

Understanding digital competence profiles among in-service and prospective art teachers in Kazakhstan

Masoumeh Shiri¹, Aidar Kuzdeubayev¹, Aidyn Kozhagulov¹, Zhazira Stambekova¹, Rakhat Berikbol², Nurgul Koshkinbayeva³

¹Faculty of Art, Abai Kazakh National Pedagogical University, Almaty, Kazakhstan

²Department of Art, Shakarim University, Semey, Kazakhstan

³Faculty of Music and Art Education, M.Kh. Dulaty Taraz University, Taraz, Kazakhstan

Article Info

Article history:

Received Jan 14, 2026

Revised May 20, 2026

Accepted May 28, 2026

Keywords:

Art education

Art teachers

Digital competence

Digital tools

Prospective art teachers

ABSTRACT

This study investigates digital competence profiles between in-service art teachers and prospective art teachers (students in art teacher education programs) across three universities in Kazakhstan. Addressing a notable gap in understanding how digital skills are distributed in art education, the research employs a comparative descriptive design with a mixed-methods approach, combining a structured survey based on the European DigCompEdu framework and semi-structured interviews. Teachers were measured in the six domains of digital competence: professional engagement, digital resources, teaching and learning, assessment, empowering learners and enabling learners' digital competence. Data from 197 participants (41 teachers, 156 prospective) showed following profiles: prospective fare better in creative and communication competencies; in-service performances are good on professional engagement and structured pedagogical activities. Face-to-face interviews triangulated findings across the survey and revealed how teacher use of digital tools in teaching and learning is shaped by generational differences prior training, as well as professional experience. These results highlight a necessity to develop role-sensitive digital skills in the field of art education. By triangulating quantitative and qualitative evidence, the study provides a nuanced understanding of digital competence across career stages and supports targeted training initiatives. It also lays the groundwork for future research using performance-based assessments and broader comparative contexts.

This is an open access article under the [CC BY-SA](https://creativecommons.org/licenses/by-sa/4.0/) license.



Corresponding Author:

Masoumeh Shiri

Faculty of Art, Abai Kazakh National Pedagogical University

Almaty, Kazakhstan

Email: m.shiri@abaiuniversity.edu.kz

1. INTRODUCTION

Over the last decade, the rapid digital transformation of educational systems around the world has significantly reshaped teaching and learning practices. Digital competence is no longer a supplementary skill but a central component of professional readiness for educators in the 21st century, as they are expected to integrate technology meaningfully into instruction and learning environments [1], [2]. Recent research highlights the importance of digital competence frameworks, such as the European Digital Competence Framework for Educators (DigCompEdu), in assessing and enhancing teachers' readiness for digital innovation in education. This framework offers structured guidance for identifying knowledge, skills, and attitudes necessary for effective digital teaching practice [3].

In Kazakhstan, at the national level, some programs such as the “Digital Kazakhstan” initiative intend to develop infrastructure and promote information and communication technology (ICT) integration in higher education and expand digital access throughout the country [4]. Despite these policy improvements, the establishment of teachers’ and future teachers’ digital competences regarding the creative and pedagogical use of such tools is problematic [5], [6]. For instance, although a number of universities have implemented digital learning management systems as part of their online teaching, a good proportion of teachers continue to express lack of confidence in effectively using such digital systems. Furthermore, the mere provision of technology does not necessarily result in relevant pedagogic utilization, particularly with respect to specific domains (e.g. art education) [7], [8]. Art education poses unique demands for digital competence because it requires not only technical proficiency but also creativity, aesthetic understanding, and the ability to facilitate artistic expression through digital tools. These tools include graphic design software, digital illustration applications, and online platforms for critique and collaboration, which extend beyond generalized digital skills into discipline-specific digital competence that are essential for both educators and future teachers.

This study contributes to the existing literature in three important ways. First, it examines digital competence within the discipline-specific context of art education, which remains underrepresented in prior research. Second, it explores differentiated digital competence profiles across career stages by examining both in-service and prospective art teachers within the same national system. Third, by integrating quantitative and qualitative data, the study provides a triangulated understanding of how digital competence manifests in creative educational settings. These contributions address both conceptual and empirical gaps in the current literature.

The rapid expansion of digital technologies in education has generated a global need for clearer conceptualization of educators’ digital competence across different career stages and disciplinary contexts. While frameworks such as DigCompEdu provide structured models for assessing educators’ digital competence, ongoing scholarly debate emphasizes that digital competence is not uniformly developed or expressed across professional roles. Differences in experience, pedagogical responsibility, and institutional engagement may shape how digital competence manifests in practice. Consequently, understanding how digital competence evolves from teacher preparation programs to in-service teaching has become an important conceptual and empirical question in contemporary educational research.

Although international studies have examined teachers’ digital competence extensively, most research focuses either on in-service teachers or on university students as separate populations [9]. A few cross-sectoral studies have examined similarities and differences between pre-service and in-service teachers in general education-based studies [10]; however, area-specific studies are somewhat scarce. More specifically, art education imposes certain unique requirements that include master practice skill, creative output work, aesthetic judgment and collaborate critic in digital media. These interdisciplinary natures indicate that the CDC in art education can be formed differently from other subjects. In the national context of Kazakhstan, whose digitalization policies are gaining momentum, there is currently little empirical evidence on educators preparedness (or not) in creative disciplines. It is also not common for current research to explore in-service and pre-service art teachers’ online competence profile within the same educational system. Moreover, limited attention has been given to how professional positioning—being a practicing teacher versus a teacher candidate—shapes the configuration of digital competence within a shared pedagogical trajectory.

In this study, the term prospective art teachers refers to students enrolled in formal art teacher education programs who are preparing for professional teaching careers. As future educators, their professional digital competence development is directly linked to the sustainability of digital transformation initiatives. Therefore, applying the DigCompEdu framework in this context enables an exploration of differentiated digital competence profiles across career stages within a discipline-specific and nationally situated educational system. In this study, we sought to understand the different digital competence profiles in-service art teachers and (prospective) art teachers based on the DigCompEdu framework in Kazakhstan. Furthermore, the objectives of the study are:

- In six DigCompEdu domains, both prospective art teachers and in-service art teachers digital competence level is surveyed.
- The advantages and disadvantages for each group are then compared in turn by section.
- Operational patterns that might come out of these different competency levels are investigated further using a combination of statistical results and semi-structured interviews.

