Development of Students' Professional Competencies in the Framework of Education Digitalization and general globalization

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ABSTRACT:
The research goals are to identify the methodological basis and efficient technological mechanisms of the formation of professional competencies of students in the conditions of the digitalization of education, as well as evaluate the effect of these on the quality of training of future specialists, more specifically, to conduct a survey on the identification of the level of formation of the digital and professional competencies of the students. comparative analysis; systematization; generalization; survey. The study has identified that learning platforms are important in shaping professional competencies of students, in the case of digitalizing the education process. The interpretation of empirical evidence conducted on the background of a survey of 1675 students demonstrated that the Coursera, edX, and Udemy platforms are effective in terms of developing digital skills, media literacy, and optimizing the learning process, and Google Classroom and Microsoft Teams facilitate the development of collaborative skills, though the impact on the acquisition of specific professional knowledge is less strong. The overall findings of the study prove the importance of digital educational resources in developing professional and digital competencies in students as the success of such tools is greatly determined by the extent of their integration into the learning process, student motivation, and consideration of the learning requirements of the students as individuals.

Keywords: digitalization of education, professional competencies, digital competencies, digital technologies, educational platforms

1. Introduction

The modern stage of the development of society is marked with accelerated scientific and technological advancement that gave rise to the appearance of new socio-economical and technological paradigm. To a major extent, these transformations are also driven by global digitalization, which is upheld by the establishment and functioning of digital infrastructures that have the capacity to process, store, transmit and analyse information in large quantities in an automatic fashion. The high accessibility, efficiency,

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interactivity and adaptability of digital technologies have become critical factors affecting all aspects of life, including educational processes (Bader et al., 2022).

Under the current conditions of global informatization, intensive scientific and technological development and growing competition in the labor market, the world's leading countries are directing their educational policies towards systemic modernization of training of new generation specialists. Forming the capacity of higher education seekers to adjust to the dynamically changing socio-economic conditions, learning the newest technological solutions and guaranteeing a high competitiveness degree in the global labor market are the key tasks of educational systems. The emergence of information, communication and digital technologies has altered the educational system radically and influenced the content of the system, methodological approaches, organizational forms and teaching tools. The paradigm of the teacher-student interaction in the digitalization of the educational process has greatly changed, which has predetermined the necessity to master digital tools, introduce adaptive learning technologies, and develop digital competence of students and teachers (Vanivska et al., 2018; Bilynska et al., 2024).

Within the scope of the current trends in education, the digitalization of the learning environment has turned out to be one of the focal points of learning policy. It can be observed especially in such strategic documents like the Strategy of the Development of Higher Education of Ukraine in 20212031, in which digitalisation is mentioned among the key vectors of development in the sector. The necessity of such direction was considerably reinforced during the COVID-19 pandemic that required the massive implementation of distance learning as the main method of guaranteeing the continuity of the education process and minimizing face-to-face contact. The lockdown measures accelerated the digital platforms and tools integration process that became a force that triggered further research on the efficacy of digital learning in various educational settings (Bader et al., 2022).

Within the context of the world digitalisation, and the shift in the organisation of the educational process, digital competence has gained a key position in the professional training of future specialists (Tejada & Pozos, 2018). On the one hand, it is explained by the widespread application of digital technologies to the sphere of professional activity, and on the other hand, by the fact that the further career development is getting increasingly dependent on the successful use of information and communication technologies (ICT). According to Cabero et al. (2020), one of the most necessary skills of the modern citizen, and in particular, of a teacher, is digital competence, which contributes to the formation of new generations of specialists. To this end, sustainable and inclusive socio-economic development is strategically significant in the context of initiatives intended to promote digital competence in all levels of education, especially higher education (Cabero et al., 2020; Basilotta-Gómez-Pablos et al., 2022).

Based on these considerations, professionally related issues such as the formation and the development of the professional competencies of students in the environment of digitalised education become the subject of a thorough examination. With the help of such a study, one will be able to objectively assess the role of digital platforms, ICT and creative tools in improving the quality of professional preparation and in providing students with adaptability to the demands of the modern labour force.

This research aims to substantiate methodological premises and find the promising technological methods that lead to the enhancement of professional abilities of students in the virtual learning space. The paper is aimed at explaining the conceptualizing structure of digital competence and professional competence, defining the assessment criteria and the identification of the suitable methods that will connect the capabilities of the digital platforms with the quantifiable learning outcomes. Much attention is paid to the analysis of causal relationships and mediating variables that affect the quality of training. As part of such an effort, the extensive empirical survey was done to determine the degree of digital and professional competencies among the students, as well as to reveal the main peculiarities and possibilities of the implementation of digital technologies in professional training in the future.

Research objectives of the study:

1. Critically analyse the contribution of digital learning platforms to improving students' professional and digital competences.

2. Determine the effectiveness of these platforms in promoting the acquisition of professional skills by students.

3. Assess the ability of digital tools and platforms to promote the development of practical skills and prepare students for entering the labour market.

4. To investigate the integration and use of adaptive learning systems, chatbots, and scientific digital resources in the context of higher education.

5. To analyse the progress and dynamics of the development of key competencies in the context of the digitalisation of education.

6. To conduct a systematic survey to assess the level of student engagement with digital platforms and their impact on learning outcomes.

7. Conduct statistical comparisons, including paired t-tests, to identify differences in professional competencies between students who use digital platforms and those who adhere to traditional teaching methods.

