnih predmeta u kojima primena digitalnih tehnologija može najviše da doprinese unapređenju nastavnog procesa.

## Ključne riječi

*digitalne kompetencije; digitalne tehnologije; stavovi nastavnika; tradicionalni model*

# Research on students' AI literacy / Istraživanje AI pismenosti studenata



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**Education for digital transformation**

**Number of the paper: 125**

## **Abstract**

The paper will present the findings of a research conducted in 2024 which aimed at investigating students' knowledge, attitudes, and behaviors regarding artificial intelligence (AI), thereby assessing their level of AI literacy. AI literacy is recognized as an essential component of contemporary education, involving the ability to interact with AI responsibly and effectively, along with understanding its ethical and social implications. The study sample consists of undergraduate and graduate students from the University of Zagreb, with data collected through a survey questionnaire. The primary focus of the research was to evaluate the depth of students' understanding of AI and its societal impact. It investigated their utilization of AI tools in learning and problem-solving, along with their attitudes and ethical awareness regarding AI. The results show that students are increasingly using AI tools in their learning process, but the level of awareness of ethical use is still relatively low. This indicates the need for the development of educational programs focusing on the ethical use of AI technology.

## **Key words**

*AI literacy, competence, ethics, students*

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### Sažetak

U radu će se prikazati rezultati istraživanja provedenog 2024. godine, čiji je cilj bio ispitati znanja, stavove i navike studenata u korištenju umjetne inteligencije, odnosno ispitati stupanj njihove AI pismenosti. AI pismenost se u suvremenom odgoju i obrazovanju prepoznaje kao dodatak klasičnom obliku pismenosti, a odnosi se na sposobnost odgovornog i učinkovitog korištenja, odnosno interakcije s umjetnom inteligencijom te na razumijevanje etičkih i društvenih implikacija korištenja alata umjetne inteligencije. Uzorak čine studenti prijediplomskih i diplomskih studija Sveučilišta u Zagrebu, a kao metoda prikupljanja podataka korišten je anketni upitnik. Centralni fokus istraživanja bio je ispitati u kojoj mjeri studenti razumiju koncept umjetne inteligencije i njezin utjecaj na društvo u kojem žive, potom načine korištenja AI alata u učenju i rješavanju zadataka, njihov stav te razinu etičke svijesti o umjetnoj inteligenciji. Rezultati pokazuju da studenti sve više koriste alate umjetne inteligencije u procesu njihova učenja, no da je razina svijesti o etičnom korištenju tih alata još uvijek relativno niska. To ukazuje na potrebu razvijanja obrazovnih programa o etičnoj uporabi AI tehnologije.

### Ključne riječi

etika; kompetencija; pismenost; studenti; umjetna inteligencija

# Teacher's perspective for didactic-methodological potentials of metaverse



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**Education for digital transformation**

**Number of the paper: 126**

## **Abstract**

Education in the 5.0 era requires precise didactic-methodical reflection on how digital technology can be employed to create innovative and stimulating teaching environments. Additionally, educational technology strengthened by artificial intelligence algorithms opens space for radical changes in the previous learning experience.

One of the key challenges facing the educational system determines the main research question of this paper, which relates to how to improve the existing teaching models with the latest technological solutions in educational technology.

This research focuses on the integration of IT-driven teaching and mixed reality technology, known as the metaverse.

This paper aims to assess the in-services teachers' awareness (in the wider territory of the city of Belgrade) of the metaverse concept and to examine the views on the possible didactic-methodological potential of integrating metaverse in education.

The data collected by the instrument in the form of an online survey was analyzed using descriptive research methods. A conceptual proposal for integrating the metaverse into a teaching scenario was included in the survey.

The potentials of the metaverse particularly stand out in the domain of teaching and evaluation, as well as in strengthening the holistic perspective of experiential learning.

In addition, the results indicate that improving digital competencies and establishing ethical principles for using the metaverse for educational purposes is necessary.

Implications for future research may include an experimental assessment of the potential of integrating the metaverse at all levels of the educational process, especially concerning the impact on various aspects of child development.

## **Key words**

*digital competences, educational potentials, metaverse, student, teaching*

# Internet safety among adolescents / Sigurnost adolescenata na internetu



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**Education for digital transformation**

**Number of the paper: 127**

## **Abstract**

The use of the internet has significantly increased worldwide over the past two decades, but at the same time, concerns have arisen about problematic usage, which is associated with serious mental health issues. The problem is defined as an activity that causes difficulties in a person's life and encompasses a wide range of activities such as gaming, social media, and online shopping. However, there is a lack of a clear definition, and certain behaviors may resemble other disorders such as obsessive-compulsive disorder or social anxiety. Children are increasingly using the internet, which requires better understanding of the risks to promote critical analysis. Parents often underestimate these risks, which can lead to problems such as divulging personal information or cyberbullying. Better support is needed to enable children to safely use the internet, considering the benefits it provides such as increased social support and academic enrichment. Cyberbullying, which can be verbal or sexual, affects the health of young people and is associated with various issues, including suicidal thoughts. Internet safety is becoming increasingly important, and access to the internet is happening at younger ages, necessitating tailored safety campaigns. Furthermore, internet safety is not only considered a technical issue but also involves the human factor. In Croatia, research on internet safety among children is limited, but there are initiatives such as the National Center for Safer Internet. The aim of the research is to explore differences between actual risky online behavior of adolescents and their self-assessment and to raise awareness about information security and the potential risks. The study will include 250 high school students (gymnasiums and vocational schools) within the Sisak-Moslavina County, which will be divided into 5 clusters. Empirical data will be collected using the BKUIS questionnaire containing 17 questions divided into 4 subscales, two of which are behavioral and two cognitive. It is expected that male students will be more cautious on the online simulation scale of student behavior, and that there will be a statistically significant difference in the simulation test between students regarding the type of schooling. Regarding the self-assessment of risky online behavior, it is expected that male students will have a self-assessment of risky online behavior that corresponds to the self-assessment of risky behavior, and that four-year high school students (gymnasiums) will have a higher self-assessment of risky behavior compared to vocational school students who will deviate from the simulation scale. A statistically significant gender difference is also expected in students' awareness of information security in favor of males, and that students in four-year high schools will have more awareness of internet safety than vocational school students.

