Teachers' Digital Competencies: Diagnosis and Development in the Context of the Teacher21 Model

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Abstract – **This article explores the use of the Teacher21 Model for the diagnosis and development of teachers' digital competencies. The Teacher21 Model is based on the European Framework of Reference for Teachers' Digital Competencies and divides them into six domains: professional engagement, digital resources, teaching, digital assessment, student support, and supporting students' digital competencies. The paper presents the results of the analysis of data obtained from a survey that included three groups of respondents: future (prospective) teachers, future (prospective) ICT methodologists and current teachers. The aim of the research is to find out how these groups perceive their digital competencies in relation to the Teacher21 Model and to identify differences between them. The results showed that all three groups have an average level of digital competencies, with the highest level in the area of professional engagement and the lowest in the area of digital assessment. The paper goes on to offer recommendations for developing teachers' digital competencies in line with trends in education and highlights the importance of the quality of education in the digital age.**

Keywords – **Digital competencies, Teacher21 Model, education, innovation, trends.**

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1. Introduction

The Teacher21 model is based on the European Reference Framework for Teachers' Digital Competencies [1] and offers recommendations and resources for improving teachers' digital competencies. It is the diagnostic tool Teacher21 of the methodological portal of the National Pedagogical Institute of the Czech Republic [1]. The digital competencies are divided by level into: novice (A1), explorer (A2), practitioner (B1), expert (B2), leader (A1), pioneer (A2).

Teachers' digital competencies play a key role in modern education. With the advent of digital technologies, teachers are expected to be able to use digital tools effectively in their teaching and to support the digital skills of their students. The Teacher21 model provides a structured framework for diagnosing and developing these competencies.

The development of teachers' digital competencies is a critical aspect of modern education, as highlighted by [2] and [3]. [2] emphasizes the need for a rethinking of teacher education and professional qualification to enhance digital competencies, while Sheffield reports on a successful professional learning model that supports teachers in integrating digital technologies. [4] proposes a model for the development of digital teaching competencies, emphasizing the importance of a sociocultural approach. [5] underscores the urgent need for measures to form digital competencies among teachers, based on a survey of secondary school teachers. These studies collectively underscore the importance of ongoing professional development and support for teachers to enhance their digital competencies.

2. Digitally Competent Teacher and Trends in Education

The current trends in education are significantly influenced by digitalization and technological advancements.

Researchers like have highlighted this impact [6]. As a result, the role of teachers has shifted, and they are now expected to take on multiple roles, including organizers, tutors, and coaches [7]. Additionally, there is a strong emphasis on empowering individuals through learning, fostering the acquisition of knowledge, skills, and values [8]. These trends are reshaping the way education is delivered and received, with a greater focus on personalized and flexible learning experiences.

A digitally competent teacher possesses knowledge about both hardware and software resources within their school. They can effectively leverage the educational potential of digital technologies in their teaching. Understanding the advantages and disadvantages of using digital tools in education is crucial. Regularly monitoring professional communities and engaging in self-learning through personal learning environments (PLEs) are essential practices for teachers. Furthermore, teachers should strategically use technology aligned with their educational goals. They must also recognize the impact of technology on the educational process.

Comparing traditional classroom communication with current trends in education and electronic communication methods is essential [9]. Exploring new didactic tools and motivating students through digital technologies should be considered. While traditional communication in schools has traditionally focused on direct verbal and non-verbal interactions, we now commonly encounter online electronic communication (both synchronous and asynchronous) in educational settings. Reflecting on these realities allows all school staff to emphasize the importance of lifelong learning and staying informed. Creating conditions for more flexible, accessible, and individualized learning processes is crucial for improving teacher performance and overcoming barriers to equal access to education. Leveraging new technologies enables educators to adapt and enhance the teaching process [9].

Interactive learning, e-learning and m-learning, microlearning, online learning, hybrid learning, webinars, cloud services in education, social networks, social groups, informal learning, blended-learning have become common learning supports. Trends in education can be identified, for example, according to the Open Innovation University report (2015 - 2023). These trends are mainly focused on virtual labs, e-technology parks with remote and virtual labs, virtual classrooms, virtual and augmented reality (3D virtual reality education), artificial intelligence, programming and robotics, blended learning, flipped classroom, redesign of learning spaces and libraries, m-learning, gamification and microlearning, cloud services, IoT (Internet of Things), newskilling, adaptive learning technologies, next generation LMS, MOOCs and Spoc. These identified key trends in education have the potential to be successfully applied both now and in the future.

Research conducted by [10] highlights the widespread utilization of online tools. Their study demonstrates that online applications and communication platforms are highly suitable for informal education. Specifically, these digital tools significantly enhance efficiency in performing everyday tasks within educational contexts. As digital technologies continue to evolve, the availability of high-quality online courses, tutorials, and gamified learning experiences has grown. These technological advancements drive innovation, impacting education as well [11].

In this context, the role of educators becomes crucial. Teachers play a pivotal role in guiding pedagogical activities toward educational goals and fostering digital literacy among students. Digitally competent teachers who integrate technology throughout the academic year are now at the forefront. Digital tools assist them in adopting novel and effective teaching methods, serving as essential support and complements to traditional education. Notably, according to [12] and [9], digital technologies create opportunities for both gifted and differently abled students. These opportunities revolve around individualized pacing, addressing specific needs, and allowing flexibility during breaks. Educational materials are readily accessible and dynamically updated due to high-speed internet connectivity. Through distance learning and online tools, educators can set personalized learning objectives, explore activating teaching methods, diversify instructional approaches (e.g., hybrid learning), discover new educational opportunities, and facilitate knowledge sharing. However, this also necessitates personal responsibility for learning, decision-making, self-monitoring, and self-assessment. In the current era, characterized by technological advancements, lifelong learning and the acquisition of information on an ad hoc basis are imperative.