2. Literature Review

The modern-day study is highly concerned with the conceptualisation of the nature of the digitalisation of education and its key elements. Specifically, AlDahdouh (2021) discusses the effects of information technology on the change of educational processes, focusing on how digital tools can be used to transform educational modes of learning and building professional skills. In the same way, Bouton et al. (2021) discuss the effects of social media on shaping modern students who engage their learning activities through online platforms. Kuzminska et al. (2018) examine the rate of teacher digital competence in Ukraine and state it as the key aspect to successful digitalisation of education. Edmunds et al. (2020) assess the effectiveness of online courses, with the effect on the honing of professional skills in students. Fromm et al. (2021) consider the future of virtual reality as an educational process and provides new chances to engage in a cyclical learning process, whereas McGrew (2021) focuses on the role of distance learning during the Covid-19 pandemic which influenced the teaching process and the learning form greatly.

When it comes to scientific research, the notion of competence is viewed through the prism of a range of educational standards and conceptual approaches that help to enhance the process of learning outcome evaluation (Mäkinen and Annala, 2010). European Qualification Framework (EQF) defines competence as an evidenced capacity to use knowledge, skills and personal, social or methodological competences in teaching and learning and in personal development with the focus on independence and personal responsibility (European Parliament and Council, 2008). The conceptualization of competence has multiple approaches in the scientific literature and this is what results in a number of models of competence-based education (Sadler, 2005). Specifically, as UNESCO (2024) says, competence is considered to be a fundamental principle of constructing an educational process that combines the real life and professional experience with the academic learning and forms the foundation of the development of the effective educational strategies (Jonnaert et al., 2007).

Professional competence is a topic of extensive scientific dialogue (Cochran-Smith and Fries, 2001; Darling-Hammond and Bransford, 2005) and finds the results of large-scale international empirical research (Blömeke et al., 2014; Kunter et al., 2013). Professional competence in scientific literature is an integrative formation of what has been said about competence in general, except that it is considered in relation to the special needs of professional activity. Specifically, within the framework of professional competence, cognitive factors alone are not the only significant ones but also motivational, volitional and social factors which directly influence the success of professional realization (Weinert, 2001). The given concept is employed to describe the set of skills required to the successful completion of professional tasks that defines its central role in the process of creating specialists in the context of the digitalization of education (Wess et al., 2021).

In this study, it is crucial to clarify the concept of digital competence, which is inherently multidimensional, covers multiple disciplines and often lacks a universally accepted definition, as interpretations vary across disciplines (Nyikes, 2018; Oļesika et al., 2021). One perspective describes digital competence as encompassing cognitive, associative and technological abilities that enable people to solve the problems of modern society, emphasizing its dynamic and interdisciplinary nature (Janssen et al., 2013). Another perspective emphasizes its importance for effective communication in personal, professional and academic contexts, including the knowledge, skills, awareness and attitudes required for the safe, critical and effective use of digital tools in problem solving, communication and information management (Gündüzalp & Yaras, 2022; Simović & Domazet, 2023). Furthermore, digital competence promotes the ability to make creative, critical and responsible contributions, both independently and collaboratively (Hatlevik et al., 2015). In an educational context, digital competence is defined as the ability to apply theoretical knowledge, practical skills and research to plan, implement and evaluate ICT-supported learning processes (From, 2017), including the transformation of information into knowledge, operations and services through the analytical, productive and creative use of ICT and social software, which significantly affects student learning outcomes (Drydakis, 2022; Ala-Mutka, 2011; Torres-Coronas & Vidal-Blasco, 2011; Park & Weng, 2020).

It is important to note that digital competence is that of being able to use digital technologies safely, critically and responsibly in learning, professional and civic matters.

The competence involves such elements as communication and collaboration competencies, data literacy, creating digital content (including programming), information literacy, media literacy, and security (including digital wellbeing and cybersecurity competencies), intellectual property knowledge, and problem-solving/critical thinking skills. The following elements of digital competence are identified as the requirements of the active interaction with digital technologies in the modern society where technology turned out to be an inseparable element of the educational process and professional activity (Consejo de la Unión Europea, 2018).

Within the framework of the worldwide digitalization of professional activity, the discussion of science is directed toward the formation of the skills on which the professional competence is based in the digital transformation. The primary role in the professional development concept is assumed by the hard skills or the technical skills acquired during formal education or through experience. The variability and ability to adapt to the changes in technology confirm the specificity of the hard skills since much depends on the professional context of the profession. Key technical skills that are essential in the digital economy are foreign language knowledge, adobe creative suite knowledge, programming languages, web development, creating digital content, code, copywriting, budgeting, statistical data analysis, user interface design, and the experience in using specifically designed software and platforms. The list of demanded technical competencies is dynamic and constantly increases depending on the requirements of the labor market due to the rapid development of digital technologies (Vieilandie et al., 2024).

At the same time, it should be understood that the introduction of digital technologies is not only a technical and organizational issue but it also has deep social and administrative contexts that determine the effectiveness of such initiatives. Previous strategies for digitalizing education have not always been successful, often due to neglect of the social processes that accompany the introduction of technological innovations. In view of the above, it becomes relevant to study the main trends in the digitalization of education, which are necessary for its successful implementation in modern conditions (Bader et al., 2022).

Overall, an examination of scholarly literature reveals a limited amount of research on the development of students' professional competencies within the framework of educational digitalization, generating a knowledge gap and necessitating thorough investigations to evaluate the influence of digital technologies on the enhancement of these competencies.

