INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN BUSINESS & SOCIAL SCIENCES

Vol 15, Issue 10, (2025) E-ISSN: 2222-6990

# Gender Differences in Digital Intelligence Quotient: A Non-Parametric Approach

Siti Fatimah Mardiah Hamzah, Suzila Mat Salleh, Noor Malinjasari Ali, Raslina Mohamed Noor, Hasmida Mohd Noor, Noor Hafiza Mohammed, Roszainora Setia, Ruzaidah Sulong@A. Rashid

Faculty of Business & Management, Universiti Teknologi MARA, Cawangan Terengganu, Malaysia

Email: hasmidam@uitm.edu.my

**DOI Link:** http://dx.doi.org/10.6007/IJARBSS/v15-i10/26659

***Published Date:*** 21 October 2025

**Abstract**

The growing reliance on digital literacy in education highlights the importance of evaluating students' digital quotient, which comprises competencies namely digital communication, safety, literacy, security, identity, use, and rights. This study aimed to (1) investigate whether significant gender differences exist in digital quotient, and (2) identify which dimensions show greater variation between male and female students. Data were collected from 184 university students, with an imbalanced number of male and female respondents. To report for this imbalance, non-parametric analysis using the Mann-Whitney U test was employed. The hypothesis testing results indicated that no significant gender differences were found across most dimensions of digital quotient, including digital communication, digital literacy, digital security, digital identity, digital use, and digital rights, thus supporting the null hypothesis in these areas. However, a significant difference was observed in digital safety ($U = 3625.00$, $z = -2.95$, $p = .003$, $r = .22$), with female students revealing higher awareness and safer practices compared to males. These findings suggest that, while male and female students generally possess comparable digital competencies, digital safety represents a critical area of variation.

**Keywords**: Digital Quotients, Gender Differences, Higher Education, Digital Competencies, Digital Skills

## Introduction

According to the DQ Institute, Digital Quotient (DQ) refers to a comprehensive set of technical, cognitive, meta-cognitive, and socio-emotional competencies that are grounded in universal moral values and that enable individuals to face the challenges and harness the opportunities of digital life (DQ Institute, 2025). DQ emphasizes the ability to adapt to the demands of the digital environment while making informed decisions in communication,

information use, and online behaviour. While Digital Intelligence Quotient (DIQ) competencies comprise a comprehensive set of technical, cognitive, and socio-emotional which enable an individual to face and overcome obstacles and challenges and suitably adjust themselves to the digital era (Na-Nan et al., 2020). The construct involves multiple dimensions, including digital communication, digital safety, digital literacy, digital identity, digital rights, digital security and digital emotional intelligence, which together reflect an individual's overall digital capability. In educational context, the ability to navigate, communicate, and function effectively in online environments has become a fundamental requirement for students. DIQ dimensions collectively reflect an individual's ability to use digital tools responsibly, ethically, and productively. As digital technology has continued to reshape education, work, and social interaction, developing strong digital competencies has become essential for students to succeed in both academic and professional settings.

While numerous studies have examined digital literacy, technology adoption, and online learning behaviour, the body of work that treats digital competence in a holistic, multi-dimensional way remains limited. The Systematic Review of Digital Competence Evaluation (López-Núñez et al., 2024) clearly notes that many instruments and studies cover only parts of digital competence, not all dimensions together. López-Núñez et al., (2024) found that many evaluations in higher education focus on specific dimensions of competence rather than the full set of competencies. Similarly, Inamorato dos Santos et al., (2023) reported that higher-education academics often display mixed levels of competence across subsets of digital tasks, with few studies assessing all dimensions together. Moreover, a systematic overview by Peters et al., (2022), highlights that although there are many studies, they often lack holistic frameworks and call for more integrated approaches.

As the importance of digital quotient across all digital competencies among higher educational institutions has caught the attention of many researchers, gender differences in digital literacy remain a major aspect required focus. Addressing these differences seems relevant as it helps to promote fairness and equal opportunities in academics and the future professions of higher education institutions graduates. The result of study on gender differences can contribute to better understanding of potential possibilities of digital inequalities. By studying digital competencies altogether, it provides evidence on how gender may influence overall competence.

Vázquez-Cano et al., (2017) in their study found there are some gender differences in specific usages, similarly showed differences only in certain tasks (such as online presentations) and not across all competence areas, summed up that gender influence in digital competencies is depending on context or dimension as some digital competencies areas showed no significant gender difference. This finding, also supported by research by Hossain et al., (2023) reports gender differences in some areas but not in others. Similarly, Abubakari et al., (2023), in their study also revealed slight but insignificant gender disparities in overall digital competence (Digital Use, Literacy, Safety etc.). These findings illustrate that, although gender is repeatedly studied as a factor, its effect tends to be fragmented and dimension-specific, rather than evidence of broad, consistent gender disparities across all dimensions of what might be called 'digital quotient'.

This variation in findings motivates this study, as there is a growing need to prepare students to engage effectively and responsibly in digital spaces. By examining gender differences across the dimensions of digital quotient, the study offers both theoretical and practical contributions to higher education institutions. The results are useful to guide in designing targeted interventions to strengthen students' digital skills, ensuring that male and female students are equally equipped to participate in digital learning.