As teachers, we have a plethora of new educational opportunities, suitable didactic aids, and emerging technologies that serve as supplements, support, and enhancers for effective education. We employ activating methods and strive to motivate learners. However, there are several challenges in this domain.

These include the digital competencies of teachers and the digital literacy of students, the prevalence of unverified information sources, limitations posed by available technologies and didactic techniques, the choice of teaching methods, an abundance of distractions, and limited interpersonal interactions.

3. Research Methodology

As this is an exploratory research that investigates the whole spectrum of teachers' digital competencies, a quantitative research design based on a teacher assessment tool (questionnaire survey) was chosen. Specifically, it was the diagnostic tool Teacher21 [1], which allows teachers to assess their digital competencies in six areas.

Main research question:

How do future teachers, future ICT methodologists and current teachers perceive their competencies according to the Ucitel21 model?

Sub-research questions:

● How do future teachers, future ICT methodologists and current teachers subjectively perceive their professional competencies with a focus on digital competencies?

● How do future teachers, future ICT methodologists and current teachers subjectively perceive their pedagogical competencies with a focus on digital content creation?

● How do future teachers, future ICT methodologists and current teachers subjectively perceive the promotion of their students' digital competencies with a focus on digital content creation?

The research sample consisted of three groups of respondents, which were selected due to the fact that they constitute a different group from the standard group of teachers studied. The most commonly researched groups are primary school teachers, secondary school teachers in general, and kindergarten teachers in particular. However, the surveyed pilot sample includes groups of future teachers (students of the Bachelor of Teaching, in Information and Communication Technology), future ICT methodologists (teachers interested in helping other teachers to develop their digital competencies and those of their pupils and to integrate digital technologies into their teaching) and groups of current teachers (students of the Teacher of Practical Education and Vocational Training) who are completing their education.

The research investigation did not aim to compare these disparate groups against each other, but to pilot possible differences in these groups. How future teachers, future ICT methodologists and current teachers perceive their digital competencies in relation to the Teacher21 model.

Data collection took place between 3/2023 and 8/2023, when respondents were invited to self-complete Teacher21 (outside of the lesson or course being delivered) either as part of the teaching or delivery of a specific course. Subsequently, respondents shared their graphs or overall assessment in Ucitel21 via their chosen LMS (Moodle). They had the opportunity to comment on or discuss their results either directly in the face-to-face meeting, in the course Moodle, or with the specific instructor.

After collecting the completed Teacher21 models from the respondents, it was first necessary to check the correctness of completion. For this reason, none were discarded, so the research sample consisted of a total of fifty-eight completed Teacher21 models (n = 58). Of these, twenty-six completed Teacher21 models were future teachers, eleven were ICT methodologists and twenty-one were current teachers.

Based on the statistical evaluation of the results of the completed models according to [13], [14], [15], tables were created and then used to analyze the data obtained through the Teacher21 model. The basic evaluation was done by looking for the position on the scale whether the respondents' answers were closer to A1 or C2 (statistical significance). The interpretation of the results is always presented below the table for the analysis of the data obtained from the application of the Teacher21 model. The resulting level is indicated in bold. This is based on the calculated mean i.e. the value that approaches the coefficient on the scale [13], [14].

4. Data Analysis and Interpretation

Tables for data analysis and interpretation are provided. What future teachers, current teachers and ICT methodologists know, use and are aware of is always analysed.

4.1. Future (Prospective) Teachers

Table 1. Professional engagement

1Professional Engagement	Absolute frequency	Relative frequency (%)	Coefficient	Multiples of frequency of choices
A1	0	0,00	1	0
A2	2	7,69	2	4
B1	12	46,15	3	36
B2	**10**	**38,46**	**4**	**40**
C1	1	3,85	5	5
C2	1	3,85	6	6
Sum	26	100		91
Average				3,50

In professional engagement, future teachers are digitally competent at B2 (B1) level. Professional engagement consists of professional communication, professional collaboration, reflective practice and continuous professional development [1]. Future teachers know, use and are aware of:

● in work communication:
    ▪ how to use digital technologies to communicate effectively, responsibly and creatively,
    ▪ how to choose appropriate communication channels, formats and styles according to purpose and context,
    ▪ how to communicate in accordance with organisational rules and ethical principles.
● for professional collaboration:
    ▪ how to use digital technologies to share and exchange experiences, knowledge and opinions with colleagues inside and outside the organisation,
    ▪ how to use digital technologies to develop co-produced knowledge,
    ▪ how to use online communities to discover new resources and ideas.
● for reflective practice:
    ▪ development through experimentation and learning from colleagues,
    ▪ how to improve and update their digital (pedagogical) competencies through experimentation and peer learning,
    ▪ how to use a range of resources to develop their own digital and pedagogical practices,
    ▪ how to evaluate and reflect on the appropriate use of digital technologies to innovate and improve teaching practices.
● at continuous professional development:
    ▪ how to use the internet to seek out opportunities for professional development,
    ▪ how to use the internet for professional development, e.g. attending online courses, webinars, online tutorials, using video tutorials etc.,
    ▪ how to use formal and informal ways of sharing experiences in online communities for their professional development.