The study itself is situated in a dual-angle context owing to its perspective of three different issues. First, it gives discipline-specific proof in the field of art education, which has not been studied enough. Second, it broadens the use of DigCompEdu to a comparative study of pre-service and in-service educators within a single national framework. Finally, the study uses a mixed-methods approach to give three different views on both measured competence levels and real-life work experiences. The results may affect how

Kazakhstan and other countries with similar new educational systems design their curricula, train teachers, plan professional development, and set national digital education policy.

Digital technologies have become more and more important in modern education, especially in creative fields like art education, where making things, designing things, and using multimedia to express yourself are all important parts of learning. The theories guiding the integration of technology and pedagogy include a range of models. For instance, the technological pedagogical content knowledge (TPACK) model highlights the intersection of content knowledge (CK), pedagogical knowledge (PK), and technological knowledge (TK) [11]. In other words, the effective integration of technology in the classroom involves not only computer literacy skills, but also the ability to use technology in the specific subject area and pedagogy.

Studies completed in Kazakhstan have demonstrated that art teachers as well as students can possess a relatively high level of digital proficiency. Despite this, the meaningful integration of technology with content and lesson objectives can prove difficult [12]. Other international studies have found that digital integration is reliant on a teacher's knowledge of how to integrate technology as well as their ability to do so, rather than their ability alone [13]. Although veteran faculty may agree with these concepts in theory, they may struggle to keep up with rapidly changing digital technology [14].

Studies comparing competences between practicing teachers and pre-service teachers reveal differences in their digital competence profiles [15], [16]. Often, practicing teachers have been found to have a higher level of professional and theoretical understanding about concepts such as curriculum development and lesson planning. However, pre-service teachers are often more knowledgeable about online communication, design tools, and collaboration platforms as they are typically more accustomed to operating in digital environments [17], [18]. Technical expertise does not always translate into sound digital pedagogy. One study performed at Abai Kazakh National Pedagogical University found that previous exposure with digital technologies played a significant role in the level of competence achieved by respondents, demonstrating that background experience and training can play an important role in digital preparedness [12]. Factors such as age, gender, technostress, and the availability of training have been recognized as influencing the process of digital competence development [19], [20]. These studies indicate the impact of the mentioned factors on the interaction of the teacher and the student with the technology. Other ideas, such as the teacher digital competency (TDC) framework, emphasize the importance of digital competence as extending beyond the technical, including aspects such as ethical, interdisciplinary, and digital participation. These are all critical in teacher education [21]. There are many studies dealing with the topic of digital competence in general educational settings, while fewer studies have been conducted in the field of comparative profiles in art educational settings.

Various digital technologies, including design software, tablets, collaboration tools, and immersive technologies, have been correlated to increased creativity and interest in art education [5]. In Kazakhstan, it was observed that the students in the art department make use of the most commonly used design software like Photoshop and CorelDRAW. However, the use of new technologies like artificial intelligence (AI) and augmented reality (AR) is still in the nascent stage, and the students lack training in these areas. It was observed that the previous experience and motivation of the students impact their levels of engagement. Some studies suggest that the levels of engagement are higher among the students using the technologies they are familiar with, whereas the unfamiliarity of the technologies may require additional support from the teachers [22]. In addition, the disparities in the levels of digital engagement are correlated to the disparities in access, self-efficacy, and learning strategies.

Kazakhstan has initiated several initiatives to utilize digital technology to modernize its schools [23]. The national "Digital Kazakhstan" plan and the HIEDTEC project are two good examples. The goal of these activities was to enhance infrastructure, implement learning management systems, and foster faculty development [4]. However, there are also challenges, including unequal access to digital technologies, regional disparities, and a lack of clear quality assurance methods [24]. Going digital is another way to see how culture and generations evolve. Generation Z students, who are currently the main buyers of college education, want classrooms that are full of media and interactive [25].

Some research has examined digital competence from a broader systemic, policy related, or specialized perspective, in addition to studies that focus on teachers and students. Researchers have investigated topics such as how students with disabilities acquire digital skills [26], the utilization of digital resources in inclusive classrooms [27], and how digital literacy can help individuals identify false information [8]. Other research has examined Kazakhstan's ICT infrastructure, policy frameworks, and the psychological and educational factors necessary for teaching digital skills in schools [28], [29].

Consequently, higher education institutions face the task of aligning curricular design and teacher preparation programs with evolving technological demands. In summary, the literature delineates several critical dimensions pertinent to digital competence in art education: theoretical integration models (e.g., TPACK), comparative distinctions between in-service and prospective teachers, patterns of digital engagement, and national policy reforms. While current research offers significant insights into digital

transformation in Kazakhstan, comparative analyses of digital competence in art education utilizing structured international frameworks are still scarce. This context lays the groundwork for the current study.

2. METHOD

2.1. Research design

This study employs a comparative descriptive design to examine and explore differences in digital competence profiles of in-service art teachers and prospective art teachers (students enrolled in teacher education programs preparing for professional art teaching) across three universities in Kazakhstan. The research employs both quantitative and qualitative methodologies to deliver a thorough comprehension of participants' digital competencies and practices. The quantitative part uses a structured survey based on the DigCompEdu framework [30]. This framework gives a complete way to measure teachers' digital skills in a wide range of teaching and learning situations, such as technical, pedagogical, and creative ones [3]. There are six areas of competence in the framework: i) professional engagement; ii) digital resources; iii) teaching and learning; iv) assessment; v) empowering learners; and vi) helping learners improve their digital skills

There are also specific indicators for each area, which show the way in which the participants utilize digital tools in their professional and creative work. The framework was adapted to fit the real world of art education, including fine arts, graphic design, and digital media. This was done to ensure that the questions in the questionnaire would be useful not just to current, but also to future, art teachers. This approach made it possible to compare the results for future and current art teachers in a way that was consistent with the DigCompEdu framework, in that it measures professional digital competence, not general digital competence, as shown in Table 1. Future art teachers are future professionals on the same path, and the adapted tool was made to measure the same aspects of their professional digital competence, taking into account the differences in their experience in light of their specific professional roles.