Accordingly, this paper pursues two main objectives: (1) to investigate whether significant gender differences exist in digital quotient; and (2) to identify which dimensions, if any, show greater variation between male and female students. By addressing these objectives, the study adds to the growing body of knowledge on digital competence and highlights areas where gender-sensitive digital education strategies may be required. Hence, this paper aims to examine gender differences in students' digital quotient, which consists of eight dimensions: digital communication, digital safety, digital literacy, digital security, digital identity, digital use, and digital rights. Based on this aim, the following hypotheses were formulated:

*$H_o$: There is no significant difference between male and female students across the dimensions of digital quotient.*

*$H_1$: There is a significant difference between male and female students across the dimensions of digital quotient.*

By exploring the dimensions of digital quotient, this study can emphasize the importance of technical, social and safety competencies when engaging in digital communication, particularly in learning. The finding also will give reasons for higher educational institutions to promote fairness and inclusivity for both genders in reducing digital risks while communicating digitally. Thus, this study makes a meaningful contribution in enhancing digital readiness among higher education institutions students, who are now into digital mediated learning environments.

**Literature Review**

The advancement of digital technologies has changed the way people learn, communicate, and interact in academic and social environments. In higher education, digital competence is no longer optional but a must for meaningful participation in learning processes, knowledge sharing, and social engagement. To conceptualize these competencies, the Digital Intelligence Quotient (DIQ) framework has been adopted, encompassing competencies namely digital communication, digital safety, digital literacy, digital identity, digital security, digital rights, and digital use (DQ Institute, 2019). Each dimension emphasizes skills and behaviours that determine how effectively students use digital spaces.

***Digital Communication*** **-** Digital communication is a key component of digital quotient because it goes beyond technical ability to include social interaction, ethical behaviour, and context-sensitive communication in digital environments. It refers to the exchange of messages, data, and information using electronic devices and digital technologies, which involves transmitting and receiving information through digital tools. This process involves the transmission and reception of information through digital tools, enabling organizations and individuals to interact with each other in real-time or exchange messages at different times and collaborate remotely (Bordi et al., 2018) which may not be separated from the

workflow (Wajcman & Rose, 2011). Digital communication is not just about sending messages, but also appropriate interactions, audience awareness, and digital presence. Since the outbreak of COVID-19, the education landscape has changed significantly to online learning, which requires digital competence like digital communication. Cabezas-González et al., (2021), found that digital communication competence has influence on students' online communication and the use of social networks significantly. Furthermore, another research on communication through WhatsApp found changes in communication behaviour during the COVID-19 lockdown, with most chats experiencing increased message activity (Seufert, 2022).

***Digital Safety*** **-** Digital safety as explained by Gasser et al. (2010), is a complex concept that is related to the well-being of digital media users that contributes to a safe digital experience. Yew et al., (2024) reported that university students often disclose personal information online without sufficient awareness of privacy risks such as phishing, identity theft, and algorithmic profiling. The study further indicates that while 85% of students are aware of basic privacy threats like phishing and 78% understand the risks of identity theft, awareness of more advanced threats remains limited. A previous study conducted by Asrese & Muche (2020) found that users involved in online activities such as social media and online gaming can lead to problematic internet use (PIU). The research highlighted the need for rules to limit addictive online activities and promote responsible internet use. Digital safety, which encompasses protecting personal information, ensuring privacy, and adopting responsible online behaviours, has been widely studied in relation to gender. Research consistently demonstrates that gender plays a role in shaping attitudes and behaviours toward online safety.

***Digital Literacy*** **–** Digital literacy involves skills in internet research, content creation and online communication. According to Yildiz et al. (2020), digital literacy is defined as the ability to create information using digital technology, and it is one of the most significant abilities that persons should possess in today. Digital literacy also refers to the capability to uncover and access information using digital means, and to be digitally literate, individuals must possess high-level critical thinking abilities such as investigation, inquiry, problem solving, and decision making (Duran & Ozen, 2018). The relevance of digital literacy was highlighted in research by Bolaji (2019). He stated that the introduction of digital literacy is critical in fostering the abilities of communicating, locating, and generating digital material to improve the quality of instructional content and to encourage the incorporation of emerging technologies into instructional delivery. This is very crucial for the students' performance in becoming part of the digital literate community. Studies from several authors explain a positive link between students' digital literacy and their perception of distance learning and emphasising digital literacy in education. Besides, gender, income, and subject discipline are also found related to digital literacy levels. However, integrating technology concepts into the curriculum may enhance the ability to learn ICT and enable respondents to be literate digitally. Wan Mokhtar et al., (2024) shows that higher digital literacy correlates with better performance. Useful for tying your dimensions of digital use/literacy to outcomes. Prior study done by Kayaduman et al. (2020), agreed that there was a significant positive correlation between students' digital literacy and distance education perceptions. Earlier study by Jan (2018), found proficiency in digital literacy among students is important. The findings indicated that respondents who have a high level of digital literacy, can utilize basic ICT tools and applications for accessing, interpreting, and communicating. Thus, students who

possess higher levels of digital literacy, use tablets and smartphones, have received computer training, and use computers often are able to have a positive attitude toward utilising ICT (Jan, 2018).