Table 2. Digital resources

2 Digital resources	Absolute frequency	Relative frequency (%)	Coefficient	Multiples of frequency of choices
A1	1	3,85	1	1
A2	7	29,92	2	14
B1	**9**	**34,62**	**3**	**27**
B2	6	23,08	4	24
C1	3	11,54	5	15
C2	0	0,00	6	0
Sum	26	100		81
Average				3,12

In digital resources, future teachers are digitally competent at level B1 (A2-B2). Digital resources include the selection of digital resources, the creation and editing of digital resources and the organisation, preservation and sharing of digital resources [1]. Future teachers know, use and are aware of:
● for a selection of digital resources:
    ▪ how to search, select and evaluate appropriate digital resources for teaching and learning. For example, the ability to find relevant and reliable resources on the Internet, compare them with other resources and verify their authenticity,
    ▪ how to be able to assess whether resources are appropriate for the age, level, and needs of learners.
● for creating and editing digital resources:
    ▪ how to create and edit digital resources using a variety of tools and techniques,
    ▪ the importance of adapting resources to the specific learning context and respecting copyright. For example, creating and editing multimedia presentations, interactive exercises, digital stories, and other types of resources to support teaching and learning,
    ▪ how to cite resources correctly and respect the rights of authors and users.
● for organising, protecting and sharing digital resources:
    ▪ how to effectively organize, protect, and share digital resources with others.
    ▪ what strategies and platforms to use. For example, use of cloud services, social networking, online libraries and other tools for storing, sorting, backing up and sharing resources.
    ▪ how to set access rights, passwords, encryption, and other measures to protect resources from unauthorised use or misuse.

Table 3. Teaching and learning

3 Teaching and Learning	Absolute frequency	Relative frequency (%)	Coefficient	Multiples of frequency of choices
A1	0	0,00	1	0
A2	7	26,92	2	14
B1	**14**	**53,85**	**3**	**42**
B2	4	15,38	4	16
C1	1	3,85	5	5
C2	0	0,00	6	0
Sum	26	100		77
Average				2,96

In teaching and learning, future teachers are digitally competent at level B1. Teaching includes teaching, pupil guidance, pupil collaboration, and independent pupil learning [1]. Future teachers know, use and are aware of:

● in teaching with digital technologies:
▪ how they can integrate digital devices and content into their teaching to increase learner motivation and interest.

● in guiding learners with digital technologies:
▪ how they can use digital technologies to communicate more intensively with learners, answering their questions and listening to their needs.

● in pupil collaboration with digital technologies:
▪ how they can design and deliver learning activities that support pupil collaboration using digital technologies, for example, to produce collaborative outcomes or document collaboration.

● in supporting pupil independent learning with digital technologies:
▪ how they can integrate pupil independent learning with digital technologies into all learning activities, for example, to collect evidence, record progress, present work or self-evaluate.

Table 4. Assessment

4 Assessment	Absolute frequency	Relative frequency (%)	Coefficient	Multiples of frequency of choices
A1	1	3,85	1	1
A2	15	57,69	2	30
B1	**6**	**23,08**	**3**	**18**
B2	4	15,38	4	16
C1	0	0,00	5	0
C2	0	0,00	6	0
Sum	26	100		65
Average				2,50

In assessment, future teachers are digitally competent at level B1 (A2). Digital assessment includes assessment strategies, analysis of learning outcomes, feedback, and planning [1]. Future teachers know, use, and are aware of:

● in assessment strategies:
▪ how to use digital technologies to create and submit assignments, formative and summative assessments, and to adapt existing assessment tools;
▪ how to modify or create custom assessment tools according to instructional needs and goals.
● in learning outcomes analysis: ▪ how to evaluate data on learner activities and performance generated by digital technologies and how to use it to provide feedback and support,

▪ how to use data to plan next steps and interventions to support learners.

● in feedback and planning:
▪ how to use digital technologies to provide feedback in the form of assessment, grading, and disclosure of information on learning performance.
▪ how to use digital technologies to share information about pupils' performance with themselves, parents, colleagues or other stakeholders.

Table 5. Empowering learners

5 Empowering Learners	Absolute frequency	Relative frequency (%)	Coefficient	Multiples of frequency of choices
A1	0	0,00	1	0
A2	9	34,62	2	18
B1	**13**	**50,00**	**3**	**39**
B2	4	15,38	4	16
C1	0	0,00	5	0
C2	0	0,00	6	0
Sum	26	100		73
Average				2,81

In empowering learners, future teachers are digitally competent at B1 (A2) level. Pupil support includes accessibility and inclusion, differentiation and individualisation, pupil activation [1]. Future teachers know, use and are aware of:

● for accessibility and inclusion:
▪ how important it is to ensure equal access to digital technologies for all pupils, especially those with special educational needs,
▪ what are the possible problems with accessibility and inclusion and what compensatory digital technologies can be recommended.

● for differentiation and individualisation:
▪ how digital technologies can support differentiation and individualisation of learning, e.g.

● for learner activation:
▪ how digital technologies can engage learners in active and motivating learning, e.g. through visualisation, animation, games and quizzes;
▪ how to support learners in using digital technologies independently and selecting the most appropriate digital technologies for a given learning context and objective.

Table 6. Facilitating learners´ digital competencies

6 Facilitating Learners´ Digital Comp.	Absolute frequency	Relative frequency (%)	Coefficient	Multiples of frequency of choices
A1	0	0,00	1	0
A2	9	34,62	2	18
B1	**10**	**38,46**	**3**	**30**
B2	5	19,23	4	20
C1	1	3,85	5	5
C2	1	3,85	6	6
Sum	26	100		79
Average				3,04

In facilitating learners´ digital competencies, future teachers are digitally competent at B1 (A2) level. Supporting pupils' digital competencies includes information and media literacy, digital communication and collaboration, digital content creation, responsible use of digital technologies and problem solving through digital technologies [1].