## **Key words**

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**Odgov i obrazovanje za digitalnu transformaciju**

**Broj rada: 127**

### **Sažetak**

Korištenje interneta u posljednjih dvadesetak godina znatno je poraslo diljem svijeta, no istovremeno se pojavila zabrinutost zbog problematičnoga korištenja, što je povezano s ozbiljnim psihičkim problemima. Problem se definira kao aktivnost koja uzrokuje poteškoće u životu osobe, a obuhvaća širok raspon aktivnosti poput videoigara, društvenih mreža i online kupovine. Međutim, nedostaje jasna definicija, a pojedina ponašanja mogu biti slična drugim poremećajima poput opsesivno-kompulzivnoga poremećaja ili socijalne anksioznosti. Djeca se sve više koriste internetom što zahtijeva bolje razumijevanje rizika radi promicanja kritičke analize. Roditelji često podcjenjuju te rizike što može dovesti do problema kao što su odavanje osobnih informacija ili cyberbullyinga. Potrebna je bolja podrška kako bi se djeci omogućilo sigurno korištenje interneta, uzimajući u obzir i prednosti koje on pruža poput povećane društvene podrške i akademskoga obogaćivanja. Cyberbullying, koji može biti verbalni ili seksualni, utječe na zdravlje mladih i povezan je s raznim problemima, uključujući suicidalne misli. Sigurnost na internetu postaje sve važnija, a internetu pristupaju sve je mlađe dobne skupine, što zahtijeva prilagođene sigurnosne kampanje. Nadalje, sigurnost na internetu ne smatra se samo tehničkim problemom, već uključuje i ljudski faktor. Istraživanja u Republici Hrvatskoj o sigurnosti djece na internetu su ograničena, ali postoje inicijative poput Nacionalnog centra za sigurniji Internet. Cilj je istraživanja istražiti razlike između stvarnoga rizičnoga ponašanja adolescenata na internetu i njihovih samoprocjena te razviti svijest o informacijskoj sigurnosti i potencijalnim rizicima. Istraživanje će obuhvatiti 250 učenika srednjih škola (gimnazije i strukovne škole) unutar Sisačko-moslavačke županije koja će biti podijeljena u 5 klastera. Empirijski podatci bit će prikupljeni anketnim upitnikom BKUIS koji sadrži 17 pitanja podijeljenih na 4 podskele od čega su dvije biheviornalne, a 2 kognitivne. Očekuje se da će učenici muškoga spola biti oprezniji na online simulacijskoj skali učeničkoga ponašanja te da će postojati statistički značajna razlika na simulacijskom testu između učenika s obzirom na vrstu škole. U samoprocjeni rizičnoga online ponašanja očekuje se da će učenici muškoga spola imati samoprocjenu rizičnoga online ponašanja koja će odgovarati samoprocjeni rizičnoga ponašanja, a da će učenici četverogodišnjih srednjih škola (gimnazije) imati veću samoprocjenu rizičnoga ponašanja u odnosu na učenike strukovnih škola koja će odstupati s obzirom na simulacijsku skalu. Očekuje se i statistički značajna rodna razlika u svijesti učenika o informacijskoj sigurnosti u korist muškoga roda te da će učenici četverogodišnjih srednjih škola imati više spoznaja o sigurnosti na internetu od strukovnih škola.

### **Ključne riječi**

*digitalni identitet, digitalna pismenost, informacijska sigurnost, problematično korištenje interneta, samoprocjena, srednje škole*

# Digital literacy of primary school first grade students



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**Education for digital transformation**

**Number of the paper: 128**

## **Abstract**

The research presented in this paper aims to explore the digital literacy of students in the first grade of primary school. The research sample consists of 104 students from northwestern Croatia. They were invited to fill out the self-assessment questionnaire consisting of eleven items including statements about their gender, place of residence (rural or urban), and simple yes/no statements concerning their knowledge of using the computer hardware and software. The research results show that there is a statistically significant difference in respondents' asking for parents' or guardians' permission to use a computer by gender ( $\chi^2=4.27$ ,  $df=1$ ,  $p=0.039$ ). There are more female respondents (81.3%) than male respondents (60.7%) who ask their parents or guardians for permission to use the computer. Most of the respondents (88.5%) know how to turn on/off computers, 87.5% of respondents know how to write a text using a computer, and 94.2% of respondents know how to make a drawing using a computer. 94.2% of respondents know how to use the Internet and there is a statistically significant difference by the place of residence ( $\chi^2=4.63$ ,  $df=1$ ,  $p=0.031$ ). There are more urban respondents (100.0%) than rural respondents (88.2%) who know how to search the internet. Most of the respondents (91.3%) understand and apply the rules of conduct on the internet. Most respondents (87.5%) self-assess themselves as having acquired the learning outcomes specified in the information-communication technology curriculum.