***Digital Identity*** **-** According to TechTarget (2024), a digital identity is "the collection of data about an individual, organization or electronic device that exists online." While Sevgi Kavut (2021) defines digital identity as composed of various dimensions including digital access, digital communication, digital security, digital rights and responsibilities etc. It views identity in relation to how individuals interact through communication technologies. Previously, Sadiku et al. (2016) explain a digital identity includes a username, password, date of birth, and social security number, along with online activities and gained increasing significance (Hu et al., 2015). When people present themselves and participate in online activities, they are an important factor in knowledge transfer. Digital identity plays a crucial role in facilitating knowledge exchange in computer-mediated communication contexts and individuals are willing to share their knowledge with strangers in online environments. Self-presentation is an important factor in contributing knowledge among online communities (Shin & Kim, 2009). In short, these literatures establish digital identity as not just about what one does online but how one is seen, verified, and responsible in the digital environment.

***Digital Security –*** DQ Institute (2019) defines digital security as the capacity to protect one's data, devices, and digital identity by adopting safe, responsible practices and using security tools effectively. Digital security involves safeguarding digital assets and systems from malicious activities and vulnerabilities through preventive, detective, and responsive measures, ensuring trust in the digital environment (ENISA, 2021). The importance of digital security has been increasingly recognized as digital platforms permeate education, work, and personal life. Recent studies by Abubakari et al., (2023) highlight that gender may play a role in shaping perceptions and practices of digital security, with female students often reporting greater concern for privacy and safety compared to their male counterparts. These findings align with the notion that digital security is not uniformly distributed across demographic groups and may reflect underlying social or cultural dynamics. Yaseen, K. A. (2022), proved in his study that educational institutions are still exposed to many security risks and attacks targeting data and information dumping, competitiveness and intellectual property issues, and targeting students, however most of the threats can be overcome with few measures, awareness, and proper practices. The present study revealed that while digital safety showed significant gender differences, digital security did not differ meaningfully between male and female students. This result aligns with Branley-Bell et al. (2022), who reported that gender was not a strong predictor of cybersecurity behaviour, although differences emerged in perceived self-efficacy.

***Digital Right*** **-** Digital rights refer to the entitlements, freedoms, and protections that individuals possess when engaging in online environments. They encompass issues such as privacy, data protection, freedom of expression, access to information, and respect for intellectual property (Pangrazio & Sefton-Green, 2021). These rights ensure that users can safely and ethically navigate digital platforms while upholding the rights of others. According to Živković (2013), digital rights are integral to digital literacy because technical proficiency alone is insufficient without ethical and responsible awareness of one's online rights and obligations. The findings also argue that digital literacy must incorporate knowledge of digital

rights, noting that awareness of privacy, intellectual property, and data protection remains insufficient even among university students. In educational contexts, digital rights are closely tied to responsible and ethical use of technology. Vuorikari et al. (2022) emphasize that competencies in digital rights help learners understand how to protect their personal data, respect intellectual property, and critically evaluate information sources. This dimension is critical for higher education students who regularly engage with online learning platforms and social media, where misuse of data or violations of privacy can have long-term consequences. The intersection of gender and digital rights has drawn scholarly attention, though evidence suggests minimal variation between male and female users in this competency. For instance, Fariña-Sánchez and Gutiérrez-Santiuste (2025) found that young entrepreneurs, regardless of gender, demonstrated similar levels of respect for digital rights, unlike other digital competencies where differences were more pronounced. Likewise, Maon et al., (2022) reported that while gender influenced certain digital skills, ethical components such as rights and privacy showed less disparity across groups.

***Digital Use*** **-** Digital use refers to the extent and manner in which individuals engage with digital technologies for communication, learning, and information management. Recent studies highlight that gender can influence patterns of digital use, though findings remain context-dependent. Previous studies by Hong & Aziz (2014) found students use digital technologies (mobile phones, laptops, Internet, Google, social media like Facebook/MySpace) both for social and academic purposes. They see digital tools used in daily life as useful for formal learning. While Hatlevik et al. (2023) conducted a cross-national study across 32 countries and found that gender gaps in digital use persist, with attitudes toward technology partially mediating the differences. This suggests that access alone does not determine digital use; rather, attitudes and confidence levels shape how frequently and effectively technology is employed. In addition, a recent study by Lin and Yu (2023) found that in higher education, students' use of digital reading tools is strongly shaped by attitudes such as perceived usefulness and support from faculty. However, not all studies report significant gender gaps. For example, Romero-López et al. (2022) found that while overall levels of digital use among university students were similar across genders, differences emerged in the *type* of digital activities performed in which female students tended to engage more in searching and evaluating resources, while male students more often focused on organizing and creating digital content. These previous studies indicate that digital use is a multidimensional construct shaped by frequency, type, and purpose of engagement, and that gender differences may or may not emerge depending on contextual and cultural variables.

**Digital Emotional Intelligence**– The study by Audrin & Audrin (2023) proposes that digital emotional intelligence comprises both trait emotional intelligence and digital competence, finding that people with higher emotional intelligence tend to have more positive attitudes and skills toward digital competence. Susanto et al., (2024) in their study in Brunei revealed that digital emotional intelligence significantly contributes to university students' readiness for digital learning, particularly in relation to well-being and adaptability. Together, these studies emphasize that digital emotional intelligence is not only essential for students' safe and effective online interactions but also for their readiness to thrive in digital learning ecosystems. The finding shared by Shao et al., (2025) in their study revealed that emotional intelligence and learning engagement jointly play a serial role in the relationship between digital technology use and academic performance in English specifically. Students who utilize

digital technology can enhance their emotional intelligence, which aids in managing learning emotions such as reducing anxiety and increasing enjoyment in learning.