Future teachers know, use and are aware of:
● for information and media literacy:
  ▪ how to introduce and support activities that help learners use digital technologies to retrieve and evaluate information from a variety of sources.

● for digital communication and collaboration:
  ▪ how to introduce and support activities that guide pupils to use digital technologies to communicate and collaborate with others, respecting the rules of behaviour and cultural differences in the digital environment.

● for digital content creation:
  ▪ how to introduce activities that enable pupils to express themselves and create content using digital technologies, such as text, photos, images and videos, and to publish and share their digital creations.

● for the responsible use of digital technologies:
  ▪ how to put in place measures to ensure pupils' digital wellbeing, e.g. how to protect privacy, secure digital identities, reduce inappropriate behaviour, and raise pupils' awareness of how digital technologies affect health and wellbeing.

● at solving problems through digital technologies:
  ▪ how to introduce and support activities that lead pupils to use digital technologies creatively and critically to solve problems, e.g. through trial and error, and lead them to learn to apply their digital competencies in new situations.

Table 7. Total summary

Total Summary	Absolute frequency	Relative frequency (%)	Coefficient	Multiples of frequency of choices
A1	0	0,00	1	0
A2	6	23,08	2	12
B1	**11**	**42,31**	**3**	**33**
B2	8	30,77	4	32
C1	1	3,85	5	5
C2	0	0,00	6	0
Sum	26	100		82
Average				3,15

Chart 1. Total Summary – histogram of frequencies
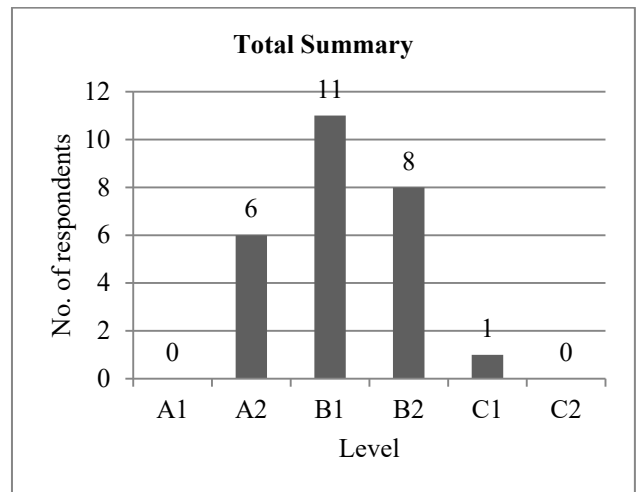
Overall, future teachers are digitally competent at B1 (B2) level.

4.2. Current Teachers

Table 8. Professional engagement

1Professional Engagement	Absolute frequency	Relative frequency (%)	Coefficient	Multiples of frequency of choices
A1	1	4,76	1	1
A2	6	28,57	2	12
B1	**7**	**33,33**	**3**	**21**
B2	6	28,57	4	24
C1	1	4,76	5	5
C2	0	0,00	6	0
Sum	21	100		63
Average				3,00

In professional engagement, current teachers are digitally competent at B1 (A2 - B2) level. Professional engagement consists of professional communication, professional collaboration, reflective practice and continuous professional development [1].

Current teachers know, use and are aware of:

● in work communication:
▪ how to use digital technologies to communicate with different groups of people such as students, parents, colleagues and non-teaching staff,
▪ how to choose appropriate communication channels, formats and styles according to purpose and context,
▪ how to communicate responsibly and ethically using digital technologies.

● for professional collaboration:
▪ how to use digital technologies to collaborate on joint projects or exchange experiences and opinions,
▪ how to use online communities to explore new learning resources and methods,
▪ how to share and exchange resources, knowledge and ideas with colleagues inside and outside the organisation,
▪ how to develop co-produced knowledge using digital technologies.

● for reflective practice:
▪ how to be aware of your strengths and weaknesses in digital (pedagogical) competencies,
▪ how to improve and update their digital and pedagogical practices through experimentation and peer learning,
▪ how to critically approach new pedagogical practices enabled by digital technologies,
▪ how to seek out examples of good practice and learning opportunities to develop their own pedagogical competencies in the field of digital technologies,
▪ how to evaluate and reflect with colleagues on the appropriate use of digital technologies to innovate and improve teaching practices.

● for continuous professional development:
▪ how to use the internet to develop their professional and pedagogical knowledge,
▪ how to use the internet to find opportunities for professional development, e.g. courses, conferences, webinars, online tutorials, video tutorials, etc.,
▪ how to use formal and informal ways of sharing experiences in online communities for professional development.

Table 9. Digital resources

2 Digital resources	Absolute frequency	Relative frequency (%)	Coefficient	Multiples of frequency of choices
A1	0	0,00	1	0
A2	7	33,33	2	14
B1	**9**	**42,86**	**3**	**27**
B2	5	23,81	4	20
C1	0	0,00	5	0
C2	0	0,00	6	0
Sum	21	100		61
Average				2,90

In digital resources, current teachers are digitally competent at level B1 (A2). Digital resources include the selection of digital resources, the creation and editing of digital resources and the organisation, preservation and sharing of digital resources [1]. Current teachers know, use and are aware of:

● for a selection of digital resources:
▪ how to use digital technologies to find and evaluate appropriate resources for teaching and learning,
▪ how to tailor search strategies and criteria according to needs.

