IJRAR.ORG E-ISSN: 2348-1269, P-ISSN: 2349-5138

INTERNATIONAL JOURNAL OF RESEARCH AND ANALYTICAL REVIEWS (IJRAR) | IJRAR.ORG

An International Open Access, Peer-reviewed, Refereed Journal

Digital Competence in Teacher Education: A Comparative Study of Gender and Academic Stream

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Abstract

Digital competence has become an important aspect of teacher preparation, influencing how prospective teachers access information, use digital resources, and integrate technology into teaching and learning. The present study examined differences in digital competence among prospective teachers in relation to gender and academic stream in Kashmir, Jammu and Kashmir, India. A descriptive survey method was employed, and a sample of 441 final-semester Bachelor of Education (B.Ed.) prospective teachers from twenty-two colleges of education was selected through stratified random sampling. The sample comprised 262 female and 179 male prospective teachers, including 315 from the arts stream and 126 from the science stream. Data were collected using the 23-item Digital Competence Scale for Prospective Teachers developed by Jasi Zainab and Prof. (Dr.) Harish Mittu (2026). Differences between group means were examined using the z-test. The findings revealed a statistically significant difference in digital competence by gender, with female prospective teachers obtaining higher mean scores than their male counterparts ($z=3.74$, $p = .000 < .01$) and the difference between arts and science stream prospective teachers was not statistically significant at the .05 level ($z=1.95$, $p=.052 > .05$). These findings highlight the importance of examining digital competence beyond broad academic classifications and support the need for inclusive, practice-oriented digital preparation in teacher education

Keywords: *Digital competence, prospective teachers, gender, academic stream, and teacher education.*

Introduction

Digital technologies have reshaped the ways in which knowledge is created, communicated, accessed, and applied. In education, this transformation has expanded opportunities for interactive learning, digital resource development, online collaboration, and technology-supported assessment. However, the educational value of these developments depends not simply on the availability of technology but also on teachers' ability to use it meaningfully, critically, and responsibly. Digital competence has therefore become an important component of contemporary teacher preparation.

Digital competence extends beyond the ability to operate computers or use online applications. It involves the knowledge, skills, and attitudes required to locate and evaluate information, create digital content, communicate and collaborate through digital platforms, solve problems, protect personal information, and use technology responsibly. Janssen et al. (2013) discussed that digital competence encompasses multiple areas of knowledge, skills, and attitudes and should not be equated merely with the frequency of technology use. This broader understanding is particularly relevant to teacher education, where technological proficiency must be connected with pedagogical judgement and professional practice.

For prospective teachers, digital competence has implications for both their present academic engagement and their future professional responsibilities. They may be expected to prepare digital teaching materials, select appropriate online learning resources, design technology-supported activities, assess student learning

through digital platforms, and address questions of privacy, copyright, and responsible technology use. The European Framework for the Digital Competence of Educators, commonly known as DigCompEdu, similarly emphasizes professional engagement, digital resources, teaching and learning, assessment, learner empowerment, and the development of learners' digital competence.

Teacher education institutions consequently have an important role in helping prospective teachers develop the competence required to integrate digital technologies into classroom practice. Exposure to digital tools alone may not be sufficient. Prospective teachers also need opportunities to evaluate digital information, select suitable resources, develop instructional materials, reflect on their technology-related practices, and apply digital tools to authentic teaching situations. Such preparation can help connect technological knowledge with the practical demands of the teaching profession.

The need to understand digital competence also raises questions about individual and educational differences. Gender and previous academic stream are two characteristics that may be associated with prospective teachers' digital experiences, opportunities, confidence, and patterns of technology use. However, these characteristics should not be treated as direct explanations of competence. Differences in access to devices, previous training, digital learning experiences, and opportunities to practise may be more informative than demographic or academic categories alone.

Review of Literature

Digital competence has evolved from a relatively narrow emphasis on technical skills towards a broader understanding that includes information literacy, communication, content creation, problem-solving, safety, and the critical use of digital technologies. Janssen et al. (2013), drawing on the views of 95 experts, identified twelve areas associated with digital competence and highlighted differences in how the concept is understood. Their work suggests that digital competence is multidimensional and cannot be adequately represented by technology access or frequent use alone.

This perspective is relevant to prospective teachers because effective digital teaching requires more than familiarity with applications. Teachers must make informed decisions about which technologies to use, how to incorporate them into learning activities, and whether the resulting experiences support educational objectives. Digital competence in teacher education should therefore be understood in relation to both practical technological abilities and their appropriate application in educational settings.