## **Key words**

*digital competence, information-communication technology; curriculum, primary education*

# Digital Education: Education today for tomorrow



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**Education for digital transformation**

**Number of the paper: 129**

## **Abstract**

Following modern trends and listening to the needs of education, economy and society, a new study program for undergraduate and master's studies at the Faculty of Education in Sombor of the University of Novi Sad titled Digital Education was accredited. The goal of this study program is to train an educational profile that will be professional help and support for teachers in the application of information-communication technologies (ICT) while teaching. Having in mind that this profile possesses the necessary knowledge in the field of digital technologies on the one hand and all the necessary pedagogical, psychological, and teaching methodology knowledge on the other hand, the Digital Education study program meets the challenges of modern education.

The goal of the research presented in this paper is to examine and determine the degree of digital competence of teachers and the level of capability for independent use of ICT, as well as to determine their attitudes toward the introduction of a professional associate into educational practice, who would be a help and support to teachers in applying ICT. In the research carried out in primary and secondary schools in the territory of Vojvodina, which is an autonomous region within the Republic of Serbia, a survey method and an anonymous survey questionnaire were used. The questionnaire was filled out by 240 teacher participants. During the research, a modified Likert scale with multiple choice questions was used.

The results of the research show that most teachers have a satisfactory level of digital competence which they have acquired through some form of informal education and that more than 90% of the participants use modern technologies for the purpose of preparing lessons and teaching. However, the majority of participants believe that the introduction of an expert associate in the application of ICT would be extremely helpful for teaching. Furthermore, the majority of participants believe that the introduction of an expert associate in the application of ICT would be extremely helpful for higher quality teaching, which implies the use of digital technologies in full capacity. Also, the results of the research indicate that the participants are not familiar with the accreditation of the Digital Education study program, as well as that they support the accreditation and consider it useful. Based on the research results, it can be concluded that in educational practice there is a real need for accreditation of the Digital Education study program, as well as for increased efforts to promote it.

## **Key words**

*digital technologies, information-communication technologies, learning, study program, teaching*

# Learning literature and digital skills among high school students



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**Education for digital transformation**

**Number of the paper: 130**

## **Abstract**

This study aims to engage high school students more deeply with literature by introducing new approaches that are essential in today's era of technological advancements. The specific focus of this research is on high school students, encouraging them to explore artistic works using technology. The research questions delve into how different models can be alternated to enhance the understanding and analysis of literary works. Additionally, they explore how young people can actively participate in creating new reading models that also incorporate digital skills which are vital in modern education. The hypothesis for this study revolves around the idea that offering young people new work models supported by technology about literary works, or providing opportunities for concrete engagement where they actively contribute to their realization, can improve the quality of their reading and learning competencies. To conduct this research, a comparative analytical approach was employed to examine the structure of literature classes in high schools. Additionally, a quantitative method based on data from specific questionnaires tailored to this age group was employed to understand their preferences and interests regarding new proposals. By combining explanatory, situational analysis, and comparison with well-executed survey data, we arrived at valuable insights into the relationship between literature and students' digital literacy. The conclusion underscores the willingness of both teachers and students to embrace new approaches and models, demonstrating their acceptance and appreciation of literature, as well as qualitative learning experiences.

## **Key words**

*digital environment, high school, learning, literature, skills, youth*

# New teaching approaches in healthcare subjects using simulation / Novi pristupi poučavanja u nastavnim predmetima zdravstvene njege upotrebom simulacije



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**Number of the paper: 131**

## **Abstract**

After the definition of simulations, simulators, and a brief historical review of the very beginnings of simulation, the paper provides an overview of learning theories, social learning theories, cognitive learning theories and constructivist learning theories, which explain the advantages of learning through simulation and ways to achieve learning outcomes.

The curriculum for the general care nurse/general care medical technician qualification is focused on practice in which emphasis is placed on theoretical knowledge and psychomotor skills. Students are required to acquire many skills through vocational subjects of 4600 teaching hours, of which even 2/3 are related to practice, either learning skills in classroom or in hospitals.

Numerous scientific and professional papers provide reasons in favor of the use of simulations in nursing education, such as the development of critical thinking, the acquisition of specific skills, teamwork, achieving a higher level of results with this method of learning, problem solving, decision making and other important skills. Recently, avatars have also been used in place of real patients with which communication skills are acquired and students can learn to react without affect. Additionally, nurse avatars can be used in some areas of healthcare in actual patient care.

## **Key words**

*nurses, patient, students, teachers, teaching*

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**Broj rada: 131**

### **Sažetak**

Nakon definicije simulacija, simulatora i kratkog povijesnog pregleda samih početaka simulacije, rad donosi pregled teorija učenja, socijalne teorije učenja, kognitivne teorije učenja i konstruktivističke teorije učenja, koje objašnjavaju prednosti učenja simulacijom i načinima ostvarivanja ishoda učenja.

Kurikulum za stjecanje kvalifikacije medicinska sestra opće njege/medicinski tehničar opće njege usmjeren je na praksu u kojem se naglasak stavlja na teorijska znanja i psihomotoričke vještine. Od učenika se zahtjeva usvajanje velikog broja vještina kroz strukovne nastavne predmete od 4600 nastavnih sati od kojih je čak 2/3 odnose na vježbe, bilo u kabinetu ili u bolnicama.

Brojni znanstveni i stručni radovi donose razloge koji govore u prilog korištenju simulacija u obrazovanju medicinskih sestara kao što su razvoj kritičkog mišljenja, usvajanje specifičnih vještina, timski rad, postizanje više razine ishoda ovim načinom učenja, rješavanje problema, donošenje odluka i druge važne vještine. U posljednje vrijeme koriste se i avatari, umjesto stvarnih pacijenata, pomoću kojih se stječu komunikacijske vještine i uči reagirati bez afekta. Dodatno, avatari medicinskih sestara mogu se koristiti u nekim dijelovima zdravstvene njege u stvarnoj skrbi za pacijenta.