● for creating and editing digital resources:
▪ how to create and edit resources using a variety of tools and techniques,
▪ how to use multimedia, interactivity and animation to enhance learner interest,
▪ how to adapt resources to a specific learning objective.

● for organizing, preserving and sharing digital resources:
▪ how to effectively organise and share learning resources using virtual learning environments, websites or blogs,
▪ how to protect sensitive content and respect copyright.

Table 10. Teaching and Learning

3 Teaching and Learning	Absolute frequency	Relative frequency (%)	Coefficient	Multiples of frequency of choices
A1	1	4,76	1	1
A2	4	19,05	2	8
B1	**12**	**57,14**	**3**	**36**
B2	3	14,29	4	12
C1	1	4,76	5	5
C2	0	0,00	6	0
Sum	21	100		62
Average				2,95

In the competency called Teaching and Learning, current teachers are digitally competent at level B1. Teaching includes teaching, pupil guidance, pupil collaboration and independent pupil learning. Current teachers know, use and are aware of:

● in teaching with digital technologies:
  ▪ how they can integrate digital devices and content into the classroom to increase student motivation and interest.

● in guiding learners using digital technologies:
  ▪ how they can use digital technology to communicate more intensively with pupils, answering their questions and listening to their needs.

  ● in pupil collaboration with digital technologies:
  ▪ how they can design and implement learning activities that support pupil collaboration using digital technologies, for example, to create collaborative outcomes or document collaboration.

● in independently supporting pupils' learning with digital technologies:
  ▪ how they can integrate pupils' independent learning with digital technologies into all learning activities, for example, for gathering evidence, recording progress, presenting work or self-evaluation.
  ▪ how to effectively organise and share learning resources using virtual learning environments, websites or blogs,
  ▪ how to protect sensitive content and respect copyright.

Table 11. Assessment

4 Assessment	Absolute frequency	Relative frequency (%)	Coefficient	Multiples of frequency of choices
A1	4	19,05	1	4
A2	**10**	**47,62**	**2**	**20**
B1	3	14,29	3	9
B2	4	19,05	4	16
C1	0	0,00	5	0
C2	0	0,00	6	0
Sum	21	100		49
Average				2,33

In assessment, current teachers are digitally competent at A2 level. Digital assessment includes assessment strategies, analysis of learning outcomes, feedback and planning [1]. Current teachers know, use and are aware of:

● in assessment strategies:
  ▪ how to integrate digital technologies into traditional assessment methods, e.g., assignment development, problem-solving support, validation of learning outcomes.

● in the analysis of learning outcomes:
  ▪ how to assess data on student activities and performance, e.g. attendance, grades, feedback.

● in feedback and planning:
  ▪ how to use digital technologies to provide feedback and advice to pupils, e.g. progress reports, targeted support.

Table 12. Empowering Learners

5 Empowering Learners	Absolute frequency	Relative frequency (%)	Coefficient	Multiples of frequency of choices
A1	2	9,52	1	2
A2	4	19,05	2	8
B1	**12**	**57,14**	**3**	**36**
B2	3	14,29	4	12
C1	0	0,00	5	0
C2	0	0,00	6	0
Sum	21	100		58
Average				2,76

In pupil support, current teachers are digitally competent at level B1. Pupil support includes accessibility and inclusion, differentiation and individualisation, pupil activation [1]. Current teachers know, use and are aware of:

● for accessibility and inclusion:
  ▪ how to ensure that all pupils have access to digital technologies and how to use them to support pupils with special educational needs.

● for differentiation and individualisation:
  ▪ how to use digital technologies to adapt learning to the different needs, abilities and interests of pupils.

● for pupil activation:
  ▪ how to support pupils to use digital technologies independently and actively in learning and in achieving learning objectives.

Table 13. Facilitating Learners´ Digital Competencies

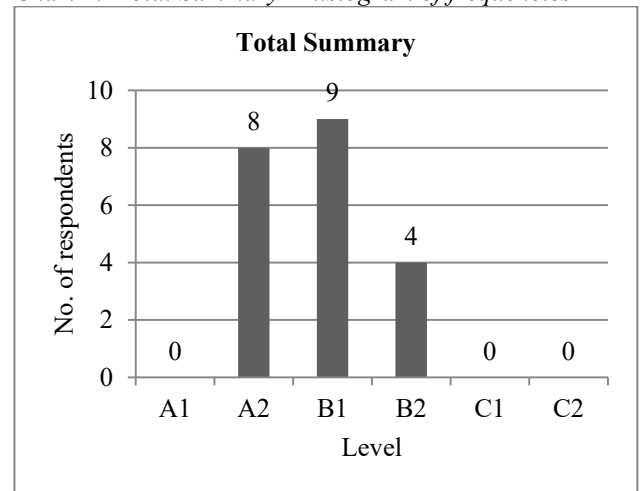| 6 Facilitating Learners´ Digital Comp.	Absolute frequency	Relative frequency (%)	Coefficient	Multiples of frequency of choices
A1	0	0,00	1	0
A2	9	42,86	2	18
B1	**7**	**33,33**	**3**	**21**
B2	5	23,81	4	20
C1	0	0,00	5	0
C2	0	0,00	6	0
Sum	21	100		59
Average				2,81

Current teachers are digitally competent at B1 (A2) level in supporting DL (digital competencies) learners. Supporting pupils' digital competencies includes information and media literacy, digital communication and collaboration, digital content creation, responsible use of digital technologies and problem solving through digital technologies [1]. Current teachers know, use and are aware of:

● for information and media literacy:
  ▪ how to introduce and support activities that help learners use digital technologies to retrieve and evaluate information from a variety of sources.