The qualitative aspect involved conducting semi-structured interviews with the selected participants to explore their experiences, attitudes, and reflections on the use of digital tools in art education. This study used triangulation, in which survey and interview results were combined, to provide a more complete and deeper understanding of digital competence. The results of the qualitative approach not only helped to expand the results of the survey, but also provided examples of digital skills in real-life situations, as in Table 1.

Table 1. Adaptation of DigCompEdu to art education context

Competence area	Original definition (DigCompEdu)	Adapted for art education (teachers/students)
1. Professional engagement	Using digital technologies for communication, collaboration, and professional development	Using Zoom and WhatsApp groups to talk about projects, give feedback on art, and keep up with the latest trends in digital design
2. Digital resources	Selecting, creating, and sharing digital educational resources	Choosing and changing digital art tools (like Adobe Photoshop and Illustrator); sharing reference materials, tutorials, and portfolios
3. Teaching and learning	Managing and orchestrating digital teaching and learning	Using digital painting, 3D modeling, or animation tools in the classroom and for project-based learning
4. Assessment	Using digital tools to enhance assessment strategies	Using peer-review apps or rubrics on platforms like Google Classroom or Padlet to look at digital art portfolios
5. Empowering learners	Using digital tools to cater to learners' needs and actively engage them	Encouraging students to express themselves through multimedia and making digital tools more accessible for art projects that include everyone (like visual storytelling and typographic experiments).
6. Facilitating learners' digital competence	Helping learners develop their digital skills	Teaching students how to use digital design software responsibly and creatively, as well as how to handle copyrights, curate digital art, and show art online

2.2. Participants and sampling

There were 197 participants in the study: 41 current art teachers and 156 future art teachers from three universities in Kazakhstan. Participants were chosen due to their active engagement in art education domains, encompassing design, visual arts, and applied arts. A purposive sampling strategy was utilized to obtain a varied array of digital experiences pertinent to both professional practice and pre-service education.

Table 2 shows the demographic information. There were 16 men and 25 women teachers, all between the ages of 28 and 60 and with 3 to 30 years of experience. There were 42 men and 114 women between the ages of 18 and 26 who were studying for a bachelor's or master's degree in art. These demographic disparities are significant for comprehending the influence of professional experience and generational familiarity with digital tools on digital competence in art education, as in Table 2.

Table 2. Demographic characteristics of participants

Group	N	Gender		Age range	Teaching experience/year of study
		Male	Female		
Teachers	41	16	25	28-60	3-30
Students	156	42	114	18-26	1-6

2.3. Instrument

Quantitative survey: a structured questionnaire design, based on the DigCompEdu self-reflection tool, was employed in the study. The tool consists of 22 elements, one for each of the six areas of competence defined in the DigCompEdu framework. A 5-point Likert scale, where 1 means “not at all competent” and 5 means “highly competent”, was used in the study. Participants responded to the survey online through institutional networks, providing a form of self-report that aligned with their role as a teacher or learner. The survey was adapted to ensure its relevance to aspiring art educators, who represent the future instructors along the same educational trajectory, and the context of art education. Qualitative interviews: semi-structured interviews were used to capture participants’ views on their level of digital competence, use of resources, communication, use of creative tools, and professionalism. The use of both methods provides a triangulation of approach, allowing a mixed-methods design to be employed.

2.4. Construct validity: Kaiser–Meyer–Olkin, Bartlett’s test, and principal component analysis

The data analysis was done using SPSS statistics, and it involved the use of descriptive and inferential statistics. The means, standard deviation, and frequency calculations were done for each of the competence domains. Independent t-tests were used to compare the groups, and the results included the effect sizes using Cohen’s d, while the internal consistency of the six domains was verified using Cronbach’s alpha coefficient. Comparative bar charts were used to show the differences in the groups, as shown in Table 3.

Table 3. Principal component analysis results for the digital competence scale

Item	Component	Factor loading	Communality
PE1	1	0.685	0.674
PE2	1	0.529	0.717
DR1	2	0.606	0.810
DR2	2	0.656	0.761
TL1	1	0.712	0.671
TL2	1	0.712	0.671
A1	3	0.642	0.642
A2	3	0.696	0.696
EL1	4	0.762	0.762
EL2	4	0.855	0.855
FL1	5	0.742	0.746
FL2	5	0.703	0.644

2.5. Data analysis

The data were analyzed with SPSS statistics, which uses both descriptive and inferential statistics. We found the means, standard deviations, and frequencies for each area of competence. Independent samples t-tests were performed to compare groups; in instances where normality or equal variance assumptions were breached, Levene’s test and Welch’s correction were utilized. We used Cohen’s d to report effect sizes, and Cronbach’s alpha showed that the six domains were consistent with each other. Comparative bar charts showed the differences between the groups in a clear way. Thematic coding was used on interview transcripts to find important patterns and show how participants used digital technology.

2.6. Ethical consideration

Before collecting the data, the consent of all the participants was obtained. The study was conducted according to the rules set by the school and the country regarding the rights of participants. There was no personal information collected from the participants, and the data was kept private. Also, the participants were made aware that the data collected from them was only for academic purposes and that they had the right to withdraw from the study at any time. Moreover, the Ethics Committee at Abai Kazakh National Pedagogical University approved the plan for the study. This ensures that the data was treated fairly, the rights of the participants were respected, and the study was conducted honestly and transparently (Approval No. AB2025-073, given out on January 4, 2025).

3. RESULTS AND DISCUSSION

3.1. Results

3.1.1. Quantitative result

Figure 1 shows the average scores for current and future art teachers in the six DigCompEdu competence areas. Overall, prospective art teachers had higher average scores in a number of areas, especially in teaching and learning and facilitating learners’ digital competence, where the differences between the two groups were most clear. In contrast, in-service art teachers had higher average scores in professional engagement and digital resources. This suggests that they were better at structured professional practice and institutional digital responsibilities. This initial comparison shows that the two groups have different levels of competence. Prospective art teachers seem to be better at learner-oriented and creative digital practices, while in-service teachers seem to be better at professionally embedded digital activities, as in Figure 1.