Røkenes and Krumsvik (2014) reviewed literature on the development of student teachers' digital competence and identified approaches that connect technology with professional learning. Their review emphasized the importance of modelling, collaboration, authentic learning, student-active approaches, assessment, metacognition, and connections between theory and practice. These approaches suggest that digital competence develops through purposeful learning experiences rather than through technical exposure alone.

For prospective teachers, opportunities to observe technology-supported teaching, design digital learning activities, collaborate with peers, and reflect on instructional decisions may be especially valuable. Teacher education programs can provide these experiences by embedding digital tools within subject-specific and pedagogical coursework.

Mengual-Andrés, Roig-Vila, and Mira (2016) developed and validated a questionnaire for assessing digital competences in higher education. This work contributed to the measurement of digital competence and provided a basis for further research in higher education contexts. The development of such instruments is important because meaningful comparisons between groups depend on measures that adequately represent the construct being investigated.

Batanero et al. (2021) reviewed research on digital competences for teacher professional development. The review identified the need to strengthen teachers' technological and pedagogical preparation. The findings support the importance of professional learning that connects digital tools with instructional purposes, rather than treating technology training as an isolated technical activity.

Similarly, Zhao, Pinto Llorente, and Sánchez Gómez (2021) systematically reviewed digital competence research in higher education published between 2015 and 2021. Their findings indicated that many studies focused on perceived digital competence and that basic levels of competence were frequently reported among teachers and students. They also highlighted methodological limitations in the existing literature and emphasized the need for appropriate learning strategies and assessment approaches.

These studies indicate that digital competence remains an important concern in higher education. They also suggest that researchers should examine not only overall competence levels but also the experiences, learning opportunities, and contextual factors associated with competence development.

Gender differences in digital competence have been investigated in relation to technology access, confidence, experience, and patterns of use. Lucas et al. (2021) examined personal and contextual factors

associated with the digital competence of 1,071 in-service teachers. The analysis identified differences associated with personal characteristics, including gender and age, while the number of tools used for teaching and learning emerged as an especially strong predictor. Ease of use, confidence, and openness to new technology were also important factors in their analysis.

These findings suggest that digital competence may be associated with a combination of personal experience and opportunities to engage with technology. However, evidence from in-service teachers does not establish that the same patterns will necessarily occur among prospective teachers. Differences may vary according to educational setting, previous exposure, access to digital resources, and the nature of the assessment instrument. Gender-related comparisons among prospective teachers therefore require context-specific investigation.

Academic stream may represent differences in prior educational experiences, subject-related activities, and opportunities to use particular technologies. However, belonging to the arts or science stream does not necessarily determine a person's ability to use digital technologies effectively. Digital competence includes a broad range of activities that extend across disciplinary boundaries, including information evaluation, communication, digital content creation, and responsible technology use.

The literature reviewed above provides a rationale for examining differences among learners and teachers, but it does not establish a consistent direction of difference between arts and science stream prospective teachers in the present context. This comparison is, therefore, an empirical question. Examining it may help determine whether broad academic-stream categories meaningfully distinguish digital competence within the selected sample.

Research Gap

The reviewed literature establishes the multidimensional nature of digital competence, the importance of technology-integrated teacher preparation, and the need to consider individual and contextual factors. However, the findings of studies involving in-service teachers or higher education populations cannot be assumed to represent prospective teachers enrolled in teacher education programs in Kashmir.

The present study addresses this contextual gap by comparing the digital competence scores of final-semester B.Ed. prospective teachers according to gender and academic stream. Its contribution lies in providing empirical evidence from colleges of education within a specific regional setting. The study also offers an opportunity to examine whether the two classifications show similar or different patterns of association with digital competence.

Statement of Problem

Digital Competence among Prospective Teachers: Examining Gender and Academic Stream Differences

Objectives

- To compare the digital competence of prospective teachers with respect to gender and academic stream.

Hypotheses

- There exists no significant difference in digital competence of female and male prospective teachers.
- There exists no significant difference in digital competence of arts stream and science stream prospective teachers.

Design of the Study

In the present study, descriptive survey method was used to collect the data. A sample of 441 prospective teachers studying in final semester of B.Ed. program, comprised of 262 females and 179 males; 315 from arts stream and 126 science streams, was drawn from 22 colleges of education of Kashmir, Jammu and Kashmir, India through stratified random sampling technique.

Research Instrument

Self-developed 23 items Digital Competence Scale for Prospective Teachers (DCS-PTs) by Ms. Jasi Zainab and Prof. (Dr.) Harish Mittu (2026) was used to measure the Digital Competency Scale for Prospective Teachers.