● for digital communication and collaboration:
  ▪ how to introduce and support activities that guide pupils to use digital technologies to communicate and collaborate with others, respecting the rules of behaviour and cultural differences in the digital environment.
● for digital content creation:
  ▪ how to introduce activities that enable pupils to express themselves and create content using digital technologies, such as text, photos, images and videos, and to publish and share their digital creations.

● for the responsible use of digital technologies:
  ▪ how to put in place measures to ensure pupils' digital wellbeing, e.g. how to protect privacy, secure digital identities, reduce inappropriate behaviour, and raise pupils' awareness of how digital technologies affect health and wellbeing.

● at solving problems through digital technologies:
  ▪ how to introduce and support activities that lead pupils to use digital technologies creatively and critically to solve problems, e.g. through trial and error, and lead them to learn to apply their digital competencies in new situations.

Table 14. Total Summary

Total Summary	Absolute frequency	Relative frequency (%)	Coefficient	Multiples of frequency of choices
A1	0	0,00	1	0
A2	8	38,10	2	16
B1	**9**	**42,86**	**3**	**27**
B2	4	19,05	4	16
C1	0	0,00	5	0
C2	0	0,00	6	0
Sum	21	100		59
Average				2,81

Chart 2. Total Summary – histogram of frequencies

Overall, current teachers are digitally competent at B1 (A2) level.

4.3. Future (Prospective) ICT Methodologists

The analysis in this chapter is identical to that of the Future Teachers. Only small differences can be seen, namely in the professional engagement. See more specifically chapter 4.1.

Table 15. Professional Engagement

1Professional Engagement	Absolute frequency	Relative frequency (%)	Coefficient	Multiples of frequency of choices
A1	0	0,00	1	0
A2	0	0,00	2	0
B1	2	18,18	3	6
B2	**6**	**54,55**	**4**	**24**
C1	2	18,18	5	10
C2	1	9,09	6	6
Sum	11	100		46
Average				4,18

Table 16. Digital resources

2 Digital resources	Absolute frequency	Relative frequency (%)	Coefficient	Multiples of frequency of choices
A1	0	0,00	1	0
A2	4	36,36	2	8
B1	**2**	**18,18**	**3**	**6**
B2	2	18,18	4	8
C1	3	27,27	5	15
C2	0	0,00	6	0
Sum	11	100		37
Average				3,36

Table 17. Teaching and Learning

3 Teaching and Learning	Absolute frequency	Relative frequency (%)	Coefficient	Multiples of frequency of choices
A1	0	0,00	1	0
A2	3	27,27	2	6
B1	**3**	**27,27**	**3**	**9**
B2	3	27,27	4	12
C1	2	18,18	5	10
C2	0	0,00	6	0
Sum	11	100		37
Average				3,36

Table 18. Assessment

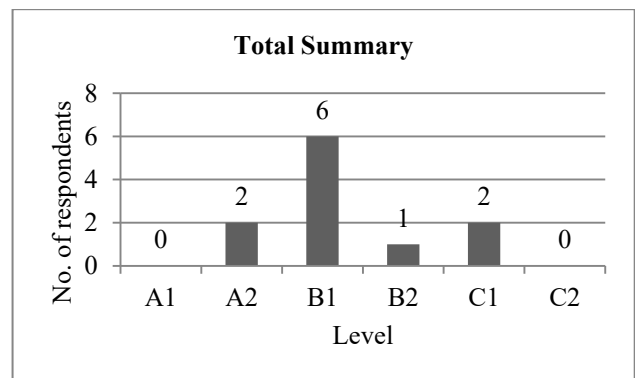| 4 Assessment	Absolute frequency	Relative frequency (%)	Coefficient	Multiples of frequency of choices
A1	0	0,00	1	0
A2	6	54,55	2	12
B1	**2**	**18,18**	**3**	**6**
B2	2	18,18	4	8
C1	1	9,09	5	5
C2	0	0,00	6	0
Sum	11	100		31
Average				2,82

Table 19. Empowering Learners

5 Empowering Learners	Absolute frequency	Relative frequency (%)	Coefficient	Multiples of frequency of choices
A1	0	0,00	1	0
A2	4	36,36	2	8
B1	**5**	**45,45**	**3**	**15**
B2	2	18,18	4	8
C1	0	0,00	5	0
C2	0	0,00	6	0
Sum	11	100		31
Average				2,82

Table 20. Facilitating Learners´ Digital Competencies

6 Facilitating Learners´ Digital Comp.	Absolute frequency	Relative frequency (%)	Coefficient	Multiples of frequency of choices
A1	0	0,00	1	0
A2	2	18,18	2	4
B1	**5**	**45,45**	**3**	**15**
B2	2	18,18	4	8
C1	2	18,18	5	10
C2	0	0,00	6	0
Sum	11	100		37
Average				3,36

Table 21. Total Summary

Total Summary	Absolute frequency	Relative frequency (%)	Coefficient	Multiples of frequency of choices
A1	0	0,00	1	0
A2	2	18,18	2	4
B1	**6**	**54,55**	**3**	**18**
B2	1	9,09	4	4
C1	2	18,18	5	10
C2	0	0,00	6	0
Sum	11	100		36
Average				3,27