In summary, the eight dimensions of digital quotient capture the comprehensive nature of digital competence. In higher education institutions, these competencies have become increasingly important especially after the pandemic. The educational landscape has changed significantly towards online and technology-mediated learning and thus, this requires students to equip themselves with comprehensive digital competencies as highlighted in the digital quotient framework.

## Methodology

This study is done using a quantitative research design utilising a structured questionnaire. The questionnaire is developed in three parts consisting of Part A, the demographic details, part B, the respondents rate their level of digital intelligence and part C, the respondents rate their online behaviour. The questionnaire on digital intelligence is adapted from an instrument developed by Na-Nan et. al (2020). Each question measures using a seven-point Likert scale ranging from 1, strongly disagree to 7, strongly agree. The respondents were selected from the public university's students in Terengganu, using convenience sampling and distributed electronically via Google Forms. There are 211 returned questionnaires and 184 (87.20%) were used for analysis purposes. Data are analysed using Statistical Package for the Social Sciences (SPSS) version 30.

## Result & Discussion

This paper will focus on the differences in digital quotient dimensions results by gender. To examine gender differences in digital quotient dimensions, nonparametric Mann–Whitney U tests were conducted due to the unequal group sizes (Male = 38, Female = 146) where the data did not meet the assumption of normality required for parametric tests. This test is reliable to unequal group sizes and remains valid when cell sizes differ greatly. A series of Mann–Whitney U tests were conducted to examine gender differences across the eight dimensions of digital quotient: digital communication, digital safety, digital literacy, digital security, digital identity, digital use, digital rights and digital emotional intelligence. Table 1 presents a summary of the hypothesis test.

Table 1
*Hypothesis Test Summary*

| | Null Hypothesis | Test | Sig.[a,b] | Decision |
|---|---|---|---|---|
| 1 | The distribution of mean Digital comm is the same across categories of GENDER. | Independent-Samples Mann-Whitney U Test | .424 | Retain the null hypothesis. |
| 2 | The distribution of mean Digital Safety is the same across categories of GENDER. | Independent-Samples Mann-Whitney U Test | .003 | Reject the null hypothesis. |
| 3 | The distribution of mean Digital Literacy is the same across categories of GENDER. | Independent-Samples Mann-Whitney U Test | .476 | Retain the null hypothesis. |

| | | | | |
|---|---|---|---|---|
| 4 | The distribution of mean Digital Security is the same across categories of GENDER. | Independent-Samples Mann-Whitney U Test | .399 | Retain the null hypothesis. |
| 5 | The distribution of mean Digital Identity is the same across categories of GENDER. | Independent-Samples Mann-Whitney U Test | .440 | Retain the null hypothesis. |
| 6 | The distribution of Mean Digital Use is the same across categories of GENDER. | Independent-Samples Mann-Whitney U Test | .531 | Retain the null hypothesis. |
| 7 | The distribution of Mean Digital Right is the same across categories of GENDER. | Independent-Samples Mann-Whitney U Test | .229 | Retain the null hypothesis. |
| 8 | The distribution of Mean Digital Emotional Intelligence is the same across categories of GENDER. | Independent-Samples Mann-Whitney U Test | .769 | Retain the null hypothesis. |

*a. The significance level is .050.*
*b. Asymptotic significance is displayed.*

The results showed no significant gender differences for digital communication (p = .424), digital literacy (p = .476), digital security (p = .399), digital identity (p = .440), digital use (p = .531), and digital rights (p = .229) and digital emotional intelligence (p=.769). This indicates that male and female students demonstrate similar levels of competence in these aspects of digital skills. The finding also concludes that overall, gender does not play a major role in shaping most aspects of students' digital quotient, including digital communication, literacy, security, identity, use, rights and emotional intelligence. Both male and female students appear to engage with digital technologies at relatively similar levels in these areas, reflecting that they have integration of digital tools in education and everyday life.

However, there are exceptions observed in digital safety. A significant difference was found in digital safety (p = .003), suggesting that gender influences how students practice and perceive safe online behaviours. This finding may indicate that male and female students adopt different approaches to online safety. Prior studies have found that female students are often more cautious about privacy and more likely to employ protective strategies online, whereas male students may show greater risk-taking tendencies in digital environments (Coopamootoo & Ng, 2023). This could explain the variation in digital safety practices between genders.

Overall, gender does not significantly influence most dimensions of digital quotient but the difference in digital safety emphasizes the need for digital literacy programs that equip all students, especially male with the skills to navigate online environments securely. While from an educational perspective, the result expressed the importance of targeted interventions to strengthen digital safety awareness and practices. Digital safety training should emphasize practical strategies such as password management, privacy settings, and critical evaluation of online content. To further discuss gender differences in digital quotient

competencies between male and female students, Mann–Whitney U Results is presented in Figure 1 and Table 2.