3. Methodology

It should be noted that a comprehensive set of scientific methods was used to achieve the objectives of this study, aimed at assessing the impact of digital technologies on the formation of students' professional competencies:

− Classification and systematisation of data: the collected survey results were structured and organised, providing an orderly basis for further analysis.

− Systematic and logical analysis, synthesis of information: these methods made it possible to comprehensively investigate the relationship between digital technologies in

education and the development of professional competencies, as well as to evaluate the effectiveness of using platforms for learning.

−   Generalisation method: used to integrate and generalise the research results, in particular to assess the impact of digital tools on the adaptation of educational programmes to the current needs of the labour market and on the effectiveness of the learning process.

−   Survey: used to collect information from students, which made it possible to assess their level of activity in using digital platforms, the effectiveness of learning, and their overall attitude towards the digitalisation of the educational process.

−   Processing of survey data: included statistical processing of the results obtained to identify the main trends and interrelationships between the use of platforms and the level of professional competencies of students.

−   Paired t-test: used to check the statistical significance of differences in the level of professional competencies between students who actively use digital platforms and those who do not.

The empirical part of the research applied descriptive statistical methods to analyse the specific features of how students' professional competencies are formed under the conditions of educational digitalisation. Data collection was carried out through an online questionnaire administered to higher education students using the MS Forms Pro platform, which contributed to ensuring the credibility and reliability of the findings.

The survey was designed to evaluate the influence of digital learning technologies on the development of professional competencies, highlighting key tendencies, strengths, and challenges associated with the digital transformation of higher education. The research examined both the frequency and the patterns of digital platform usage, as well as the students' level of professional competence within a digital learning environment.

A total of 1,675 respondents took part in the study, which lasted from 22 January 2024 to 22 January 2025, providing a representative sample and ensuring a high level of reliability of the results. The questionnaire contained both closed questions (with answer options) and open questions, which allowed students to express their own opinions. Among the main questions were the following:

−   How would you rate the effectiveness of learning platforms for developing professional skills?

−   How often do you use learning platforms?

−   How have your digital skills changed after using these platforms?

−   What digital tools do you use to develop your professional competencies?

−   Which platforms help you acquire practical skills and look for a job?

−   How often do you use adaptive learning platforms to improve your learning outcomes?

−   How effective do you find chatbots for psychological support and stress management during your studies?

−   How effective do you find the use of digital tools in your learning?

This methodological approach made it possible to conduct a broad assessment of how digitalisation influences the development of students' professional competencies and to identify the main regularities within this process. However, it is important to recognise

certain limitations of the study, as the findings rely exclusively on self-reported survey data. Such an approach may involve subjective perceptions, differences in students' familiarity with digital platforms, as well as uneven participation, which could affect the overall objectivity and generalisability of the conclusions. To overcome these limitations, future studies should combine questionnaires with objective tasks to test learning outcomes, the use of behavioural data, and long-term studies, which will increase external validity and allow the effect of enthusiasm to be separated from real growth in competencies. Despite these limitations, the large sample size and one-year observation period provide a solid empirical basis for drawing conclusions and identifying trends in the development of students' digital and professional competencies.

4 Results

In the given work, the 1,675 students survey was conducted to identify the role of digital learning platforms in guaranteeing the acquisition of professional competencies, which nowadays became an unavoidable component of the educational process in the era of digitalisation. These platforms offer an extensive selection of learning resources, collaboration tools, media content creation and the potential of developing specialised knowledge and are applicable as the tools of acquiring the professional knowledge required to be successful in the future profession. According to the results of the survey, the most popular platforms were Coursera, edX and Udemy, which were all denoted by the respondents as having a fundamental role in competence development. Their use was identified to spur digital literacy, media skills, information search skills and the aptitude to casual and streamline learning with the help of specialised courses and certification programmes.

In the meantime, Google Classroom and Microsoft Teams might be treated as chiefly effective at ensuring that there was communication, coordination, and collaboration in the learning process. Nevertheless, their contribution to the attainment of specialised knowledge and the formation of better professional competencies was estimated as a relatively insignificant one. Despite their invaluable role in the regulation of the learning processes and facilitation of interactions between the students, they do not fully prepare the status of content depth that are required to generate highly specialised professional expertise.