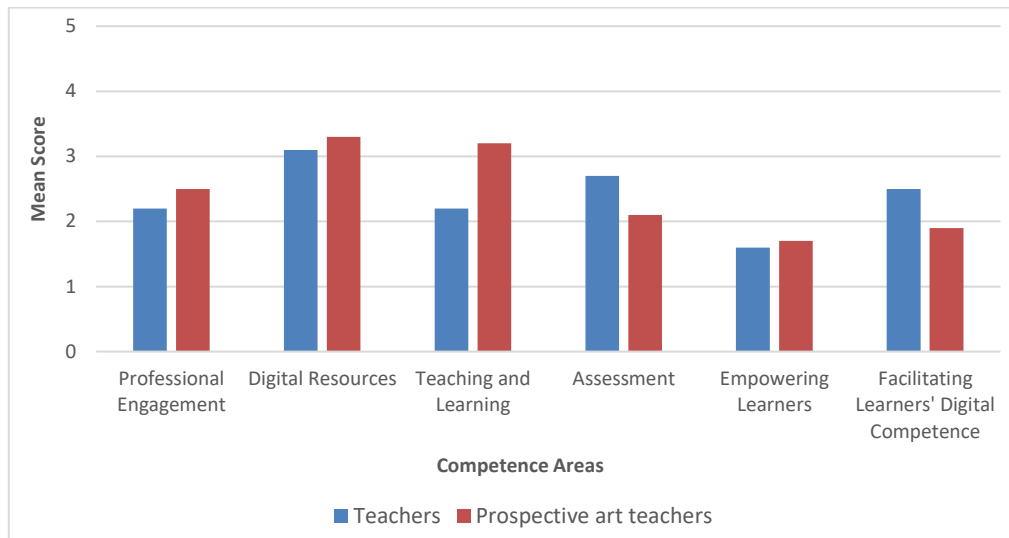


Figure 1. Comparative mean scores of teachers and prospective art teachers across the competence areas

Table 4 shows the results of independent samples t-tests that looked at the digital skills of teachers and students, as well as the effect sizes that went along with them. The findings indicate that teachers significantly outperformed students in professional engagement ($t=3.41$, $p=0.001$, $d=1.038$) and digital resources ($t=2.472$, $p=0.017$, $d=0.752$). The effect sizes were high and medium to large, in that order. Students performed significantly better on assessment ($t=-3.102$, $p=0.003$, $d=-0.944$) and facilitating learners’ digital competence ($t=-3.012$, $p=0.004$, $d=-0.916$), both demonstrating large effect sizes. These results show that teachers are better at using digital tools to plan their lessons and organize their work, while students are better at studying on their own and working together online. There were no significant differences in empowering learners, which could imply that this is a weak area for everyone, as in Table 4.

Table 4. T-test and effect sizes

Competence area	Group with higher mean	Mean difference	t-value	p-value	Cohen's d	Effect size
PE	Teachers	0.7593	3.41	0.001	1.038	Large
DR	Teachers	0.7037	2.472	0.017	0.752	Medium to large
TL	Teachers	0.463	1.798	0.079	0.547	Medium
A	Students	-0.7222	-3.102	0.003	-0.944	Large
EL	–	-0.0185	-0.096	0.924	-0.029	Negligible
FL	Students	-0.6296	-3.012	0.004	-0.916	Large

Table 5 shows the average and standard deviation for each competence area, as well as the Cronbach’s alpha values for the adapted instrument. The values indicate that the instrument was reliable. The average Cronbach’s alpha for the questionnaire was 0.82. This means that the questionnaire was mostly reliable. Students performed better than teachers most of the time, especially when it came to digital resources ($M=3.3$) and teaching and learning ($M=3.2$). On the other hand, teachers performed better when it

came to helping students improve their digital skills ($M=2.5$) and assessment ($M=2.7$). The descriptive trends also supported the results obtained from the inferential analysis, indicating that the tool was still effective in art education, as in Table 5.

The last comparison of the total digital skills of students and teachers shows a small difference. On a 5-point scale, students scored higher overall ($M=2.45$) than teachers ($M=2.38$). This difference is small, but it shows a trend among generations: students who grew up with technology may be more comfortable using digital platforms, even if they are not necessarily better at everything, as shown in Figure 2.

Table 5. Descriptive statistics and reliability of competence areas

Competence area	Mean (T)	SD (T)	Mean (S)	SD (S)	Cronbach's alpha
PE	2.2	0.73	2.5	0.69	0.82
DR	3.1	0.90	3.3	0.96	
TL	2.2	0.75	3.2	0.89	
A	2.7	0.66	2.1	0.80	
EL	1.6	0.60	1.7	0.60	
FL	2.5	0.61	1.9	0.67	

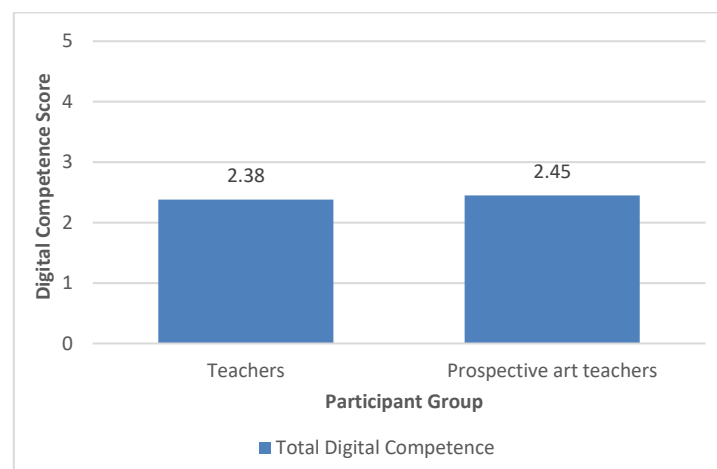


Figure 2. Total digital competence of teachers and prospective art teachers

3.1.2. Qualitative insights from interviews

To complement the quantitative results, a series of semi-structured interviews was conducted among a group of participants from the same three universities. In total, there were eight participants, four of whom were current art teachers, and the other four were senior art teachers who were contemplating a career as art teachers. All the participants gave their informed consent to be part of the study and had the option to remain anonymous by using fake names. They could be interviewed either physically or through video conferencing.

