



# Digital Competencies and Artificial Intelligence for Education: Transformation of the Education System

Petr Svoboda<sup>1</sup>

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Currently, the importance of artificial intelligence (AI) is increasing as an exciting technology in the teaching process. AI can help teachers create innovative learning content and gain new insights. For example, AI can be used to create and edit educational materials and multimedia content, such as graphics, videos, sounds, presentations, worksheets, interactive lessons, tests and quizzes. The use of AI in adaptive learning systems can help students learn and progress at their own pace. AI can also assist students and teachers in understanding text. However, as stated by the European School Education Platform (OECD iLibrary, 2022, [https://www.oecd-ilibrary.org/education/pisa-2022-assessment-and-analytical-framework\\_dfe0bf9c-en](https://www.oecd-ilibrary.org/education/pisa-2022-assessment-and-analytical-framework_dfe0bf9c-en)), the use of AI in interactive learning materials may have limitations and the results may be biased. A national research report with Microsoft (Kopecký et al., 2023, <https://e-bezpeci.cz/index.php/pohledem-vedy/3554-ceske-skoly-a-umela-intelligence-vysle-dky-vyzkumu>) stated that AI can reduce students' creativity, critical thinking and collaboration, increase their dependence on technology and encourage plagiarism. Teachers have low awareness of what AI is, how to use it in education and how to regulate it. Only a small proportion of teachers use AI tools in their classes.

The younger generation is intensively using digital technologies and for them, AI provides personalized education (Luckin et al., An argument for AI in

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✉ Petr Svoboda  
petr.svoboda@cvut.cz

<sup>1</sup> Masaryk Institute of Advanced Studies, Czech Technical University in Prague, Kolejná 2637/2a, Prague 6 160 00, Czech Republic

Education, 2020, <https://discovery.ucl.ac.uk/id/eprint/1475756/>). Research on the potential development of AI in the Czech Republic can be found on the Czech Government website (2020, <https://vlada.gov.cz/assets/evropske-zalezitosti/aktualne/AI-souhrna-zprava-2018.pdf>), and on the Ministry of Industry and Trade website (National Strategy of AI in the Czech Republic, 2021, [https://vlada.gov.cz/assets/evropske-zalezitosti/umela-inteligence/NAIS\\_kveten\\_2019.pdf](https://vlada.gov.cz/assets/evropske-zalezitosti/umela-inteligence/NAIS_kveten_2019.pdf)). Intelligent management systems are not a novelty in education. Such systems apply AI in the education field. These systems use algorithms based on the analysis of generated and collected data to help organize, optimize and improve the learning and teaching process by providing personalized and adaptive learning experiences. These systems recognise the level of learning based on the students' responses and develop it over time (European Commission, 2022, [https://www.oecd-ilibrary.org/education/pisa-2022-results-volume-i\\_53f23881-en](https://www.oecd-ilibrary.org/education/pisa-2022-results-volume-i_53f23881-en)).

Virtualization and gamification have become increasingly popular, with dynamic growth in recent years. Virtualization in education means replacing traditional education in classrooms with an online environment. Adapting to technological advancements necessitates the evolution of online learning, crucial for fostering digital skills relevant to the twenty-first century. Jílková (2021, [https://www.temjournal.com/content/102/TEMJournalMay2021\\_699\\_706.html](https://www.temjournal.com/content/102/TEMJournalMay2021_699_706.html)) noted that companies and schools seek new ways of working and learning online. Perceptions of the shift during the coronavirus pandemic were mixed. While some found it effective, enjoyable, and flexible (Akuratiya, *International Journal of Research and Innovation in Social Science*, 2020), others faced issues like unclear instructions and unreliable internet. Online learning encourages independence and participation (Saputra et al., *Budapest International Research and Critics Institute Journal*, 2021), but challenges remain.

Gamification focuses on the use of game elements and techniques in education to motivate students to learn. Virtualization and gamification can be used separately or together. Blended learning is an approach to education that combines online and face-to-face classroom learning, such as learning activities like watching video lectures, participating in online discussions and completing assignments. In pedagogical practice, it is used in face-to-face, blended and distance learning and creates a flexible learning environment. M-learning is learning through mobile devices and uses mobile technology for educational purposes. The combination of m-learning and blended learning allows students to access learning materials and interact with teachers and classmates any time and anywhere, which increases the flexibility and efficiency of the learning process (Dziuban et al., *International Journal of Educational Technology in Higher Education* 2018).