Other platforms, such as TED, Duolingo and iTunes U, have a limited role in the development of professional competencies, which mainly contribute to the development of cognitive activity and general media literacy, but their contribution to the development of specific professional skills is much less. It is worth noting that these platforms can be useful for developing general knowledge or improving skills in certain areas, such as languages or science but they do not contribute to the deep mastery of professional competencies (see Figure 1).
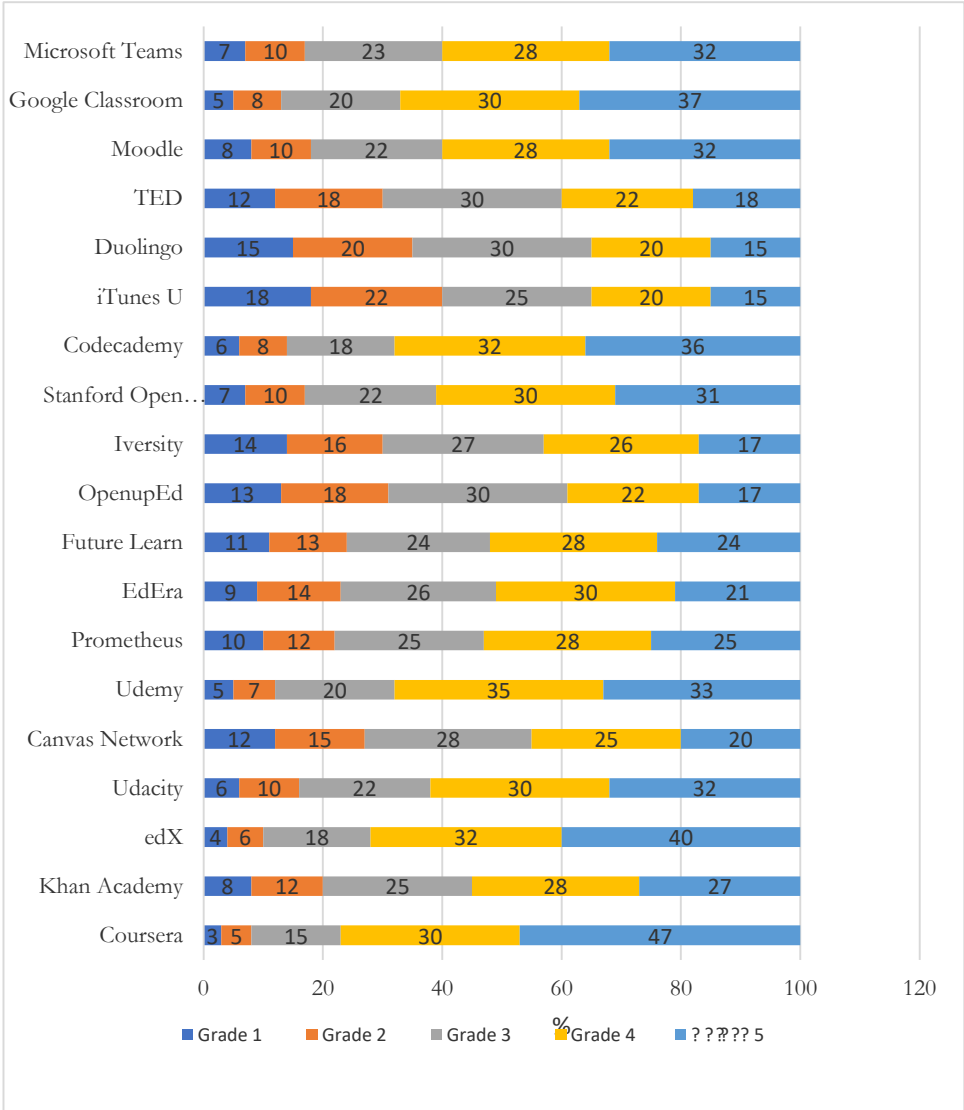
Figure 1: *Analysis of the contribution of learning platforms to the development of students' digital and professional skills*
Notes: grade 1 – not at all; grade 2 – moderate level of assistance; grade 3 – medium level of assistance; grade 4 – high level of assistance; grade 5 – maximum level of assistance
Source: Authors' own calculations based on the survey

Thus, the effectiveness of learning platforms in developing professional and digital competencies depends on their specifics, course content, and the tools they provide for the development of educational and professional skills.

Based on the received data, a great part of the respondents rates the usage of learning platforms as the effective method to acquire professional competencies.

Specifically, 35.34% of the respondents expressed that the platforms are highly effective at the development of their skills, and 35.70% expressed them to be effective. These findings show that the platforms have a positive influence on the learning process because most users indicate the level of engagement in the learning process is high. Simultaneously, the recognition of the use of platforms as ineffective only by 7.94% of the respondents, which shows that there are a small number of respondents who have not yet made platforms a major instrument in building professional capabilities. Meanwhile, only 3.88% reported that they did not notice any impact of using such resources, which might be the evidence of the poor adaptation of these respondents to using digital technologies in studying.

The regularity of using digital learning platforms represents another important indicator when evaluating their influence on students' professional preparation. According to the survey results, 37.49% of respondents reported engaging with such platforms several times per week, which demonstrates their active participation in the educational process through digital resources. In addition, 24% of students stated that they access these platforms on a daily basis, highlighting the considerable degree to which such tools have been integrated into their academic activities.However, there is also a category of students who use platforms less actively: 14.39% of respondents indicated that they rarely use the platforms, and 6.27% do not use them at all, which may indicate the need for additional incentives and motivational measures to encourage more active use of digital resources in learning.