The interview process was conducted through a series of open-ended questions about the experiences of the participants regarding digital tools in creative processes, the challenges facing the integration of digital tools in art education, self-assessment of their digital competence, and suggestions to improve their digital competence training. Each interview lasted between 25 to 30 minutes. Thematic analysis identified multiple recurring patterns corresponding to the six DigCompEdu competence areas. The qualitative findings enrich the survey results by demonstrating the application of digital competence in both educational and creative contexts, as presented in Table 6.

Interviews provided a nuanced picture of how prospective art teachers and current art teachers engage with digital technologies across the six DigCompEdu competence areas. A number of significant patterns and differences were identified that highlighted the widely varying digital experiences and expectations of the cohort. Confidence in digital environment: tutors have admitted that they were not always confident when using digital tools. This was often because they were not formally trained, and intimidated by the swirling sea of new technology thrashing against their feet. On the other hand, pre-service art instructors were found to be more flexible and confident with, frequently teaching themselves about new digital platforms through online tutorials, support from their peers, and a trial-and-error process. This generation gap highlights the importance of formal, teacher-focused professional development opportunities that can remove any “informal learning” bias.

Table 6. Illustrative quotes comparing teacher and student perspectives across digital competence areas

Theme	Supporting quote (teacher)	Supporting quote (student)
Digital confidence	Some platforms intimidate me; we were not taught how to use them.	Most of the time, we figure out how to use tools by trying things out.
Digital confidence	I often skip updates because it takes me a long time to learn new software.	When I encounter a problem, I learn more quickly by watching online tutorials.
Digital confidence	I still prefer chalkboards; technology can be distracting at times.	We are accustomed to using multiple apps to perform different tasks.
Resource use	I often reuse slides because it is hard to find new content.	We follow art pages and YouTubers to pick up new skills.
Resource use	There are some excellent digital archives, but I am not always sure how to access them.	I like to use Pinterest or Behance to make mood boards.
Resource use	I sometimes use printed books instead of online sources because I do not trust them.	When I am stuck on a design idea, I use online forums to get help.
Communication	I use WhatsApp frequently, but I am unsure how to manage online conversations effectively.	We use Google Docs and chat apps to work on group projects.
Communication	I do use email sometimes, but students do not check it very often.	I want professors to utilize interactive tools like Miro or Padlet.
Communication	I used Teams once, but no one took part.	It is easy to discuss ideas in Zoom breakout rooms.
Creative use of tools	I wish I knew how to be more creative with Photoshop.	Digital painting is a natural part of my process now.
Creative use of tools	We need to learn how to use digital tools with traditional art techniques.	I get better results when I use Procreate with hand-drawn sketches.
Creative use of tools	The tablet is great, but I am unsure how to utilize all its features.	When I work with layers and effects on a computer, I feel freer.
Professional engagement	I occasionally read online forums, but I do not feel like I am part of the digital art community.	I share my art on Instagram and get feedback from other artists.
Professional engagement	I attend webinars, but I am unsure how to utilize the new tools in class.	We share design ideas with other people on Discord or Behance.
Professional engagement	It is challenging for me to network online; I miss attending in-person exhibitions.	I found internships by looking at profiles on LinkedIn and Instagram.

- Use of resources: teachers often used materials they were already familiar with or did not look into new digital resources because they were hard to get to or took too long to figure out. At the same time, those who wanted to be art teachers were looking for new ideas and ways to teach on sites like YouTube, Pinterest, and Behance. This implies that students exhibit greater proactivity and curiosity in utilizing digital resources, highlighting the necessity of fostering analogous exploratory practices among educators.
- Communication: educators mentioned difficulties on how to communicate digitally, as there was little response from students in the email- and Team collaboration environment. Meanwhile preservice art teachers preferred interactive platforms such as Padlet and Miro, indicating a need for co-constructed expressive online spaces. This implies that various communication styles could be a challenge to effective online interaction in-depth unless properly addressed during instructional planning.
- Creative use of tools: the teachers expressed their doubts in effectively using advanced software if their basic art skills were considered traditional. On the other hand, digital painting and Procreate software were readily available for aspiring art educators to utilize in their own creative pursuits. This indicates the role of technology in promoting creativity in a variety of mediums.
- Professional engagement: the teachers felt like they were the only ones in the digital community and did not usually participate in webinars and online forums. Future artists who wanted to be teachers used websites like Instagram, LinkedIn, and Discord to improve their craft by engaging with other professionals in their field. This indicates that teachers need to be provided with better ways to network and be part of online professional communities.

Overall, these results show that future art teachers are very self-motivated and flexible when it comes to learning online. Nevertheless, teachers require specific assistance to become better with technology and to be more confident with it. In order to improve the digital competencies of teachers in art education effectively, it is essential that effective strategies be implemented to address not only the technology aspect but also the cultural and psychological impacts that affect the use of technology by teachers and students alike. The conclusions drawn from the study are better understood when you put the qualitative and quantitative findings together to have a complete view of how digital competence in art education has evolved in the past years.

3.2. Discussion

The results of this study provide a thorough understanding of the digital skills of art teachers and art teachers-to-be in Kazakhstan. The quantitative survey indicated that both groups attained scores below the

midpoint (2.5 out of 5) across all six DigCompEdu competence domains. This means that they could use some help with their digital skills. These findings align with national studies, such as Aisulu [6], indicating that many university instructors do not feel prepared to teach online. One of the best things about this study is that it used both quantitative and qualitative data. The survey revealed varying levels of competence between the two groups, while the interviews provided a more in-depth analysis of the reasons behind certain patterns. In the digital confidence domain, for instance, teachers got lower scores on the survey and said in interviews that they often felt unsure because they had not had much formal training and technology was changing so quickly. One teacher noted, “*I know how to use PowerPoint or Zoom, but I do not think I am creatively using these tools.*” In contrast, prospective art teachers scored higher in the survey for the same domain and described proactive, self-directed learning behaviors, using online tutorials and peer support. This substantiates and situates the quantitative results.