Chart 3. Total Summary – histogram of frequencies

Table 22. Total results

	Professional Engagement	Digital Resources	Teaching and Learning	Assessment	Empowering Learners	Facilitating Learners´ Digital Comp.	Total Summary
Future teachers	B2	B1	B1	B1	B1	B1	**B1 (B2)**
Future ICT	B2	B1	B1	B1	B1	B1	**B1**
Current teachers	B1	B1	B1	A2	B1	B1	**B1 (A2)**

5. Results

The research investigated the digital competencies of future teachers, future ICT methodologists and current teachers according to the Teacher21 model [1]. The research sample consisted of 58 respondents from three groups: 26 future teachers, 11 future ICT methodologists and 21 current teachers. The results showed that future teachers and future ICT methodologists achieved higher levels of digital competencies than current teachers. This may be due to the fact that future teachers and ICT methodologists are more familiar with modern technologies and their use in education. Current teachers may have less motivation or opportunity to develop their digital competencies.

The highest level of digital competencies was achieved in the area of professional engagement, meaning that respondents were able to use digital technologies for personal and professional development, communication and collaboration with other teachers and students. This is in line with the trend of lifelong learning and sharing of experiences and best practices in the pedagogical community.

The lowest level of digital competencies was achieved in the area of digital assessment, meaning that respondents had difficulties in using digital tools and methods for pupil assessment, feedback and data analysis. This may be due to a lack of appropriate digital assessment tools, a lack of trust in digital data, or a lack of familiarity with the possibilities and benefits of digital assessment. Future ICT methodologists are essentially at the same level as future teachers.

The main research question was: How do future teachers, future ICT methodologists and current teachers perceive their competencies in relation to the Teacher21 model? The answer to this research question is that future teachers and ICT methodologists achieved higher levels of digital competencies than current teachers in all six domains of the Teacher21 model. ICT methodologists were the most competent group and current teachers were the least competent group.

The sub-research questions were related to individual areas of digital competencies. The answers are as follows:

● How do future teachers, future ICT methodologists and current teachers subjectively perceive their professional competencies with a focus on digital competencies?

In the area of professional engagement, all respondents achieved a high level of digital competencies, with no statistically significant differences between groups. This means that respondents are able to use digital technologies for personal and professional development, communication and collaboration with other teachers and students.

● How do future teachers, future ICT methodologists and current teachers subjectively perceive their pedagogical competencies with a focus on digital content creation?

In the area of digital resources, future teachers and ICT methodologists achieved higher levels of digital competencies than current teachers, with ICT methodologists being statistically significantly better than future teachers. This means that respondents are able to find, create, share and manage digital resources for teaching.

In the area of teaching and learning, future teachers and ICT methodologists achieved higher levels of digital competencies than current teachers, with no statistically significant differences between future teachers and ICT methodologists. This means that the respondents are able to plan, implement and evaluate teaching using digital technologies with little demand on didactic-methodological application.

In the area of digital assessment, future teachers and ICT methodologists achieved higher levels of digital competencies than current teachers, with ICT methodologists performing statistically significantly better than future teachers. This means that respondents are able to use digital tools and methods for student assessment, feedback and data analysis.

In the area of learner's support, future teachers and ICT methodologists achieved higher levels of digital competencies than current teachers, with no statistically significant differences between future teachers and ICT methodologists. This means that respondents are able to support learners in developing their digital skills, critical thinking, creativity and collaboration.

● How do future teachers, future ICT methodologists and current teachers subjectively perceive the support of digital competencies of their students with a focus on digital content creation?

In the area of supporting learners' digital competencies, future teachers and ICT methodologists achieved higher levels of digital competencies than current teachers, with ICT methodologists being statistically significantly better than future teachers. This means that respondents are able to support pupils in developing their digital literacy, citizenship and identity.

6. Research Summary

The research investigation used the Teacher21 model [1] as a diagnostic tool that allows teachers to assess their digital competencies in six areas: professional engagement, digital resources, teaching, digital assessment, pupil support and pupil digital competencies support [1].

Future teachers and ICT methodologists achieved higher levels of digital competencies than current teachers in all six areas of the Teacher21 model, meaning that they were better prepared to use digital technologies in education and to support pupils' digital competencies. ICT methodologists were the most competent group, outperforming future teachers and current teachers in all areas except professional engagement. This shows that ICT methodologists have specific knowledge and skills in digital technology that enable them to use and disseminate it effectively to other teachers. The current teachers were the least competent group, lagging behind the future teachers and ICT methodologists in all areas. This suggests that current teachers need more support and motivation to develop their digital competencies and to adapt to changes in education.

The research investigation did not aim to compare these heterogeneous groups against each other, but to show possible differences in these groups on a pilot basis. The research investigation confirmed the importance of the Teacher21 model as a tool for diagnosing teachers' digital competencies. The results of the research showed that all three groups of respondents are overall digitally competent at B1 level (see Table 22), which means that they know, use and are aware of the basic aspects of digital competencies. Recommendations for pedagogical practice are that teachers should use the Teacher21 model to support their professional development, engage in professional collaboration and sharing of experiences with colleagues, and promote digital competencies among their students, including innovative and creative approaches to teaching through digital technologies.

In today's educational reality, digital technologies play a pivotal role in education [16]. Educators are progressively integrating advanced technologies into their pedagogical practices [17]. Several research projects e.g. [18] along with pedagogical experiences, demonstrate that digital technologies and innovative didactic tools can enhance student learning outcomes through well-chosen teaching methods and formats [19], [20].