Delimitation

The present study was delimited to colleges of education of Kashmir, Jammu and Kashmir, India.

Statistical Technique

The objectives and hypotheses of the study have been tested by using z'-test.

Result and Discussion

Analysis of data, result and interpretation of findings has been done keeping in view the objectives and hypotheses of the study.

Result Pertaining to Digital Competence of Prospective Teachers with respect to Gender

The objective was to compare the digital competence of prospective teachers with respect to gender. After administering the digital competence scale for prospective teachers; mean, standard deviation, standard error of difference and z'-value for digital competence of female and male prospective teachers were computed and the result have been presented in table 1.

H_0: There exists no significant difference in digital competence of female and male prospective teachers.

Table 1

Significance of Difference between Digital Competence of Female and Male Prospective Teachers

Group	N	M	SD	SE_D	z-value	p-value	Remarks
Female	262	86.20	9.44	.81	3.74	.000	p < .01
Male	179	83.18	7.50				

Table values of z' (df = 439) at 0.05 and 0.01 level of confidence are 1.96 and 2.58 respectively.

Table 1 shows the mean scores, standard deviations, standard error of difference and z'-value for digital competence of female and male prospective teachers. The table 1 reveals that the mean digital competence scores of female and male prospective teachers are 86.20 and 83.18 respectively. It may be concluded that female prospective teachers have better digital competence as compared to male prospective teachers. The value of standard deviation in case of female and male prospective teachers is 9.44 and 7.50 respectively. The z'-value for mean digital competence scores of female and male prospective teachers comes out to be 3.74, which is statistically significant at 0.01 level of confidence. It shows that female and male prospective teachers differ significantly from one another with respect to their digital competence.

Hence, the stated hypothesis that there exists no significant difference in digital competence of female and male prospective teachers is rejected at 0.01 level of confidence.

This finding adds a context-specific observation to the wider discussion of gender and digital competence. Lucas et al. (2021) found that gender was among the personal characteristics associated with in-service teachers' digital competence, although the number of digital tools used for teaching and learning was a particularly strong predictor in their analysis. Their findings reinforce the importance of examining digital competence alongside the experiences and opportunities that shape it.

The higher mean observed among female prospective teachers in the present study should not, however, be interpreted as evidence that female teachers are inherently more digitally competent. The comparison identifies a difference in the scores obtained by the two groups, but it does not establish why that difference occurred. Previous training, confidence, access to devices, patterns of technology use, academic experiences, and other unmeasured factors may warrant investigation in future research.

The finding also raises a practical question for teacher education institutions: Are prospective teachers receiving sufficient opportunities to develop and demonstrate digital competence? Rather than designing training around assumptions about gender, institutions should assess actual learning needs and provide equitable opportunities for all prospective teachers to practise digital teaching, evaluate online resources, create digital content, and use technology for assessment.

Result Pertaining to Digital Competence of Prospective Teachers with respect to Academic Stream

The objective was to compare the digital competence of prospective teachers with respect to academic stream. After administering the digital competence scale for prospective teachers; mean, standard deviation, standard error of difference and z'-value for digital competence of arts stream and science stream prospective teachers were computed and the result have been presented in table 2.

H_0: There exists no significant difference in digital competence of arts stream and science stream prospective teachers.

Table 2

Significance of Difference between Digital Competency of Arts and Science Stream Prospective Teachers

Stream	N	M	SD	SE_D	z-value	p-value	Remarks
Arts	315	85.49	9.19	.93	1.95	.052	p > .05
Science	126	83.68	7.71				

Table values of z' (df = 439) at 0.05 and 0.01 level of confidence are 1.96 and 2.58 respectively.

Table 2 shows the mean scores, standard deviations, standard error of difference and z'-value for digital competence of arts stream and science stream prospective teachers. The table 2 reveals that the mean digital competence scores of arts stream and science stream prospective teachers are 85.49 and 83.68 respectively. It may be concluded that arts stream prospective teachers have better digital competence as compared to science stream prospective teachers. The value of standard deviation in case of arts stream and science stream prospective teachers is 9.19 and 7.71 respectively. The z'-value for mean digital competence scores of arts stream and science stream prospective teachers comes out to be 1.95, which is statistically not significant at 0.05 level of confidence. It shows that arts stream and science stream prospective teachers do not differ significantly from one another with respect to their digital competence.

Hence, the stated hypothesis that there exists no significant difference in digital competence of arts stream and science stream prospective teachers is accepted at 0.01 level of confidence.