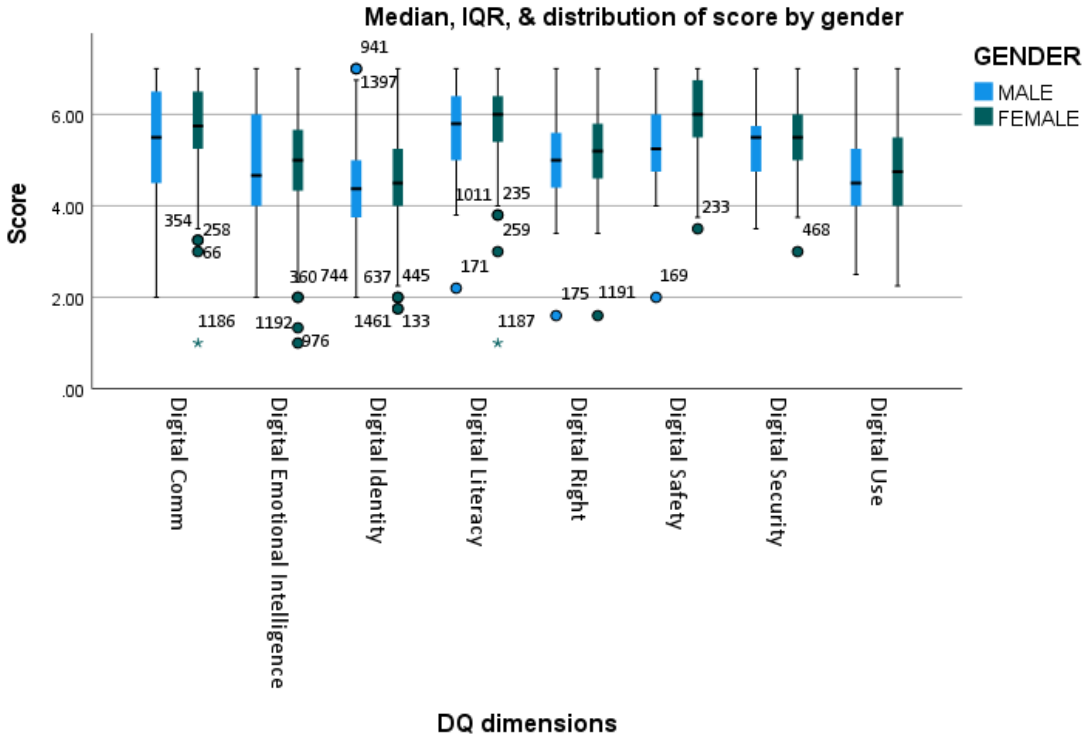


Figure 1: Score for DQ dimensions by gender

Table 2
*Mann–Whitney U Results*

| Dimension of digital quotient (DQ) | Male (n=38) (Median - IQR) | Female (n=146) (Median - IQR) | U | z | p (2-tailed) | Effect Size (r) | Interpretation |
|---|---|---|---|---|---|---|---|
| Digital Communication | 5.50 (2.13) | 5.75 (1.31) | 3007.0 | -0.800 | .424 | .06 | No significant difference |
| Digital safety | 5.25 (1.31) | 6.00 (1.25) | 3625.00 | -2.933 | .003 | .22 | Significant difference |
| Digital Literacy | 5.80 (1.45) | 6.00 (1.05) | 2981.50 | -0.713 | .476 | .05 | No significant difference |
| Digital Security | 5.50 (1.19) | 5.50 (1.00) | 3019.00 | -0.843 | .399 | .06 | No significant difference |
| Digital Identity | 4.38 (1.38) | 4.50 (1.25) | 2999.00 | -0.772 | .440 | .06 | No significant difference |
| Digital Use | 4.50 (1.38) | 4.75 (1.50) | 2956.50 | -0.627 | .531 | .05 | No significant difference |
| Digital Rights | 5.00 (1.30) | 5.20 (1.20) | 3125.00 | -1.204 | .229 | .09 | No significant difference |
| Digital Emotional Intelligence | 4.67 (2.00) | 5.00 (1.33) | 2423.00 | -0.294 | .769 | .02 | No significant difference |

An Independent-Samples Mann–Whitney U test was conducted to examine gender differences across seven dimensions of digital communication skills. The results showed no significant differences between male and female students for digital communication (U = 3007.0, z = -0.80, p = .424, r = .06), digital literacy (U = 2981.50, z = -0.71, p = .476, r = .05), digital security (U = 3019.0, z = -0.84, p = .399, r = .06), digital identity (U = 2999.0, z = -0.77, p = .440, r = .06), digital use (U = 2956.5, z = -0.63, p = .531, r = .05), digital rights (U = 3125.0, z = -1.20, p = .229, r = .09) and digital emotional intelligence rights (U = 2423.0, z = -0.294, p = .769, r = .02)

However, a significant gender difference was found for digital safety (U = 3625.0, z = -2.95, p = .003, r = .22), with females reporting stronger digital safety practices than males as presented in Figure 2.