7. Conclusion

The Teacher21 Model is a significant tool for enhancing pedagogical skills and competencies among teachers. Its primary objective is to foster innovation in education and introduce fresh approaches to classroom practice. The Teacher21 Model specifically focuses on developing teachers' digital competencies, which is crucial in an era where digital technologies play an increasingly prominent role in education.

In the present day, digital technologies influence most human activities and fields, including the realm of education. A digitally competent teacher achieves positive outcomes in knowledge and skill transmission. Empirical research indicate that digital technologies and innovative didactic tools can significantly enhance student learning outcomes. Educational institutions should actively support their teachers in developing skills for online and other forms of teaching and learning, as the digital era unfolds. Leveraging technological opportunities can significantly improve the quality of education and learning. Schools risk losing credibility as modern educational institutions if they fail to integrate new technologies into their teaching practices.

Initially, digitally supported education aimed to assist students with disabilities and gifted learners. Today, our focus has shifted towards equipping all students for future challenges, higher education, practical applications, and life in a rapidly evolving society and industry. To achieve this, innovative teaching tools and cutting-edge digital technologies must be integrated into the educational process.

References:

[1]. UCITEL21.RVP. (2023). *Přehled digitálních kompetencí.* UCITEL21.RVP. Retrieved from: https://ucitel21.rvp.cz/ [accessed: 19 April 2024].

[2]. Tsankov, N., & Damyanov, I. (2019). The Digital Competence of Future Teachers: Self-Assessment in the Context of Their Development. *International Journal of Interactive Mobile Technologies (iJIM)*, *13*(12), 4–18. Doi: 10.3991/ijim.v13i12.11068

[3]. Sheffield, R., Blackley, S., & Moro, P. (2018). A Professional Learning Model Supporting Teachers to Integrate Digital Technologies. *Issues in Educational Research, 28*, 487-510.

[4]. Colás-Bravo, P., Conde-Jiménez, J., & Reyes-de-Cózar, S. (2019). [The development of the digital teaching competence from a sociocultural approach] El desarrollo de la competencia digital docente desde un enfoque sociocultural. *Comunicar, 61,* 21-32. Doi: 10.3916/C61-2019-02

[5]. Niyazova, G. Z., Saparkhojayev, N. P., Bazarbaeva, A. I., & Azybayev, M. A. (2022). Development of digital competence of school teachers. *World Journal on Educational Technology: Current Issues, 14*(3), 592–603. Doi: 10.18844/wjet.v14i3.7196

[6]. Gashimov, E., & Pestova, V. (2021). Modern Trends in Education in the Era of Digitalization: Task and Prospects of Development. *Ilomata International Journal of Social Science, 2*(4), 287-295. Doi: 10.52728/ijss.v2i4.394

[7]. Sidorov, A. (2023). Actual trends in teachers' professional development in the context of modern educational practices. *Man and Education*.

[8]. Mohanty, M. (2019). Contemporary Trends in Education. In Leal Filho, W., Azul, A., Brandli, L., Özuyar, P., Wall, T. (eds) *Quality Education. Encyclopedia of the UN Sustainable Development Goals*. Springer, Cham.
Doi: 10.1007/978-3-319-69902-8_35-1

[9]. Svoboda, P. (2022). Educational Program for the Development of Digital Competencies of Teachers of Social Sciences in Secondary Vocational Education. In *Human Interaction, Emerging Technologies and Future Systems* V. Basel: Springer Nature Switzerland, 705-713.

[10]. Svoboda, P. at.al. (2020). Research of Teachers' Digital Competences in an International Context In *The Impact of the 4th Industrial Revolution on Engineering Education*. Basel: Springer Nature Switzerland, 788-799.

[11]. Petr Adamec & Roman Hrmo. (2023). Entrepreneurship Education of University Students - Examples of Good Practice. *TEM Journal, 12*(3), 1300-1306.

[12]. Lund, A., Furberg, A., Bakken, J. et. al. (2019). Co znamenají profesní digitální kompetence ve vzdělávání učitelů? *Severský žurnál digitální gramotnosti*, 9 (4).

[13]. Chráska, M. (2007). *Metody pedagogického výzkumu. Základy kvantitativního výzkumu.* Praha: Grada.

[14]. Gavora, P. (2000). *Úvod do pedagogického výzkumu.* Brno: Paido.

[15]. Eger, L., & Egerová, D. (2022). *Metodologie výzkumu.* Plzeň: Západočeská univerzita v Plzni.

[16]. MŠMT. (2020). *Strategie vzdělávací politiky ČR do roku 2030+.* MŠMT. Retrieved from: https://msmt.gov.cz/uploads/Brozura_S2030_online_CZ.pdf [accessed: 20 April 2024].

[17]. Svoboda, P. (2024). Digital Competencies and Artificial Intelligence for Education: Transformation of the Education System. *International Advances in Economic Research*, 1-4.
Doi: 10.1007/s11294-024-09896-z

[18]. Olofsson, A. D., Fransson, G., & Lindberg, J. O. (2020). A study of the use of digital technology and its conditions with a view to understanding what 'adequate digital competence'may mean in a national policy initiative. *Educational studies, 46*(6), 727-743.

[19]. Dobrovská, D., & Vaněček, D. (2021). New Trends in Training Methodologies. In *International Conference on Interactive Collaborative Learning*, 983-990. Cham: Springer International Publishing.

[20]. EU SCIENCE HUB. (2020). *DigCompEdu - European Commission.* Europa.
Retrieved from: https://joint-research-centre.ec.europa.eu/digcompedu_en [accessed: 22 April 2024].