The research aim was to identify new visions for the future, as well as the main advantages and barriers to integration into the teaching process. Virtual technologies, e-technology parks with virtual laboratories, virtual classes, and the learning process with virtual and augmented reality, are didactic tools that represent the path to the new reality with programming and robotics as the main aspects of the modern teaching process. E-technology parks with virtual laboratories are a specific type of technology park that uses modern technologies to simulate real laboratory environments in digital form.

The study's secondary goal was to investigate the digital competencies of educators based on the European Digital Competence Framework. Using 10 in-person questions (semi-structured interview: Study 1), experts' opinions on the educational program were investigated. The sample consisted of 20 university teachers from various universities in the Czech Republic. The interview was designed to obtain evaluations, comments, suggestions and ideas that could be included in the educational program concept within the new education system.

Furthermore, based on a 48-item, web-based, multiple-choice questionnaire (Study 2) ([Online Supplemental Appendix](#)), current trends in education were assessed. The questionnaire was developed based on an analysis of research studies and strategic documents from the Ministry of Education, Youth and Sports in the Czech Republic. These included the Strategy of Digital Education until 2020 (MŠMT, 2020, <https://www.msmt.cz/vzdelavani/skolstvi-v-cr/strategie-digitalniho-vzdelavani-do-roku-2020>), the Strategy of the Education Policy of the Czech Republic until 2030+ (MŠMT, 2021, <https://www.msmt.cz/vzdelavani/skolstvi-v-cr/strategie-vzdelavaci-politiky-2020-1>), and European Commission documents aimed at creating a framework for digital skills for European Union (EU) citizens. Specifically, the following reports were examined: Vuorikari and Brande (DigComp 2.0: A Digital Competency Framework for Citizens, 2016, <https://op.europa.eu/en/publication-detail/-/publication/bc52328b-294e-11e6-b616-01aa75ed71a1/language-en>), Vuorikari & Punie (DigComp 2.1: A Digital Competency Framework for Citizens with Eight Proficiency Levels, 2017, <https://publications.jrc.ec.europa.eu/repository/handle/JRC106281>), the Digital Competence Framework for Educators—DigCompEdu (Publications Office of the EU, 2017, <https://publications.jrc.ec.europa.eu/repository/handle/JRC107466>), and the Metodický portál RVP.CZ (2018, <https://ucitel21.rvp.cz/>). Formally, the questionnaire predominantly consisted of multiple-choice items, including Likert-type scales ([Online Supplemental Appendix](#)). The questionnaire was sent to 2508 potential respondents in secondary schools. After data collection ended, the total response rate was 80,3% (2015 teachers working in secondary schools). The distribution of schools among the respondents was: 81.2% (1,636) of respondents worked at secondary vocational schools, 11.8% (238) at secondary vocational training centres, 3.4% (69) at grammar schools and 3.6% (72) at conservatories.

Data analysis was conducted using descriptive statistics. Other statistical methods used included the chi-square test of independence, chi-square goodness-of-fit test, analysis of variance (ANOVA), and the t-test for comparing two independent samples. This exploratory research (Study 1 and Study 2) was followed by another research study that focused on digital tools and resources used by secondary school teachers in the Czech Republic for teaching, as well as their evaluation of their own knowledge, skills, and limitations in this regard.

Based on this research (Study 1 and Study 2), the current results will be used to optimize the educational program concept within the new educational system. In the research, almost all teachers reported a positive impact of digital technology use on the achievement of educational goals, which confirms the findings of international research (Donnelly et al., *Computers & Education*, 2011; Player-Koro, *Education Inquiry*, 2012). Teachers use more demanding digital teaching tools to

a limited extent. Knowledge emerges as a predictor of digital technology use and as an important component of digital competence. On the other hand, international research (ECDL, 2018, [https://www.icdl.sk/buxus/docs/interne\\_informacie/Marketing/Predstava-a-skutocnost\\_NeformalnyPrekladCZ.pdf](https://www.icdl.sk/buxus/docs/interne_informacie/Marketing/Predstava-a-skutocnost_NeformalnyPrekladCZ.pdf)) conducted in five European countries showed that people tend to overestimate themselves in the area of digital competence. The advantage of using mobile technologies in education is that 70% of the students already have this equipment. Respondents mentioned the possibility of learning anywhere and any time. Second, respondents mentioned that using this technology is faster than learning via a computer. The relevant idea could be a combination of M-learning with gamification. The next trend mentioned in the questionnaire was microlearning, i.e., short-term training for five minutes. Sharing learning materials in the cloud and using tools for analysing student progress in the learning process is a modern approach.

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