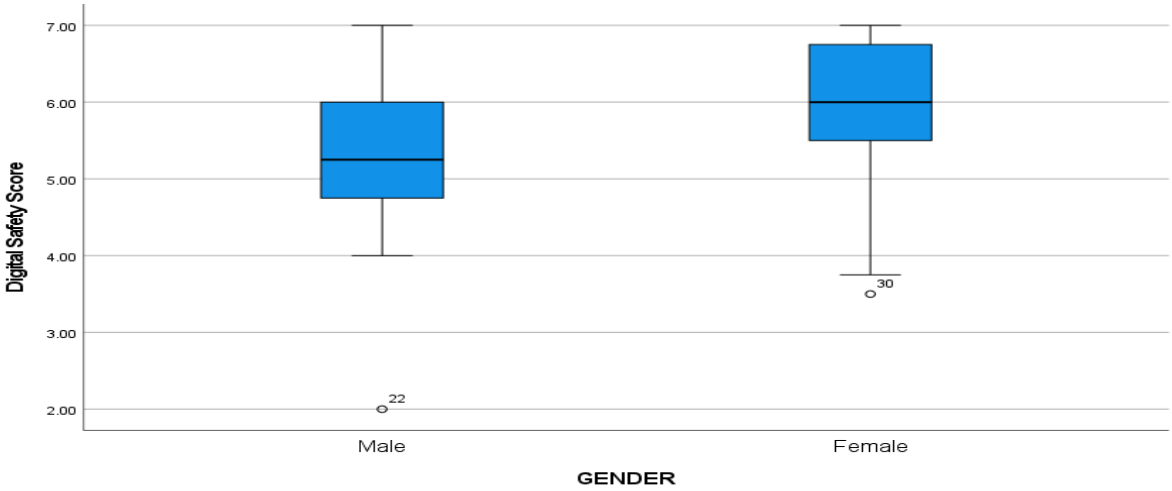


Figure 2: Digital Safety score by gender

The analysis revealed that gender differences in digital communication skills were generally minimal, as no significant differences were found in seven of the eight dimensions tested. This indicates that male and female students demonstrate comparable competencies in digital literacy, security, identity management, rights awareness, and overall digital usage.

Notably, a significant difference emerged in digital safety, with female students reporting stronger safety practices than male students. This aligns with prior studies which indicate that females often adopt more preventive strategies in digital environments, particularly concerning privacy and security. Female students demonstrated higher awareness and practices regarding digital safety, suggesting that they may be more cautious in protecting personal information and managing online risks, and awareness of cyber threats (Zulkifli et al.,(2020); Coopamooto & Ng (2023) and have better judgment in selecting and processing digital information, indicating higher awareness in handling digital data/information responsibly (Lopez Vincent et al., (2022).

These results highlight the importance of emphasizing digital safety education, particularly for male students, to encourage responsible online practices. Educational institutions should consider integrating targeted workshops or awareness programs that address cyber safety, digital threats, and personal data protection. While most digital skills are consistently practiced across genders, addressing this gap in digital safety may help foster

a safer and more balanced digital environment for all students. Research done by Moallem (2019) found that most university students willingly share their personal information despite understanding the risks of identity theft. These students lack sufficient knowledge on data protection and cyber security even though they are aware that their data is not safe. This is due to lack of information on safety and protection against threats in online activities given by education institutions.

From an educational perspective, this finding underlines the importance of combining digital safety training into academic programs, particularly targeted at enhancing awareness among male students. Institutions could implement workshops or awareness campaigns that address safe online practices, cyberbullying prevention, and strategies for protecting personal data. Furthermore, the findings suggest that while gender does not significantly impact most dimensions of digital skills, digital safety remains a key area where gender-sensitive interventions could be beneficial. For instance, Steinfeld (2022) found that female adolescents reported greater concern about online risks and engaged more actively in safety practices compared to their male counterparts, highlighting gender-specific experiences in internet safety education. Similarly, Coopamootoo and Ng (2023) reported that women often rely on personal networks for safety and privacy guidance, whereas men are more likely to use multiple advice sources and technological tools, suggesting nuanced differences in protection strategies. Weinberger et al. (2023) further revealed that females exhibited stronger concerns regarding privacy and anonymity online, regardless of their technical expertise, reinforcing the notion of a gender gap in safety attitudes. In Malaysia, a study on secondary school students showed that awareness of cyber threats was uneven, with notable deficiencies in safety knowledge, underscoring the importance of embedding online safety education into the curriculum (Zulkifli et al., 2020). Complementing these findings, a study at Al Quds University identified risky online behaviours among undergraduates and emphasized the need for enhanced cybercrime awareness (Ahmead, 2024). Collectively, these studies affirm that gender differences are evident in digital safety and support the present study's finding that female students demonstrated significantly greater variation in this dimension compared to male students.

In contrast, no significant gender differences were found in digital communication, literacy, security, identity, use, or rights. This suggests that both male and female students share similar levels of competence in these dimensions. One possible explanation is that digital technologies have become deeply integrated into daily life and academic activities, leading to a more uniform development of digital skills across genders.