In terms of changes in digital skills after using the learning platforms, the results show a positive trend. 36.72% of respondents reported a significant improvement in their digital skills, and 37.01% reported a noticeable improvement, which indicates the effectiveness of the platforms in developing the capacity to work with new technologies and digital tools. Only 10.57% of respondents did not note any changes in their skills, which may be the result of insufficient use of platforms or the inadequacy of course materials to meet certain student needs, while only 1.67% of respondents admitted that the quality of their digital skills had decreased, which is a small percentage of the total sample (Figure 2).
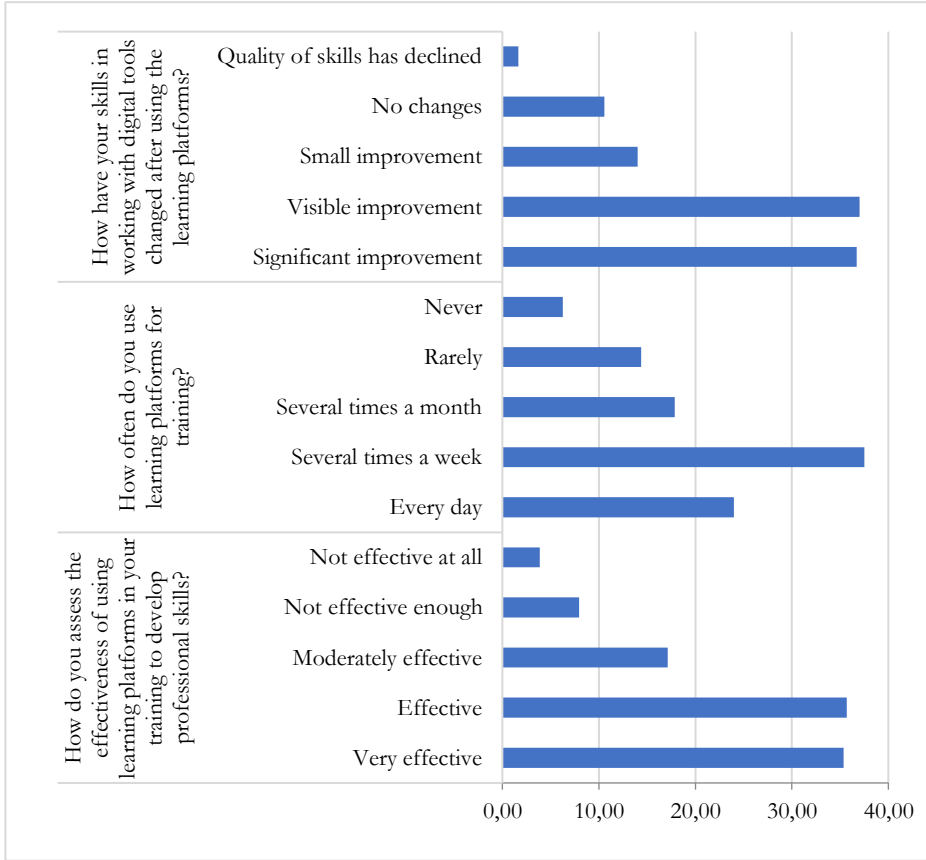
Figure 2: *Evaluation of the effectiveness of learning platforms in the development of students' professional competencies*
Source: authors' own calculations based on the survey

As the discussion of the results shows, learning platforms also contribute significantly to the development of professional skills in students to facilitate the successful process of mastering digital tools and technologies. However, in order to make the most of them, it is necessary to arouse the motivation of those students who use such platforms with less frequency and provide the content they use with greater customization to the needs of the various users.

The results of the surveys also show that various digital tools, which serve to develop competency, are actively used (Figure 3). Quizlet was the most popular among them and 77.5% of respondents admitted to using it. This proves the usefulness of the platform in autonomous learning especially in consolidation of knowledge using flashcards and interactive activities. Moreover, Kahoot! was chosen by 68.7% of the respondents, which showed its high ability to attract students due to the elements of gamification and interactive testing, which contribute to the learning process significantly.
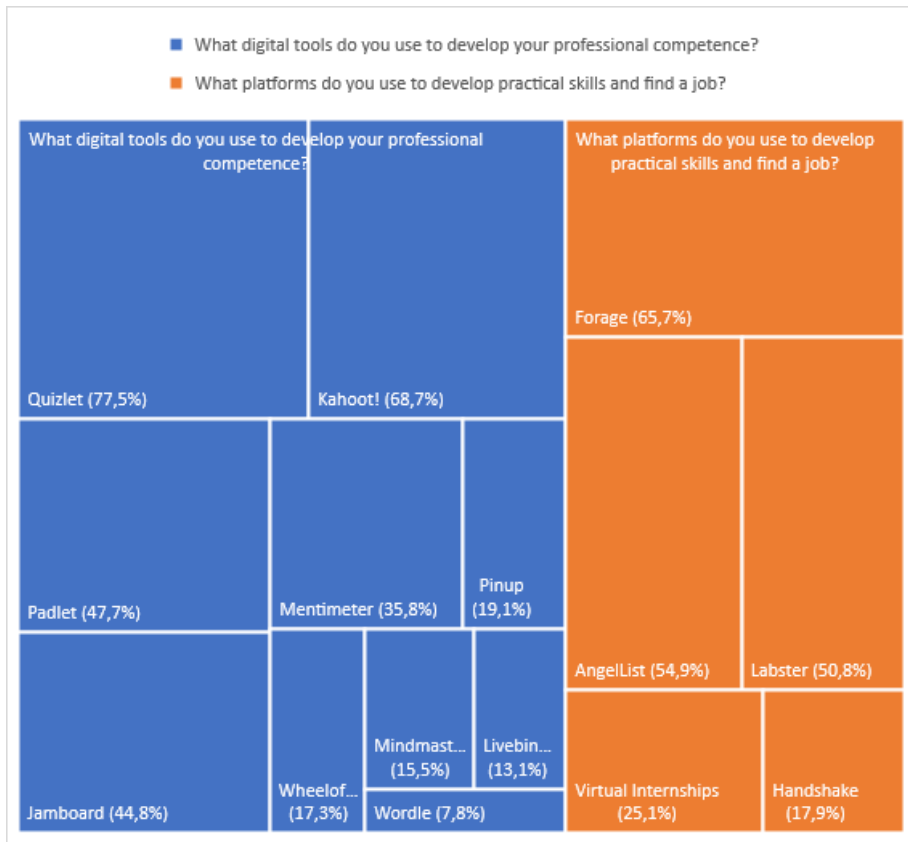
Figure 3: *Analysis of the effectiveness of digital platforms and tools for developing practical skills and career preparation*
Source: authors' own calculations based on the survey

Platforms that are less popular, such as Pinup (19.1%) and Mindmaster (15.5%), have more specific uses, focusing on visualization and mapping of ideas, which can be useful for solving design or strategic planning tasks. The use of Wheelofnames (17.3%) and Livebinder (13.1%) is also limited, which may be due to their specific use in individual or customized cases. In addition, fewer than 10% of respondents reported using tools such as Wordle (7.8%), suggesting their limited significance in the context of professional competence development.