### **Ključne riječi**

*medicinske sestre, nastavnici, pacijent, poučavanje, učenici*

# Science teachers' attitudes regarding e-learning / Stavovi nastavnika iz područja prirodnih znanosti o e- učenju



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## **Abstract**

The aim of this paper was to investigate and analyze the attitudes of biology, chemistry, mathematics, and physics teachers towards e-learning considering gender, age, and the type of school they work at.

Teachers from different parts of the Republic of Croatia participated in the study (N=208). For this research, the original Test of e-Learning Related Attitudes (TeLRA) scale was used, which examines teachers' attitudes towards the challenges of e-learning, the benefits of e-learning, the use of computer systems and preferences regarding e-learning innovations and the use of computers in leisure time. The questionnaire included general information about the teachers (gender, age, subject and school where they work).

The research results showed that teachers predominantly have a positive attitude towards e-learning. Compared to female teachers, male teachers have a slightly stronger preference for the use of computers in lesson preparation and prefer to be informed about technological innovations. Older teachers are less confident in using computers. Chemistry and biology teachers consider e-learning to be more challenging, have a more negative attitude towards the use of computer systems and less interest in e-learning innovations and the use of computers than math and physics teachers, but agree that e-learning has advantages over other teaching methods.

The results of this study contribute to a better understanding of teachers' acceptance and use of e-learning. It is important that teachers are willing to adapt to new realities and look for opportunities to improve their skills in e-learning, as this is key to creating a higher quality and more modern educational process.

## **Key words**

*benefits of e-learning, challenges of e-learning, e-learning, teachers, teaching*

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**Odgoj i obrazovanje za digitalnu transformaciju**

**Broj rada: 132**

## Sažetak

Cilj ovoga rada bio je ispitati i analizirati stavove nastavnika biologije, kemije, matematike i fizike o e-učenju s obzirom na spol, dob i vrstu škole u kojoj rade.

U istraživanju su sudjelovali nastavnici iz različitih krajeva Republike Hrvatske (N = 208). Za potrebe ovoga istraživanja korištena je originalna Skala stavova o e-učenju kojom se ispituju stavovi nastavnika o izazovima e-učenja, prednostima e-učenja, korištenju računalnih sustava i preferencijama u pogledu inovacija e-učenja i korištenja računala u slobodno vrijeme. Upitnik je upotpunjen općim podacima o nastavnicima (spol, dob, nastavni predmet i škola u kojoj rade). Rezultatima istraživanja utvrđeno je da nastavnici imaju uglavnom pozitivne stavove o e-učenju. Nastavnici u odnosu na nastavnice daju nešto veću prednost korištenju računala za pripremu lekcija i radije se informiraju o tehnološkim inovacijama. Stariji nastavnici su nesigurniji u korištenju računala. Nastavnici kemije i biologije e-učenje smatraju izazovnijim, imaju negativniji stav o korištenju računalnih sustava te manji interes za inovacije e-učenja i korištenja računala u odnosu na nastavnike matematike i fizike, ali se svi slažu da e-učenje ima prednosti u odnosu na druge metode poučavanja.

Rezultati ovoga istraživanja doprinose boljem razumijevanju prihvaćanja i korištenja e-učenja od strane nastavnika. Važno je da nastavnici budu spremni prilagoditi se novim okolnostima i tražiti mogućnosti za poboljšanje svojih vještina u e-učenju, koje su ključne za stvaranje kvalitetnijega i suvremenijega odgojno-obrazovnog procesa.

## Ključne riječi

*e-učenje, izazovi e-učenja, nastava, nastavnici, prednosti e-učenja*

# Teachers' and students' attitudes to using gamification in teaching / Stavovi učitelja i studenata prema korištenju igrifikacije u nastavi



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**Number of the paper: 133**

## **Abstract**

Gamification refers to the use of game elements in a non-gaming context, such as the teaching process. It refers to the addition of activities and/or content that are typically present in games to learning content or activities and to other processes during classes with the aim of encouraging students' motivation, their activity or competitiveness. The paper will present the results of the research, which aims to examine the familiarity of primary education teachers and students of teacher education with the concept of gamification and their attitudes towards its use in teaching. Differences in the intention to use gamification in the future between respondents and the connection between personality traits and attitudes of respondents towards the implementation of gamification in teaching will be examined. The research was conducted with an online questionnaire on a convenient sample of N=200 teachers and students from the Faculty of Teacher Education in Zagreb who are employed or studying in Zagreb. It is expected that the results will show that there is no statistically significant difference between respondents in their attitudes towards gamification in class and that a positive attitude is a statistical predictor of future use of gamification in class. It is expected that the results will show that the intention to use gamification in the future is statistically significantly related to openness to new experiences and self-efficacy.

## **Key words**

*gamification, positive attitude, primary education teacher, students, teaching*

**Katarina Širanović**

*OŠ Tituša Brezovačkog*

**Odgoj i obrazovanje za digitalnu transformaciju**

**Broj rada: 133**

### **Sažetak**

Igrifikacija se odnosi na korištenje elemenata igre u neigrajućem kontekstu, kao što je nastavni proces. Odnosi se na dodavanje aktivnosti i/ili sadržaja koji su tipično prisutni u igrama u sadržaje ili aktivnosti učenja te u druge procese tijekom nastave s ciljem poticanja motivacije učenika, njihove aktivnosti ili kompetitivnosti.