The results of the Mann–Whitney U test indicated that, overall, gender differences across the dimensions of digital quotient were minimal. Out of the seven dimensions examined, only digital safety showed a statistically significant difference, with female students demonstrating higher levels of safety awareness and protective behaviours in digital environments. For the remaining dimensions—digital communication, digital literacy, digital security, digital identity, digital use, and digital rights—no significant differences were observed between male and female students. This suggests that while students, regardless of gender, generally share similar competencies in most aspects of digital quotient, variations may emerge in areas that involve risk management and online safety practices. Therefore,

*objective 1 is answered, confirming that gender differences exist but are confined primarily to digital safety.*

The analysis revealed that among the eight dimensions of digital intelligence quotient, digital safety was the only area that showed a significant gender difference. Female students reported higher levels of awareness and practices related to digital safety compared to their male counterparts. This suggests that females tend to be more cautious in managing online risks, such as protecting personal information, avoiding suspicious interactions, and safeguarding their privacy in digital environments. In contrast, no significant differences were found between male and female students in other dimensions, including digital communication, literacy, security, identity, use, and rights. These findings indicate that while both genders demonstrate comparable competencies in most areas of digital quotient, digital safety emerges as the dimension with the greatest variation, highlighting the importance of addressing gender-specific concerns in digital education initiatives. *This finding meets the objective no.2 in this paper.*

The hypotheses of this study proposed that significant gender differences may exist across the dimensions of digital quotient. The results of the Mann–Whitney U test provided mixed support for these hypotheses. As shown in Table 1, the null hypothesis (**$H_o$**) was retained for six of the seven dimensions—digital communication (U = 3007.0, z = -0.80, p = .424), digital literacy (U = 2981.5, z = -0.71, p = .476), digital security (U = 3019.0, z = -0.84, p = .399), digital identity (U = 2999.0, z = -0.77, p = .440), digital use (U = 2956.5, z = -0.63, p = .531), and digital rights (U = 3125.0, z = -1.20, p = .229). These findings indicate no significant gender differences in these areas of digital quotient. Overall, the results show that $H_o$ was largely supported, as most dimensions revealed no gender differences. The *null hypothesis ($H_o$) was retained, as no statistically significant gender differences were observed*.

However, the presence of a significant difference in digital safety provides partial support for the alternative hypothesis ($H_1$). The findings partially supported this assumption. Specifically, the alternative hypothesis ($H_1$) *There is a significant difference between male and female students across the dimensions of digital quotient, was accepted for the dimension of digital* safety, as the Mann–Whitney U test indicated a significant difference between male and female students, with females reporting stronger safety-related practices. The null hypothesis was rejected for the digital safety dimension (U = 3625.0, z = -2.95, p = .003, r = .22), indicating a statistically significant difference between male and female students. Female students scored higher in digital safety, suggesting that they are more attentive to online risks, privacy concerns, and protective behaviours in digital environments. These results suggest that gender plays a limited role in shaping students' digital competencies, influencing primarily safety-related behaviours, while most aspects of digital quotient are shared equally between male and female students.

Based on the findings discussed, it undeniably contributes to the growing body of research on digital competencies by examining gender differences on digital quotient among higher educational institutions. As the result revealed significant differences between male and female on digital safety, it signifies that privacy awareness and risks is a possible critical factor in educating students about safer digital practices. Thus, it offers valuable information for higher educational institutions particularly, educators, administrators and policy makers

in these learning institutions to provide digital safety training especially male students. Furthermore, by focusing on Malaysian higher education students, this study adds local evidence to a field that is mostly based on Western studies and provides regional insights into digital quotient in the post-pandemic education context.

**Limitations**

This study has several limitations in interpreting the finding data. Firstly, the imbalance in the number of male and female respondents may have affected the accuracy of group comparison analyses. Although non-parametric tests the Mann–Whitney U were employed to address this issue, the unequal sample size may still limit the generalizability of the gender-based findings. Secondly, the scope of this study was limited to students within a specific context, and therefore the results may not be generalized to broader populations such as working professionals or individuals in different cultural and educational settings. Finally, the study adopted a cross-sectional design, which restricts the ability to establish causal relationships between gender and digital quotient dimensions. Longitudinal or mixed-method approaches could provide deeper insights into how digital competencies grow over time and across different learning environments.

**Recommendation**

Future studies could address the limitations highlighted above in several ways. First, researchers should aim to include a more balanced sample across gender groups to allow stronger comparisons and more reliable conclusions. Expanding the demographic diversity of respondents (e.g., different age groups, disciplines, or cultural backgrounds) would also provide a broader understanding of digital competencies. Future study also can consider adopting longitudinal designs could help track how digital competencies develop over time and in response to interventions such as digital literacy training programs. Such an approach would also allow researchers to examine causal relationships between factors such as gender, digital use, and skill development. Finally, future research may explore additional predictors or mediators, such as digital attitudes, self-efficacy, or institutional support, which may further explain variations in digital quotient dimensions. Combining quantitative methods with qualitative insights (e.g., interviews or focus groups) could also deepen the understanding of students' experiences and challenges in navigating digital environments.

**Conclusion**

In conclusion, the study examined gender differences of the eight dimensions of digital quotients. The result revealed that gender differences were not significant in all dimensions except for digital safety, where females had greater awareness of digital safety than male. The finding is consistent with previous research which found that women are generally more cautious when communicating online. The study also provides insight to higher educational institutions in Malaysia on demographic factors like gender that can influence digital competencies. These results suggest the need for targeted strategies to promote equal digital competence across all dimensions, ensuring students are better prepared for learning and professional demands in the digital era. In addition, the results are useful for educators and policy makers in higher education institutions. Future research also could be done by incorporating longitudinal design to further explore the relationship between gender and digital quotient in educational context.