When considering platforms aimed at fostering practical skills and supporting career preparation, Forage emerged as the most widely used, with 65.7% of students indicating their engagement with it. This platform offers virtual internships that replicate real workplace conditions across different sectors, including finance, marketing, technology, and law. Such opportunities enable students to acquire hands-on experience and strengthen their professional readiness. The relatively high level of student involvement with Forage underscores its value in bridging academic learning with practical job-related competencies. Other platforms for acquiring practical skills include Labster (50.8%), which provides virtual learning in areas such as biology, chemistry, and physics,

allowing students to gain experience with laboratory research, which contributes to the development of practical skills in the sciences and is an important element in preparing students for research. The AngelList (54.9%) and Virtual Internships (25.1%) platforms help students find vacancies and internships, allowing them to gain practical experience in real companies, which is important for future employment. However, Handshake is less popular (17.9%), which may indicate the limited use of this platform among students actively seeking employment opportunities.

Thus, the results of the research demonstrate that digital tools and platforms aimed at developing professional competence and job search are gaining popularity among students, although the level of their use varies depending on specific needs and types of learning tasks. Different platforms provide different opportunities for building and improving professional skills, allowing students to adapt their learning practices to meet their goals and the requirements of the modern work environment.

The analysis of survey data concerning the use of adaptive learning platforms, such as Knewton and Smart Sparrow, indicates that their overall effectiveness in enhancing students' learning outcomes remains rather limited. According to the data, 39.20% of respondents noted the low effectiveness of these platforms, which is likely due to problems with integrating the tools into curricula or their limited applicability in specific disciplines. Only 13.10% of students actively use these platforms on a regular basis, which indicates that adaptive technologies, although they have some potential to improve learning outcomes, they are not widely used in the educational environment, given their low level of efficiency and accessibility to a wide audience.

Regarding the use of chatbots, in particular Woebot, for psychological support and stress management in education, the survey results show a variety of assessments of the effectiveness of this tool. Only 12.50% of respondents do not use chatbots at all, which indicates a certain interest in these technologies. However, the majority of students evaluate chatbots as moderately effective (33.40%), and the rest of the respondents note the effectiveness of these chatbots quite often (25.10%), which indicates a significant role of these tools in overcoming stressful situations. Only 11.70% of respondents recognized chatbots as very effective, which indicates the need to optimize their algorithms and functionality to achieve higher efficiency in providing psychological support.

The analysis of using digital platforms for scientific activities, such as ResearchGate, Mendeley, JSTOR, ScienceDirect and Google Scholar, showed that they have a high level of use among students and researchers. In particular, ResearchGate (30.30%), Google Scholar (28.30%), and Mendeley (26.10%) were highly rated for their effectiveness in supporting research, which confirms the importance of these platforms for access to scientific publications, collaboration with other researchers. The JSTOR (23.90%) and ScienceDirect (22.20%) platforms also demonstrate a high level of use in the research process, although their effectiveness was assessed somewhat lower, which may be due to the specifics of the scientific fields in which these resources are used, as well as the level of access to their paid versions (see Table 1).

Table 1: Study on the use of adaptive learning platforms, chatbots and scientific resources in the educational environment

Question		1 (never / not effective at all)	2 (rarely / almost not effective)	3 (sometimes / effective)	4 (quite often / almost effective)	5 (very often / very effective)
How often do you use adaptive learning platforms such as Knewton or Smart Sparrow to improve your learning outcomes?		39.20%	28.10%	19.60%	8.30%	4.80%
How effective do you think chatbots like Woebot are in providing psychological support and helping to overcome stress during studies?		12.50%	17.30%	33.40%	25.10%	11.70%
How do you evaluate the effectiveness of using digital tools such as ResearchGate, Mendeley, JSTOR, ScienceDirect, and Google Scholar for your study?	*ResearchGate*	3.40%	8.60%	27.50%	30.20%	30.30%
	Mendeley	4.30%	7.10%	33.80%	28.70%	26.10%
	JSTOR	5.50%	10.20%	31.90%	28.50%	23.90%
	ScienceDirect	6.30%	9.80%	32.60%	29.10%	22.20%
	Google Scholar	3.10%	4.40%	34.50%	29.70%	28.30%

Source: authors' own calculations based on the survey

So, according to the received results, it is possible to mention that adaptive platforms have not been popularized in the academic process; chatbots, despite having a certain level of demand among students, should be further optimized to make their application in the sphere of psychological support more effective; and digital assistants of scientific activity are the primary ones in the educational environment, but they should be enhanced to make the use of chatbots more effective.