For the resource use domain, teachers had a tendency to either use the resources they already knew or avoid new resources because they were hard to access. On the other hand, prospective teachers in the art domain had explored the available sites like YouTube, Pinterest, and Behance. This was also supported by the survey results, which showed prospective teachers in the art domain had a higher interest. In the same way, teachers in the communication domain found it hard to get the students to reply to emails or Teams, but the students enjoyed using interactive tools like Padlet and Miro.

There was another evident pattern in creative use of tools: survey respondents indicated that future art teachers were engaging more consistently with creative digital tools, and this finding was corroborated by interview quotations about apps such as Procreate. Teachers, skilled in conventional pedagogical tools, struggled to introduce the use of creative digital tools into their teaching. This combination of quantitative and qualitative evidence demonstrates that the divides between generations and roles appear in specific areas of competence. The study also benchmarked its findings against those of previous studies, providing a subtler interpretation of its results. Earlier research by Sultanbayeva *et al.* [8] indicates that students excel in the creative and communicative applications of technology, whereas teachers concentrate on instructional uses. The absence of a significant difference in this regard can be explained by the fact that it was also found that there were no substantial disparities in the total scores obtained by the subjects in this study, a fact that differentiates from other studies that have reported significant differences in the total digital skills of the subjects [11]. The findings from the interview section of the study also reveal that despite the different strengths of the two groups, they face similar challenges in their profession, as teachers’ experience offsets their low digital skills and students’ flexibility offsets their low instructional skills.

Overall, the findings from the study reveal that digital skills in art education cannot be said to be evenly distributed but are instead subject to the different work environments that individuals have been exposed to in the past. The findings from the study do not imply that one of the groups is superior to the other but that they have different digital skills profiles that are complementary to each other. The teachers in the study have a well-structured digital profile that is pedagogically sound, while the prospective art educators have an adaptive and creative digital profile. The different profiles of the two groups are a result of different developmental stages in their shared profession. From the findings of the study, it is evident that there are implications that have to be taken into account in practice. The study shows that the modified DigCompEdu framework is effective in evaluating digital competence in the creative field by providing standardized metrics while allowing flexibility in recording discipline-specific practices.

4. CONCLUSION

This study employed the DigCompEdu framework to examine and investigate discrepancies in the digital competence profiles of both current and aspiring art teachers in Kazakhstan across six essential competence domains. The research provided a triangulated and contextually refined understanding of digital competence in art education through the integration of quantitative survey data and qualitative interviews. The results show that both groups exhibit a moderate level of overall digital competence, thus confirming the need to continue enhancing it. They do not support the idea of a hierarchical structure but rather show that complementary competence profiles are shaped by professional experience and education background. In-service teachers showed higher levels of competence in structured pedagogical practice and institutional engagement, whereas prospective art teachers showed higher levels of competence in empowering learners and facilitating digital creativity.

The study contributes to the development of the theoretical framework for digital competence among educators in creative disciplines by exploring the unique yet interrelated profiles of digital competence. It also provides teachers, curriculum designers, and policymakers with valuable tips for how to design higher education art education so that it delivers digital competence that is relevant to the real world and not too much one thing or another. Teachers’ professional development should include the development of the ability to creatively apply technology in the classroom. In other words, teacher education should focus

on the development of the capacity to transform existing technical competence into pedagogical practice informed by effective teaching methodologies.

Despite its contributions, this study has several limitations that should be acknowledged. First, the DigCompEdu framework was originally developed for in-service educators. Although prospective art teachers represent future professionals within the same pedagogical trajectory, certain domains of the framework are inherently role-specific (e.g., professional engagement and assessment practices). Measurement invariance across groups was not formally tested; therefore, the findings should be interpreted as complementary digital competence profiles rather than strict hierarchical comparisons between teachers and prospective teachers. Second, self-reported data were used to measure digital competence. Self-assessment tools offer significant insights into perceived competence; however, they may be prone to response bias or overestimation. The lack of performance-based or artifact-based validation constrains the capacity to infer conclusions regarding actual digital practice. Finally, the study was conducted in a particular national and disciplinary context (art education in Kazakhstan), potentially constraining the applicability of the findings to other educational systems or subject areas. Fourth, the sample size, especially in the teacher group, was not very big, which could affect the statistical power and model stability of more advanced comparative analyses.

Future research should integrate performance-based assessments, digital portfolio evaluations, or observational data to corroborate self-reported competence. Moreover, multi-group confirmatory factor analysis may be utilized to investigate measurement invariance among participant groups. Extending the research to additional disciplines, institutional environments, and transnational contexts would enhance both the theoretical and practical comprehension of educators' digital competence development.

ACKNOWLEDGMENT

Declaration of generative AI and AI-assisted technologies in the writing process: During the preparation of this work, the authors used "Chat GPT" and "Grammarly" in order to provide an "academic translation service and grammar checker". After using this service, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

FUNDING INFORMATION

The author declares that no funds, grants, or other support were received during the preparation of this manuscript.

AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Masoumeh Shiri	✓	✓	✓	✓	✓	✓		✓	✓	✓			✓	
Aidar Kuzdeubayev				✓	✓	✓				✓		✓		
Aidyn Kozhagulov	✓			✓			✓		✓		✓			✓
Zhazira Stambekova		✓					✓		✓					
Rakhat Berikbol	✓		✓							✓		✓		✓
Nurgul Koshkinbayeva					✓					✓				

C : **C**onceptualization

M : **M**ethodology

So : **S**oftware

Va : **V**alidation

Fo : **F**ormal analysis

I : **I**nvestigation

R : **R**esources

D : **D**ata Curation

O : Writing - **O**riginal Draft

E : Writing - Review & **E**ditting

Vi : **V**isualization

Su : **S**upervision

P : **P**roject administration

Fu : **F**unding acquisition

CONFLICT OF INTEREST STATEMENT

No competing interests declared.

INFORMED CONSENT

Prior to data collection, all participants provided informed consent by explicitly indicating their agreement at the beginning of the questionnaire. The study was conducted in accordance with the ethical guidelines established by the relevant institutional and national regulations governing research involving human subjects. No personal identifiers were collected, and all responses were anonymized. Participants were informed that their responses would be used exclusively for academic research purposes and that participation was voluntary, with the right to withdraw from the study at any stage without any consequences.