U radu bit će predstavljeni rezultati istraživanja kojim se želi ispitati upoznatost učitelja primarnoga obrazovanja i studenata Učiteljskog studija s konceptom igrifikacije te njihovi stavovi prema korištenju iste u nastavi. Ispitat će se razlike u budućoj namjeri korištenja igrifikacije između ispitanika te povezanost između crta ličnosti i stavova ispitanika prema implementaciji igrifikacije u nastavu. Istraživanje je provedeno online upitnikom na prigodnom uzorku od  $N = 200$  učitelja i studenata Učiteljskog studija koji su zaposleni ili studiraju u Zagrebu. Očekuje se kako će rezultati pokazati da nema statistički značajne razlike između ispitanika u stavovima prema igrifikaciji u nastavi te da je pozitivan stav statistički prediktor budućega korištenja iste u nastavi. Očekuje se kako će rezultati pokazati da je namjera budućega korištenja igrifikacije u nastavi statistički značajno povezana s otvorenosti prema novim iskustvima i samoučinkovitosti.

### **Ključne riječi**

*igrifikacija, nastava, pozitivan stav, studenti, učitelji primarnoga obrazovanja*

# Threshold concepts in Computer Science teaching / Koncepti praga u nastavi informatike



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**Education for digital  
transformation**

**Number of the paper: 134**

## **Abstract**

Fundamental concepts underlie every scientific field. Among them, there are concepts that represent a turning point in the understanding of the field and whose understanding is a significant challenge for students. Such concepts are called threshold concepts. The aim of this paper is to provide an overview of the characteristics of threshold concepts that distinguish them from fundamental concepts, to identify threshold concepts in the field of computer science, and to emphasize the need for selecting appropriate teaching strategies and approaches for teaching threshold concepts using digital technology.

In addition to the list of threshold concepts in computer science derived from the literature review, a list of threshold concepts derived from research with computer science teachers is presented. The nominal group technique, which provides a structured approach to idea exchange within the group, was used to identify threshold concepts. Participants first identified the threshold concepts individually by writing explanations and then presented them to the group. The group discussed and voted to reach a consensus. In identifying threshold concepts, the focus was on recognizing transformative and integrative features to identify concepts whose understanding triggers a significant shift in the understanding of the subject area and makes connections that were previously hidden.

Identifying threshold concepts can help guide learning and teaching. With a better understanding of the difficulties students face, teachers can provide personalized support to help students master these concepts using technology. Further research will focus on analyzing the possibilities of applying approaches based on educational recommender systems for teaching threshold concepts.

## **Key words**

*computer science, personalization, STEM, teaching, threshold concept*

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**Odgoj i obrazovanje za digitalnu transformaciju**

**Broj rada: 134**

## Sažetak

U svakom znanstvenom području postoje temeljni koncepti. Među njima se mogu izdvojiti koncepti koji predstavljaju prekretnicu u razumijevanju područja, a čije razumijevanje učenicima predstavlja veliki izazov. Takvi se koncepti nazivaju koncepti praga. Cilj ovoga rada je dati pregled karakteristika koncepata praga koje ih razlikuju od temeljnih koncepata, identificirati koncepte praga u području informatike te istaknuti potrebu odabira odgovarajućih nastavnih strategija i pristupa poučavanju koncepata praga uz pomoć digitalne tehnologije.

Uz popis koncepata praga u području informatike načinjen pregledom literature, u radu se prezentira i popis koncepata praga dobiven kao rezultat istraživanja među učiteljima i nastavnicima informatike. Za identificiranje koncepata praga korištenja je tehnika nominalne grupe koja je omogućila strukturirani pristup razmjeni ideja u grupi. Ispitanici su najprije individualno identificirali koncepte praga uz pisanje obrazloženja, zatim ih prezentirali grupi, a nakon toga je organizirana grupna diskusija te glasovanje kako bi se donijela zajednička odluka. Prilikom identificiranja koncepata praga naglasak je bio na uočavanju svojstava transformativnosti i integrativnosti kako bi se detektiralo koncepte čije razumijevanje pokreće značajnu promjenu u razumijevanju područja kao i uspostavu veza koje su prethodno bile skrivene.

Identificiranje koncepata praga može pomoći u usmjeravanju učenja i podučavanja. Uz bolje razumijevanje poteškoća s kojima se učenici suočavaju, učitelji i nastavnici mogu uz pomoć tehnologije pružiti personaliziranu podršku učenicima u savladavanju ovih koncepata. Daljnja istraživanja bit će usmjerena na analizu mogućnosti primjene pristupa temeljenih na obrazovnim sustavima preporučivanja u poučavanju koncepata praga.

## Ključne riječi

*informatika; koncept praga; personalizacija; poučavanje; STEM*

# Students' attitudes towards artificial intelligence / Stavovi učenika prema umjetnoj inteligenciji



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**Education for digital  
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**Number of the paper: 135**

## **Abstract**

The aim of the research is to investigate the predictors that contribute to the prevalence of Chat GPT use and the attitudes of 8th grade students towards artificial intelligence in the city of Zagreb. Artificial intelligence and various tools such as Chat GPT are becoming more and more present in students' lives, while their use in schools is still not defined, and teachers decide on the implementation or ban of artificial intelligence tools. The population of respondents is defined as the population of 8th-grade students in the City of Zagreb (N=7670), and the total number in the study will be 250. The size of the subsample (boys and girls) will be approximately the same in order to ensure a normal distribution and to meet the parametric requirements. For the purposes of the research, four research hypotheses were set. Boys are expected to differ from girls regarding cognitive, affective, and behavioral components of attitude towards artificial intelligence. In order to collect data, four schools in the City of Zagreb will be included, one each from the east, west, south and the city center. The use of a random stratified sample at the level of Croatia and with a larger number of participants would enable the generalization of the conclusions at the level of the population.