Based on empirical data analysis, the use of digital platforms, tools and resources has a strong influence on the formation of key competencies of higher education students. Specifically, the intensity of the digital competence among the respondents who incorporate digital technologies into the learning process increases significantly (1203 vs. 259), which proves the positive interdependence between technological adaptability and the efficiency of the digital skills learning process. The same tendency is demonstrated by the indicators of information and communication competence (1286 vs. 356) and cognitive activity in the digital environment (1275 vs. 348), which confirms the high degree of students' involvement in the use of online resources for educational activities. At the same time, the increase in the level of media literacy (1185 vs. 412), information literacy (1250 vs. 365) and search skills (1103 vs. 298) correlates with the expansion of access to structured scientific information through specialized digital tools. The increase in

communication and collaboration competencies (1133 vs. 384) is also an important aspect, indicating the growing effectiveness of digital platforms in ensuring interactive interaction of students. At the same time, the relatively lower rate of personalized information strategy (981 vs. 215) may indicate the need for further adaptation of digital tools to individualize the learning process (see Table 2).

Table 2: The dynamics of key competencies development in the context of digitalization of education

Indicator	Description	Without using platforms	With the use of platforms
Digital competence	The capacity to efficiently employ digital technologies for the collection, processing, and dissemination of information, encompassing proficiency in the use of digital tools and resources.	259	1203
Information and communication competence (ICT)	Mastery of basic ICT skills for organizing the educational process, research and professional tasks through digital platforms and resources.	356	1286
Media literacy	The ability to critically perceive media content produced in the digital environment and create media products for educational and professional purposes.	412	1185
Information literacy	The competence to efficiently locate, critically evaluate, and systematically organise information from diverse sources, including hypertext, multimedia, and other digital formats.	365	1250
Search skills	The ability to perform effective information retrieval using online platforms and scientific databases, including formulating the right queries and analyzing materials.	298	1103
Multimedia information management	The ability to organize and work with large amounts of multimedia content (texts, videos, images, audio) to optimize the learning process.	273	1057
Personalized information strategy	The ability to develop and implement individual strategies for organizing and managing information in accordance with personal needs and goals.	215	981
Communication and collaboration competencies	The ability to effectively collaborate with other participants in the learning process through digital platforms, discussing problems and completing tasks together.	384	1133
Cognitive activities in the digital space	The ability to carry out cognitive activities using digital tools to collect, analyze and interpret scientific information.	348	1275
Reflective and diagnostic competence	Ability to self-evaluate and adjust own learning activities based on feedback and analysis of achievements, weaknesses and development planning.	302	1095

Source: authors' own calculations based on the survey

In general, the results support the idea that the incorporation of digital platforms into teaching and learning process improves the cultivation of the essential skills and offers a good ground to build the digital literacy of students.

The findings of the paired t-test that was performed to examine the difference between the level of developing professional competence with and without the utilization of digital platforms and tools reveal that there is a statistically significant difference in means of the two groups. In particular, the average score of the sample that did not use digital platforms was equal to 321.20, and the average score of the sample that applied to digital platforms was equal to 1156.8. Such a generous gap indicates the beneficial impact of online platforms on the development and growth of professional skills. Simultaneously, the fact that the variation in each group is observed also indicates that the results can also be determined by other factors, such as the personalities of individual students (Table 3).

The obtained t-statistic of -34.39 significantly exceeds the critical value of 2.26 at the two-tailed test, which makes it possible to reject the null hypothesis concerning the non-occurrence of the differences in the means of professional competence and accept an alternative hypothesis of the significant presence of a dissimilarity. In addition, the resulting p-value (7.34×10^{-11}) is significantly lower than the standard value of 0.05, and hence, the obtained results are statistically sound. The correlation coefficient of 0.64 between the use of digital platforms and the degree of professional competence formation is moderately strong and positive. Though, it is a statistically significant relationship, the average value of the correlation indicates that not every platform has the same effect on the improvement of professional skills. The variance indicates differences in the levels of variability: for the group without digital platforms, the variance is 3823.73, and for the group using platforms – 10047.29, which indicates a greater variability of results in the group using digital platforms, which may be due to the influence of many factors, including the diversity of the platforms themselves, as well as the individual characteristics of the study participants.

Table 3: Comparative analysis of professional competencies with and without the use of digital platforms: results of a paired t-test

Indicator	Development of professional competencies without the use of digital platforms and tools	Development of professional competencies using digital platforms and tools
Mean	321.20	1156.8
Variance	3823.73	10047.2889
Observations	10	10
Pearson Correlation	0.64	—
Hypothesized Mean Difference	0	—
Number of degrees of freedom (df)	9	—
t-statistics (t Stat)	-34.39	—
P (P(T'<=t) one-tail)	3.67×10^{-11}	—

Indicator	Development of professional competencies without the use of digital platforms and tools	Development of professional competencies using digital platforms and tools
t Critical one-tail	1.83	—
(P(T<=t) two-tail)	7.34×10^{-11}	—
(t Critical two-tail)	2.26	—

Source: authors' own calculations based on the survey

Therefore, the outcomes of the paired t-test provide evidence that the application of digital platforms and tools exerts a substantial and statistically confirmed influence on the development of professional competencies.

5. Discussion

Drawing on the obtained findings, a number of important theoretical and practical conclusions can be formulated concerning the development of students' professional competencies in the digitalised educational environment. The results demonstrate that learning platforms are a crucial factor in fostering professional competencies; however, their overall effectiveness is determined by the specific type of platform, the range of its functional capabilities, and the degree of its integration into the educational process.