ETHICAL APPROVAL

The Ethics Committee of Abai Kazakh National Pedagogical University also formally approved the research protocol. This ensured that the data was handled ethically, that participants' rights were respected, and that the research was conducted openly and honestly. (Approval No. AB2025-073, given out on January 4, 2025).

DATA AVAILABILITY

The datasets used and/or analyzed during the current study are available from the corresponding author, [MS], on reasonable request.




REFERENCES

- [1] J. M. Barroso-Tristán, I. García-Lázaro, and S. Reyes-de-Cózar, "Gamification in digital environments and the development of teachers' digital competence: a systematic review," *Humanities and Social Sciences Communications*, vol. 12, no. 1, p. 1834, 2025, doi: 10.1057/s41599-025-06115-w.
- [2] J.-A. López-Núñez, S. Alonso-García, B. Berral-Ortiz, and J.-J. Victoria-Maldonado, "A systematic review of digital competence evaluation in higher education," *Education Sciences*, vol. 14, no. 11, p. 1181, Oct. 2024, doi: 10.3390/educsci14111181.
- [3] E. Suzer and M. Koc, "Teachers' digital competency level according to various variables: a study based on the European DigCompEdu framework in a large Turkish city," *Education and Information Technologies*, vol. 29, no. 16, pp. 22057–22083, Nov. 2024, doi: 10.1007/s10639-024-12711-1.
- [4] Z. Nurbekova and B. Nurbekov, "Digitalization of the education system in Kazakhstan: experience, problems and perspectives," *Strategies for Policy in Science and Education-Strategii na Obrazovatel'nata i Nauchnata Politika*, vol. 31, no. 4s, pp. 218–226, Jul. 2023, doi: 10.53656/str2023-4s-19-dig.
- [5] A. Haleem, M. Javaid, M. A. Qadri, and R. Suman, "Understanding the role of digital technologies in education: a review," *Sustainable Operations and Computers*, vol. 3, pp. 275–285, 2022, doi: 10.1016/j.susoc.2022.05.004.
- [6] D. Aisulu, "Digital transformation of higher education in Kazakhstan: challenges and solutions," *Economic Annals-XXI*, vol. 209, no. 5–6, pp. 42–55, Jun. 2024, doi: 10.21003/ea.V209-05.
- [7] M. Shiri and K. Baigutov, "Evaluating art students' engagement with digital technologies in classroom settings," *International Journal of Advanced and Applied Sciences*, vol. 11, no. 11, pp. 240–248, Nov. 2024, doi: 10.21833/ijaas.2024.11.025.
- [8] G. Sultanbayeva, A. Akynbekova, A. Belgarayeva, Z. Buyenbayeva, and A. Ashimova, "Digital Literacy as a tool for identifying fake news: a comparative analysis using the example of European and Kazakh media," *Journal of Information Policy*, vol. 15, pp. 1–30, Dec. 2024, doi: 10.5325/jinfopoli.15.2025.0001.
- [9] V. Candido, A. Cattaneo, and D. Petko, "Exploring multimedia principles and learning from errors in augmented reality and video," *Learning and Instruction*, vol. 101, p. 102244, Feb. 2026, doi: 10.1016/j.learninstruc.2025.102244.
- [10] L. Momdjian, M. Manegre, and M. Gutiérrez-Colón, "Bridging the digital competence gap: a comparative study of preservice and in-service teachers in Lebanon using the DigCompEdu framework," *Technology, Knowledge and Learning*, vol. 30, no. 2, pp. 655–683, Jun. 2025, doi: 10.1007/s10758-024-09794-7.
- [11] L. Anthonysamy, A. C. Koo, and S. H. Hew, "Self-regulated learning strategies in higher education: fostering digital literacy for sustainable lifelong learning," *Education and Information Technologies*, vol. 25, no. 4, pp. 2393–2414, Jul. 2020, doi: 10.1007/s10639-020-10201-8.
- [12] M. Shiri, K. Baigutov, R. Izmagambetova, O. Abisheva, and Y. Ryssymbetov, "The impact of academic rank on teachers' TPACK competence in art education," *International Journal of Advanced and Applied Sciences*, vol. 12, no. 3, pp. 49–57, Mar. 2025, doi: 10.21833/ijaas.2025.03.006.
- [13] K. A. Nguyen *et al.*, "Instructor strategies to aid implementation of active learning: a systematic literature review," *International Journal of STEM Education*, vol. 8, no. 1, p. 9, Dec. 2021, doi: 10.1186/s40594-021-00270-7.
- [14] H. Kim, H. J. So, and J. Y. Park, "Examining the effect of socially engaged art education with virtual reality on creative problem solving," *Educational Technology and Society*, vol. 25, no. 2, pp. 117–129, 2022.
- [15] M. E. Kanyika, R. Sadykova, and Z. Kosmyrza, "Digital literacy competencies among students in higher learning institutions in Kazakhstan," *Global Knowledge, Memory and Communication*, Sep. 2024, doi: 10.1108/GKMC-04-2024-0224.
- [16] F. D. Guillén-Gámez, J. Ruiz-Palmero, and M. Gómez-García, "Digital competences in research: creativity and entrepreneurship as essential predictors for teacher training," *Journal of Computers in Education*, vol. 11, no. 4, pp. 1263–1282, Dec. 2024, doi: 10.1007/s40692-023-00299-3.
- [17] A. List, "Defining digital literacy development: an examination of pre-service teachers' beliefs," *Computers & Education*, vol. 138, pp. 146–158, Sep. 2019, doi: 10.1016/j.compedu.2019.03.009.
- [18] L. Zhang, C. Yang, and Y. Zheng, "Digital competence for sustainable education of pre-service teachers: a systematic literature review (2014–2024)," *Frontiers in Psychology*, vol. 16, p. 1710983, Jan. 2026, doi: 10.3389/fpsyg.2025.1710983.
- [19] M. Temirkhanova, G. Abildinova, and C. Karaca, "Enhancing digital literacy skills among teachers for effective integration of computer science and design education: a case study at Astana International School, Kazakhstan," *Frontiers in Education*, vol. 9, p. 1408512, Oct. 2024, doi: 10.3389/educ.2024.1408512.