## **Key words**

*artificial intelligence, attitudes, Chat GPT, students*

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**Sažetak**

Cilj je istraživanja istražiti prediktore koji doprinose prevalenciji korištenja *Chat GPT*-a i stavove učenika 8. razreda prema umjetnoj inteligenciji u gradu Zagrebu. Umjetna inteligencija i razni alati poput *Chat GPT*-a postaju sve prisutniji u životima učenika, a upotreba istih u školama još uvijek nije definirana te profesori odlučuju o implementaciji ili zabrani alata umjetne inteligencije. Populacija ispitanika definirana je kao populacija učenika 8. razreda Grada Zagreba ( $N = 7670$ ), a ukupan broj u istraživanju će biti 250. Veličina poduzorka (dječaka i djevojčica) bit će približno ista kako bi se osigurala normalna distribucija te zadovoljili preduvjeti za parametriju. Za potrebe istraživanja postavljene su četiri istraživačke hipoteze. Očekuje se da se dječaci razlikuju od djevojčica s obzirom na kognitivnu, afektivnu i ponašajnu komponentu stava prema umjetnoj inteligenciji. U cilju prikupljanja podataka bit će obuhvaćene četiri škole u Gradu Zagrebu, po jedna s istoka, zapada, juga te iz centra grada. Korištenje slučajnoga stratificiranog uzorka na razini Hrvatske i s većim brojem sudionika omogućilo bi generaliziranje zaključaka na razini populacije.

**Ključne riječi**

Chat GPT, stavovi, učenici, umjetna inteligencija

# Pedagogical Values of Contemporary Digital Technologies at Faculties of Fine Arts



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**Education for digital transformation**

**Number of the paper: 136**

## **Abstract**

Contemporary digital technologies bring about a revolution in the way we communicate, and they continuously shape the way we interact in all spheres of life. The primary objective of this research is to examine the significance and potential of integrating information and communication technologies (ICT) and artificial intelligence (AI) into arts faculties. By analyzing relevant literature, we aim to identify the key opportunities and challenges associated with leveraging these technologies to foster creativity and develop contemporary artistic practices in the digital age. Additionally, this research seeks to explore how ICT and AI can be effectively utilized to prepare arts faculty students for teaching "digital natives." Literature was selected through searches of scientific databases such as Science Direct and Google Scholar using relevant keywords. Criteria for article selection included the year of publication, author citation, and peer-reviewed articles. The literature analysis indicates the need for the educational process at arts faculties to be better adapted to the development and application of new technologies in artistic expression, as well as the need for continuous alignment of teaching content with changes in technology. The paper critically analyzes various approaches to the application of ICT and AI in arts faculties, as well as how students' digital competencies may depend on teachers' digital competencies. In addition to the possibilities, this paper will also point out ethical challenges of using AI, emphasizing the need for further development of policies that promote responsible use of these technologies.

## **Key words**

*artificial intelligence, digital competencies, fine arts, information and communication technology*

# ICT in primary education – students’ perspective



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**Education for digital transformation**

**Number of the paper: 137**

## **Abstract**

Information and Communication Technology (ICT) integration in primary education has revolutionized teaching. Through computers, tablets, and interactive whiteboards, educators create dynamic and immersive learning environments. Students engage with interactive educational software, digital textbooks, and online resources, enhancing comprehension and retention. ICT fosters collaborative learning opportunities, as students collaborate on projects and communicate with peers globally. It cultivates critical thinking, problem-solving, and digital literacy skills essential for success in the 21st century. However, challenges like the digital divide and concerns regarding screen time and digital distractions warrant careful consideration. Despite challenges, ICT empowers educators to deliver innovative and engaging lessons, preparing students to thrive in an increasingly digital society. Effective implementation requires ongoing professional development, robust infrastructure and pedagogical strategies that leverage technology effectively.

This paper presents the results of research whose goal was to determine the attitudes of elementary school students about ICT in education. Two hundred students participated in the survey which was conducted by computer science teachers in the period from April to May 2023.

The results of this research present the students' perspective about the use of ICT in primary education and shed light on students' perspectives regarding the students' use of ICT in primary education. By delving into their experiences, preferences, and challenges encountered, we have uncovered a nuanced understanding of the role ICT plays in shaping their educational journey.

## **Key words**

*ICT, primary education, students*

# Academics' perceptions of using AI in Higher Education



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**Education for digital transformation**

**Number of the paper: 138**

## **Abstract**

Generative artificial intelligence (AI) is an emerging and rapidly evolving technology. AI is the simulation of human intelligence in machines programmed to think and act like humans. The integration of AI technologies in higher education has the potential to streamline didactic and research processes and enhance their outcomes. Also, technology and auxiliary teaching include many tools that serve to help students to get information, to organize their thinking, and to demonstrate their learning.

This study presents a qualitative design research based on understanding the academics' perceptions of using AI to facilitate didactic and research process and how they perceive its role within higher education in Albania. The results indicate that academics have a positive perception that AI can be effectively used in personalized teaching and learning process, administrative and research support. The didactic sourcing technology should be used as part of the university training program and including protocols regarding ethics in education and academic integrity.