Although the arts stream group had a higher observed mean, the evidence does not provide sufficient grounds to conclude that arts and science stream prospective teachers differed significantly in digital competence. Equally, the nonsignificant result does not establish that the groups are identical or that academic stream can never be associated with digital competence.

One possible interpretation is that digital competence involves abilities that can be developed across disciplinary backgrounds. Locating and evaluating information, communicating digitally, creating learning resources, protecting personal data, and using digital platforms are relevant to both arts and science education. These competencies may be influenced by opportunities for practice and the quality of teacher preparation, rather than by academic stream alone. This explanation remains tentative because the present study did not directly measure participants' digital experiences, training, or technology-use patterns.

The result supports a cautious approach to grouping prospective teachers according to their prior academic backgrounds. Digital training should be informed by demonstrated competence and specific learning needs rather than by the assumption that one academic stream necessarily produces stronger digital skills.

Conclusion

The present study examined digital competence among 441 final-semester B.Ed. prospective teachers in Kashmir, Jammu and Kashmir, with reference to gender and academic stream. The findings revealed a statistically significant difference between female and male prospective teachers, with female participants obtaining higher mean scores. In contrast, the difference between arts and science stream prospective teachers was not statistically significant at the .05 level.

These findings provide context-specific evidence about digital competence among prospective teachers and underline the importance of examining differences without relying on broad assumptions about individual or academic groups. The results do not establish the reasons for the observed gender difference or demonstrate equivalence between academic streams. Rather, they point towards the need for further investigation of the educational experiences and opportunities associated with digital competence.

Teacher education institutions can respond by providing inclusive, practice-oriented digital learning experiences and assessing prospective teachers' actual training needs. By connecting digital skills with pedagogical practice, responsible technology use, and continuous professional learning, teacher preparation programmes can better support prospective teachers in meeting the demands of technology-integrated education.

Educational Implications

- Teacher education institutions should incorporate digital competence into regular coursework and teaching practice. Activities may include creating digital instructional materials, selecting appropriate online resources, developing technology-supported lesson plans, and using digital assessment tools.
- Digital competence development should be based on assessed needs rather than assumptions about gender or academic background. The significant gender difference observed in this sample warrants further investigation and may encourage institutions to examine whether particular groups have different levels of access, confidence, training, or practical experience.
- Prospective teachers from both arts and science streams should have opportunities to develop a broad range of digital skills. The absence of a statistically significant difference between the two streams suggests that academic stream alone should not be used as a basis for assigning digital training opportunities.
- Teacher education institutions should evaluate whether digital training improves practical teaching competence, rather than relying exclusively on self-reported or general digital competence scores. Authentic tasks, teaching demonstrations, digital portfolios, and structured feedback may help establish how effectively prospective teachers can apply digital skills in educational settings.

References

1. Batanero, J. M. F., et al. (2021). Digital competences for teacher professional development. *European Journal of Teacher Education, 45*. https://doi.org/10.1080/02619768.2020.1827389
2. Janssen, J., Stoyanov, S., Ferrari, A., Punie, Y., Pannekeet, K., & Sloep, P. (2013). Experts' views on digital competence: Commonalities and differences. *Computers & Education, 68*, 473–481. https://doi.org/10.1016/j.compedu.2013.06.008
3. Lucas, M., Bem-Haja, P., Siddiq, F., Moreira, A., & Redecker, C. (2021). The relation between in-service teachers' digital competence and personal and contextual factors: What matters most? *Computers & Education, 160*, Article 104052. https://doi.org/10.1016/j.compedu.2020.104052
4. Mengual-Andrés, S., Roig-Vila, R., & Mira, J. B. (2016). Delphi study for the design and validation of a questionnaire about digital competences in higher education. *International Journal of Educational Technology in Higher Education, 13*, Article 12. https://doi.org/10.1186/s41239-016-0009-y
5. Røkenes, F. M., & Krumsvik, R. J. (2014). Development of student teachers' digital competence in teacher education: A literature review. *Nordic Journal of Digital Literacy, 9*(4), 250–280. https://doi.org/10.18261/ISSN1891-943X-2014-04-03
6. Zainab, J., & Mittu, H. (2026). Digital Competence Scale for Prospective Teachers (DCS-PTs) *(Unpublished).*
7. Zhao, Y., Pinto Llorente, A. M., & Sánchez Gómez, M. C. (2021). Digital competence in higher education research: A systematic literature review. *Computers & Education, 168*, Article 104212. https://doi.org/10.1016/j.compedu.2021.104212