- [20] D. Peng and Z. Yu, "A literature review of digital literacy over two decades," *Education Research International*, vol. 2022, pp. 1–8, May 2022, doi: 10.1155/2022/2533413.
- [21] G. Falloon, "From digital literacy to digital competence: the teacher digital competency (TDC) framework," *Educational Technology Research and Development*, vol. 68, no. 5, pp. 2449–2472, Oct. 2020, doi: 10.1007/s11423-020-09767-4.
- [22] T. Linde-Valenzuela, F. D. Guillén-Gámez, and A. Devitt, "Digital literacy of teachers, families, and students for virtual participation in school: a multiple comparison analysis," *IEEE Revista Iberoamericana de Tecnologías del Aprendizaje*, vol. 17, no. 1, pp. 1–8, Feb. 2022, doi: 10.1109/RITA.2022.3149800.
- [23] Z. Bakirova, A. Tasova, M. Absatova, D. Sadirbekova, B. Auezov, and G. Meirbekova, "Enhancing digital competence and learning motivation of master's students: a new educational model for Kazakhstan's higher education system," *Frontiers in Education*, vol. 11, p. 1675872, Feb. 2026, doi: 10.3389/educ.2026.1675872.
- [24] A. Seilkhan, Z. Abdrassulova, M. Erkaebaeva, R. Soltan, M. Makhambetov, and A. Ydyrys, "Problems of distance education in Kazakhstan during the COVID-19 pandemic," *World Journal on Educational Technology*, vol. 14, no. 2, pp. 380–389, Mar. 2022, doi: 10.18844/wjet.v14i2.6913.
- [25] V. Zarubina, M. Zarubin, Z. Yessenkulova, R. Salimbayeva, and G. Satbaeva, "Digital transformation of the promotion of educational services of Kazakhstani universities," *Journal of Innovation and Entrepreneurship*, vol. 13, no. 1, p. 3, Jan. 2024, doi: 10.1186/s13731-023-00355-3.
- [26] A. Ibraimkulov, A. S. Yerimbetova, and K. Gromaszek, "Development of digital literacy of students with disabilities," *Advanced Technologies and Computer Science*, no. 2, pp. 4–9, 2021.
- [27] A. Yersultanova, N. Karelkhan, G. Azieva, M. Uaisova, and L. Abdibekova, "Educational resources for teaching digital literacy in an inclusive classroom," *The Bulletin*, vol. 403, no. 3, pp. 92–101, Jun. 2023, doi: 10.32014/2023.2518-1467.495.
- [28] P. Kropachev, M. Imanov, J. Borisevich, and I. Dhomane, "Information technologies and the future of education in the Republic of Kazakhstan," *Scientific Journal of Astana IT University*, vol. 1, pp. 30–38, Mar. 2020, doi: 10.37943/AITU.2020.1.63639.
- [29] G. S. Togabayeva, A. K. Kozybay, and G. S. Shaizadanova, "The impact of digital technologies on the development of critical thinking in art education students," (in Kazakh), *Gumilyov Journal of Pedagogy*, vol. 152, no. 3, pp. 237–255, 2025, doi: 10.32523/3080-1710-2025-152-3-237-255.
- [30] F. Caena and C. Redecker, "Aligning teacher competence frameworks to 21st century challenges: the case for the European Digital Competence Framework for Educators (DigCompEdu)," *European Journal of Education*, vol. 54, no. 3, pp. 356–369, Sep. 2019, doi: 10.1111/ejed.12345.

BIOGRAPHIES OF AUTHORS






Masoumeh Shiri    is a Ph.D. candidate in Art Education, Graphic and Design at Abai Kazakh National Pedagogical University, Kazakhstan. She has published several scholarly articles in the field of art education, with a particular research focus on the role of digital technologies in enhancing creativity among art students. Her academic interests include digital literacy, technology-enhanced learning, and innovative pedagogical approaches in art and design education. She can be contacted at email: m.shiri@abaiuniversity.edu.kz.






Aidar Kuzdeubayev    is a Ph.D. candidate in Art Education at Abai Kazakh National Pedagogical University, Kazakhstan. He has published several scholarly articles and one academic book. His research focuses on analyzing university art curricula through descriptive geometry, with particular emphasis on drawing by descriptive geometry methods and the application of AutoCAD in visual arts education. His academic interests include descriptive geometry, technical drawing, and AutoCAD-based instruction in higher art education. He can be contacted at email: akuzdeubayev08@gmail.com.






Aidyn Kozhagulov    is vice dean for Academic Affairs, Science and International Relations at Abai Kazakh National Pedagogical University, Kazakhstan. He holds significant academic and administrative roles within the Faculty of Arts and has contributed to research in art education and pedagogical methods. His academic interests include pedagogical strategies in arts education, curriculum analysis, and international academic collaboration. He can be contacted at email: aidyn.kozhagulov@bk.ru.






Zhazira Stambekova    holds a Ph.D. and has over 15 years of professional experience in education. She is head of the Department of Design at the Institute of Art, Culture and Sports. Her academic career includes teaching and administrative positions in vocational, secondary, and higher education institutions. She is the author of more than 15 scientific and educational publications indexed in national citation databases. Her professional interests focus on design education, curriculum development, and pedagogical methodology. She can be contacted at email: jazira_84_s@mail.ru.



Rakhat Berikbol    holds a Ph.D. in Philosophy with a specialization in Fine Arts. He is actively engaged in art education, with particular emphasis on the interaction between ethnic art and graphic art. He is the author of numerous academic books and scholarly articles. His research interests include ethnic visual culture, graphic art, and theoretical and methodological issues in art education. He can be contacted at email: rahat.berikbol@yandex.kz.



Nurgul Koshkinbayeva    holds a Ph.D. holder and associate professor at M. Kh. Dulaty Taraz University, Kazakhstan. She serves as the head of the Department of Music and Art Education. She holds academic degrees in arts and professional education, including a Ph.D. in the field of vocational/teacher education. Her academic and professional activities are focused on art education, teacher training in the field of arts, and the development of modern pedagogical approaches in creative and design-based education. She can be contacted at email: nr.koshkinbayeva@dulaty.kz.