## **Key words**

*artificial intelligence, ChatGPT, technology, university*

# LESS IS MORE: A review of shortening the questionnaire on students' attitudes towards artificial intelligence (SATAI) / MANJE JE VIŠE: prikaz skraćivanja upitnika o stavovima studenata prema



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**Education for digital transformation**

**Number of the paper: 139**

## **Abstract**

Artificial intelligence (AI) is becoming increasingly present in all areas of life. Previous research has mostly focused on the use of AI from the perspective of students, with almost no research on the attitudes of students - future teachers towards AI. This paper aims to create a shortened version of the original questionnaire that would make it easier to investigate teachers' attitudes towards artificial intelligence in the future. A study was conducted on a sample of 276 students from the Faculties of Humanities and Social Sciences in Osijek and Rijeka, and the Faculty of Teacher Education University of Zagreb, using the SATAI questionnaire. The results indicate that the shortened form of the questionnaire correlates very well with the subscales within the attitudes of the respondents towards AI in education compared to the longer version. The research conclusion supports the validity of the shorter form of the questionnaire, whose validity is the same compared to the longer version with half the number of items. Accordingly, teachers can use it to investigate attitudes related to new AI educational methods.

## **Key words**

*artificial intelligence, education, instrument validity, SATAI*

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**Odgoj i obrazovanje za digitalnu transformaciju**

**Broj rada: 139**

## Sažetak

Umjetna inteligencija sve je prisutnija u svim područjima života. Dosadašnja istraživanja uglavnom su bila usmjerena na korištenje umjetne inteligencije (AI) iz perspektive učenika, a gotovo da ne postoje istraživanja o stavovima studenata - budućih nastavnika prema AI. Ovaj rad ima za cilj kreiranje skraćene verzije originalnog upitnika kojom bi se u budućnosti lakše mogli ispitivati stavovi nastavnika o umjetnoj inteligenciji. Na uzorku je od 276 studenata Filozofskih fakultet u Osijeku i Rijeci, te Učiteljskog fakulteta Sveučilišta u Zagrebu provedeno istraživanje u kojemu je korišten SATAI upitnik. Rezultati ukazuju kako skraćena forma upitnika vrlo dobro korelira sa subskalama u sklopu stavova ispitanika prema umjetnoj inteligenciji u obrazovanju u odnosu na dužu verziju. Zaključak istraživanja govori u prilog valjanosti kraće forme upitnika čija je valjanost ista u odnosu na dulju verziju uz upola manji broj čestica. Sukladno tome, nastavnici ga mogu koristiti u istraživanju stavova vezanih uz nove AI obrazovne metode.

## Ključne riječi

*umjetna inteligencija, obrazovanje, SATAI, valjanost instrumenta*

# Possibilities of using AI (ChatGPT) for teaching purposes



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**Education for digital transformation**

**Number of the paper: 140**

## **Abstract**

The progressive development of technology, especially in the field of artificial intelligence (AI), significantly affects all social aspects and different social fields, including education. Among the most famous and widespread forms of AI are chatbots, which are easy to use and user-friendly.

In this paper, we examine and discuss current application and trends of using chatbots in education, primarily for teaching purposes. Furthermore, the authors have created a lesson plan for one unit using ChatGPT 3.5 in the area of primary education. The entire process (questions and prompts) of creating a teaching lesson plan using AI (conversation with ChatGPT 3.5) is given in the paper and evaluated by authors. To gain the triangulation of results both researchers (authors) carried out the analysis independently. The results show that it is possible for AI to create/generate a lesson plan based only on given learning outcome. Despite all the shortcomings (e.g. accuracy of information), the contribution and advantages of AI for the improvement of the teaching process is unquestionable (in terms of creativity and devising activities for given outcomes, producing examples, saving time etc.). However, for AI to be effective for teaching purposes, as in all other areas, undoubtedly it requires specific skills and competencies of teachers such as critical thinking, content knowledge etc. The authors suggest a follow up research, i.e. giving AI generated lesson plans to teachers in a focus group to analyze it with and without knowing it is AI generated etc.

Nevertheless, it is necessary to conduct further research regarding the application of artificial intelligence for educational purposes, especially taking into account ethical aspects, copyright, etc.

## **Key words**

artificial intelligence, ChatGPT, lesson plan, primary education, teaching

# Opinions and attitudes of prospective primary school teachers on the use AI applications in education



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**Education for digital transformation**

**Number of the paper: 141**

## **Abstract**

The surge in the popularity of Artificial Intelligence (AI) applications has created significant interest in their potential integration into primary education. The primary objective of this paper is to investigate the viability and optimal strategies for implementing AI technologies across diverse subjects, while concurrently assessing the opinions and attitudes of future educators toward the integration of AI in their pedagogical practices. Through a nuanced exploration of their perspectives, the study aims to uncover the readiness, concerns, and expectations of the upcoming generation of educators, shedding light on the socio-cultural dynamics surrounding AI adoption in educational contexts. The research method is based on an online questionnaire taken by students from the Faculty of Teacher Education, University of Zagreb.

The findings of this research contribute to the ongoing discourse on AI in education by offering a nuanced understanding of its potential benefits and challenges. This knowledge is crucial for shaping informed policies, designing effective teacher training programs, and ensuring responsible and ethical implementation of AI applications in primary education. As technology continues to evolve, this research serves as a foundational exploration into the intricate dynamics between AI, education, and ethical considerations.