Firstly, the research findings revealed that platforms offering certification courses and specialized training programs have the greatest contribution to the development of students' professional competencies. These platforms, Coursera, edX, Udemy and so forth have a substantial influence on the development of digital, information, media and collaboration competencies, on which the development of students depends professionally. Google Classroom and Microsoft Teams are learning management tools that can help one build communication skills and facilitate successful collaboration, but they may not be sufficient to train to become a specialized professional.

Secondly, adaptive learning platforms, despite their potential, have not been widely implemented in the educational process, which requires further study of the factors that limit their effectiveness and integration into curricula. Thirdly, chatbots as psychological support tools are in some demand among students but their effectiveness requires further optimization. Finally, digital platforms for scientific activities, such as ResearchGate, Mendeley, JSTOR, ScienceDirect, and Google Scholar, remain the main tools for scientific activity but their functionality needs to be further improved to achieve greater efficiency.

The outcomes of the study align with the theoretical perspectives of several researchers who underscore the pivotal role of digital technologies in transforming educational processes and fostering the professional competencies of higher education students. Specifically, it was observed that engagement with online educational platforms serves as a critical driver for developing professional skills, digital literacy, and competencies related to effective communication and collaboration within digital environments. These findings correspond with the conclusions of AlDahdouh (2021), who

highlights the significance of information technology in reshaping the educational paradigm and preparing specialists for the demands of a digital society.

Analysis of the empirical data obtained confirms the position of Edmunds et al. (2020) regarding the high effectiveness of online courses in the process of students acquiring professional competencies. It has been established that the integration of Coursera, edX and Udemy platforms into the educational process contributes to the adaptation of educational programmes to the modern requirements of the labour market, ensures the development of specialised professional skills and expands the interdisciplinary training of students. At the same time, the higher effectiveness of these platforms compared to others can be explained by the design features of the courses, the authenticity of assessment practices, and the availability of mentoring support and student support mechanisms, which ensure deeper specialisation. This observation opens up space for a broader discussion of how pedagogical models and platform capabilities interact in the process of competence formation and how effectively this dynamic meets the needs of the labour market, which outlines an important direction for further research.

Furthermore, the findings of this study support the conceptual assumptions outlined by Hatlevik et al. (2015), who emphasise the multidimensional nature of digital competence. It encompasses not only technical proficiency but also the capacity to apply digital tools in a creative, critical, and responsible manner, both individually and collaboratively. At the same time, the results are consistent with the perspective of From (2017), who argues that digital competence integrates the ability to employ theoretical knowledge, practical skills, and research-based approaches in the design, implementation, and evaluation of learning processes supported by information and communication technologies.

The outcomes are in addition to those provided by Draydakis (2022), Ala-Mutka (2011), Torres-Coronas and Vidal-Blasco (2011), and Park and Weng (2020), who state that the application of digital technologies leads to the effective transformation of information into knowledge, operational processes, and services with the aid of analytical, productive, and creative use of digital resources and social software. Based on this, the findings of the research prove the great importance of digital educational platforms to optimize the learning process and enhance the professional competence of students, thus showing the significance of further implementation of information technologies in the academic life, further enhancing its response to the dynamic needs of the digital society.

6. Conclusions

According to the study, the digitisation of education is a decisive factor in shaping students' professional competencies. It has been established that the integration of adaptive educational platforms and digital resources contributes to the development of specialised skills, critical thinking and professional mobility. At the same time, translating these findings into education policy requires the development of effective standards for updating curricula, targeted measures to improve teacher qualifications, and the creation of an assessment system that directly links interaction with digital platforms to measurable skills. Integrating the principles of equity, accessibility and quality assurance into these processes will ensure systemic improvements and promote sustainable, evidence-based

discussions between educational institutions and accreditation bodies at both national and international levels. Empirical evidence has shown that digital tools are highly effective for training professionals but their effectiveness depends on the level of integration into the educational process and pedagogical strategies. Further studies should focus on improving methodological approaches to the use of digital technologies in vocational education.

The results of the empirical research prove the significant role of the digital educational platforms in the construction of the professional competencies of the students. The expression of this influence is their flexibility to adaptation to change in technology, their ability to interact well in online space, their critical ability think effectively as well as their levels of digital literacy. The frequency and intensity of using digital learning tools were also determined to be correlated to the acquisition of specialised knowledge and practical skills that must be given to the future professional to make it competitive.

The practical significance of the research is that it is possible to implement the study findings and suggestions to enhance the design of higher education programmes, offer a methodological framework of the combination of digital technologies into the learning process, and increase the efficacy of the distance and blended learning models. The suggested solutions could be used as the basis to establish the adaptive learning strategies involving innovative digital solutions to the professional training based on the requirements of the modern labour market.

Future studies ought to focus on the more in-depth analysis of how digital technologies impact professional growth of students and take into consideration the unique attributes of different disciplines of study. The potential directions that promise to succeed are the exploration of the feasibility of personalised learning pathways, modelling the adaptive model by using artificial intelligence, and determining the most appropriate methodology of measuring professional competence in the digitalised learning setting. Simultaneously, preference must be given to mixed research methods that will integrate the analysis of behavioural information with learning outcomes, therefore, allowing a more accurate interpretation of the mechanisms in the formation of competence. Inter-institutional experiments and pre-registered replications can be used to additional assure scalability, methodological rigour, and due regard to other aspects, including accessibility, motivation, a learning context, and equity principles.

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