## **Key words**

*AI applications, education, ICT, prospective teachers*

# Analysis of digital resources for teaching ICT in the City of Zagreb primary schools / Analiza digitalnih resursa za provedbu nastave informatike u osnovnim školama Grada Zagreba



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**Education for digital transformation**

**Number of the paper: 142**

## **Abstract**

Following recent reforms, Computer Science education in the elementary school curriculum in the Republic of Croatia has been radically reduced in terms of teaching hours. On the other hand, awareness of the importance of digital technologies today results in significant investments in equipping schools with information and communication technologies (ICT). Digital literacy is becoming imperative in all areas and subjects of elementary school education. In this context, reducing the digital divide is important due to unequal access to digital technologies and knowledge sources. Students who have limited access to resources cannot have the same opportunities in the educational process. The aim of this paper is to investigate the differences in available resources for the implementation of Computer Science courses in primary schools. For the purpose of the research, the attitudes and opinions of primary school teachers in the City of Zagreb were examined using a questionnaire. Attitudes towards digital tools and technologies in relation to available ICT resources and their use in Computer Science courses are examined. The paper presents an analysis of the application of available digital tools, technologies and content, and their impact on the quality of the teaching process.

## **Key words**

*computer science teachers, computer science teaching, digital divide, information and communication technology*

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**Odgoj i obrazovanje za digitalnu transformaciju**

**Broj rada: 142**

## Sažetak

Nastava predmeta Informatika u kurikulumu osnovne škole u Republici Hrvatskoj je po najnovijoj reformi radikalno smanjena po broju sati. S druge strane svijest o važnosti digitalnih tehnologija u današnjem društvu rezultira značajnim ulaganjima u opremljenost škola informacijsko - komunikacijskim tehnologijama (IKT). Digitalna pismenost pritom postaje imperativom u svim područjima i predmetima osnovnoškolskog obrazovanja. U tom svjetlu je važno smanjiti digitalnu podjelu uslijed nejednakog pristupa digitalnim tehnologijama i izvorima znanja. Učenici koji imaju ograničen pristup resursima nemaju iste mogućnosti u obrazovnom procesu.

Cilj ovog rada je istražiti razlike u dostupnim resursima za provedbu nastave informatike u osnovnim školama. U svrhu istraživanja anketnim upitnikom su ispitani stavovi i mišljenja učitelja osnovnih škola na području Grada Zagreba u vezi dostupnih digitalnih alata i tehnologija te njihovoj primjeni u nastavi Informatike s obzirom na dostupne IKT resurse. Rad prikazuje analizu primjene dostupnih digitalnih alata, tehnologija i sadržaja, te njihov utjecaj na kvalitetu nastavnog procesa.

## Ključne riječi

*digitalna podjela; informacijsko-komunikacijska tehnologija; nastava informatike; učitelji informatike*

# Aligning initial teacher education learning outcomes and the program for professional development as a prerequisite for the development of digital competences



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**Education for digital transformation**

**Number of the paper: 143**

## **Abstract**

Digital competences of teachers are recognized as a prerequisite for a successful teaching process. The initial teacher education aims to ensure the development of competences necessary for entry to the profession, including teacher digital competence, which is considered the fundamental competence of all teachers today.

The European Commission has developed the European Framework for Teachers' Digital Competences (DigCompEdu, 2017) which includes and describes 22 digital competences specific to teachers in six areas: professional engagement, digital resources, and materials, learning and teaching, monitoring and evaluation, empowering students, enabling development and directing students' digital competences.

The complexity of social processes and the accelerated development of knowledge impose the need for constant professional development and continuous learning, which is necessary so that teachers can follow and implement innovations in their performance curricula, as well as in their daily work with students.

In order to enable the continuum in the development of digital competences following initial teacher education, the ContinueUP project created a model for harmonizing the learning outcomes of digital competence in the area of professional engagement, at the level of initial teacher education and its further development at professional development programs. The competence development model is based on the development of digital competences at the levels recognized in DigCompEd and ensures a continuum in the development of the digital competence of teachers. The model is applicable in an international context and meets the needs of teachers across Europe.

## **Key words**

ContinueUP, continuous professional development, digital competences, initial teacher training, professional engagement

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**Odgov i obrazovanje za digitalnu transformaciju**

**Broj rada: 143**

## Sažetak

Digitalne kompetencije učitelja prepoznate su kao preduvjet za uspješan nastavni proces. Inicijalno obrazovanje učitelja ima za cilj osigurati razvoj kompetencija nužnih za ulazak u profesiju, pa tako i digitalne kompetencije učitelja koja se danas smatra temeljnom kompetencijom svih učitelja. Europska komisija razvila je Europski okvir za digitalne kompetencije nastavnika (DigCompEdu, 2017) koji obuhvaća i opisuje 22 digitalne kompetencije specifične za učitelje u šest područja: profesionalni angažman, digitalni izvori i materijali, učenje i poučavanje, praćenje i vrednovanje, osnaživanje učenika, omogućavanje razvoja i usmjeravanje digitalnih kompetencija učenika.

Kompleksnost društvenih procesa i ubrzani razvoj znanja nameću potrebu za stalnim profesionalnim razvojem i kontinuiranim učenjem koje je neophodno kako bi učitelji mogli pratiti i implementirati inovacije u svoje izvedbene kurikulume, kao i u svakodnevni rad s učenicima.

Kako bi se omogućio nastavak razvoja digitalnih kompetencija nakon inicijalnog obrazovanja učitelja, u projektu ContinueUP, kreiran je model usklađivanja ishoda učenja digitalne kompetencije u području profesionalnog angažmana, na razini inicijalnog obrazovanja učitelja i njenog razvoja u programima profesionalnog razvoja. Model razvoja kompetencije se temelji na razvoju digitalnih kompetencija na razinama prepoznatim u DigCompEdu i osigurava kontinuum u razvoju digitalne kompetencije učitelja. Također, primjenjiv je u međunarodnom kontekstu i odgovara potrebama učitelja diljem Europe.

## Ključne riječi

*ContinueUP; digitalne kompetencije; inicijalno obrazovanje učitelja; profesionalni angažman; profesionalni razvoj*