**Contribution of Study**

This study examines the eight DIQ dimensions which highlight digital competence across gender in digital context. The findings contribute to existing knowledge by validating the competencies of DIQ within higher education setting. Contextually, the findings also provide localized evidence from Malaysia, by adding additional input to previous studies which are largely focus on western countries. The results reveal that gender differences are most evident in digital safety, suggesting the need for targeted training in online protection and awareness. These insights are valuable for educators, higher education management and policymakers in developing gender-sensitive and culturally relevant digital education strategies. Overall, the study enhances both theoretical and practical understanding of how students engage responsibly and effectively in digital learning environments.

**References**

Abubakari S.M, Zakaria G.A.N, Musa J., & Kalinaki K., (2023) Assessing digital competence in higher education: A gender analysis of DigCom 2.1 Framework in Uganda, SAGA: *Journal of Technology and Information systems*, Vol 1, Issue 4, November 2023, page 114-120, DOI: https://doi.org/10.58905/saga.v1i4.210

Asrese, K., Muche, H. (2020) Online activities as risk factors for Problematic internet use among students in Bahir Dar University, North West Ethiopia: A hierarchical regression model. PLoS ONE 15(9): e0238804. https://doi.org/10.1371/journal.pone.0238804

Audrin, C., and Audrin, B. (2023) More than just emotional intelligence online: introducing "digital emotional intelligence". *Frontiers in Psychology*. 14:1154355 https://doi.org/10.3389/fpsyg.2023.1154355

Bolaji, H. O. (2019). Digital literacy: an emerging technological concept for innovative classroom content delivery. *Journal of Library, Science Education & Learning Technology*, 1 (1). 173 –180

Branley-Bell, D., Coventry, L., Dixon, M., Joinson, A., & Briggs, P. (2022). Exploring Age and Gender Differences in ICT Cybersecurity Behaviour. *Human Behavior and Emerging Technologies*, Article 2693080. https://doi.org/10.1155/2022/2693080

Cabezas-González, M., Casillas-Martín, S., & García-Valcárcel Muñoz-Repiso, A. (2021). Basic Education Students' Digital Competence in the Area of Communication: The Influence of Online Communication and the Use of Social Networks. *Sustainability*, 13(8), 4442. https://doi.org/10.3390/su13084442

Coopamootoo, K. P. L., & Ng, M. (2023). *"Un-Equal Online Safety?" A gender analysis of security and privacy protection advice and behaviour patterns*, arXiv. https://doi.org/10.48550/arXiv.2305.03680

DQ Institute, (2025), *DQ (Digital Intelligence)*, https://www.dqinstitute.org/global-standards/#DQ-Global-Standards

DQ Institute (2019). *DQ framework: A common language for digital literacy, skills and readiness*. DQ Institute. https://www.dqinstitute.org/global-standards/

Duran, E., & Özen, N. E. (2018). Digital literacy in Turkish lessons. *Türkiye Eğitim Dergisi, 3*(2), 31–46. Retrieved from https://dergipark.org.tr/tr/download/article-file/604621

ENISA. (2021). *Cybersecurity Terminology and Definitions*. European Union Agency for Cybersecurity. https://www.enisa.europa.eu/

Fariña-Sánchez, M., & Gutiérrez-Santiuste, E. (2025). Gender and digital rights: An empirical study among young entrepreneurs. *Administrative Sciences*, 15(1), 12. https://doi.org/10.3390/admsci15010012

Gasser, U., Maclay, C. M., & Palfrey, J. G. (2010*). Working towards a deeper understanding of digital safety for children and young people in developing nations*. Berkman Center Research Publication No. 2010-7, Harvard Public Law Working Paper No. 10-36, Available at SSRN: https://ssrn.com/abstract=1628276

Hatlevik, O. E., Throndsen, I., & Loi, M. (2023). Digital gender gaps in students' knowledge, attitudes and skills: An integrative data analysis across 32 countries. *Education and Information Technologies*, 28(10), 11753–11775. https://doi.org/10.1007/s10639-023-12272-9

Hossain MT, Akter S, Nishu NA, Khan L, Shuha TT, Jahan N, Rahman MM and Khatun MT (2023) The gender divide in digital competence: a cross-sectional study on university students in southwestern Bangladesh. *Frontiers of Education* 8:1258447. doi: https://doi.org/10.3389/feduc.2023.1258447

Hu, C., Zhao, L., & Huang, J. (2015). Achieving self-congruency? Examining why individuals reconstruct
their virtual identity in communities of interest established within social network platforms.
*Computers in Human Behavior*, 50, 465–475. https://doi.org/10.1016/j.chb.2015.04.027

Inamorato dos Santos, A., Chinkes, E., Carvalho, M.A.G. et al. The digital competence of academics in higher education: is the glass half empty or half full?. *International Journal Education Technology in Higher Education* 20, 9 (2023). https://doi.org/10.1186/s41239-022-00376-0

Jan, S. (2018). Gender, school and class wise differences in level of digital literacy among secondary school students in Pakistan. *Issues and Trends in Educational Technology*, 6(2). https://doi.org/10.2458/azu_itet_v6i2_jan

Kayaduman, H., & Battal, A. (2020). *The relationship between digital literacy and distance education perceptions.* In *ICERI2020 Proceedings* (pp. 2223–2227). IATED. https://doi.org/10.21125/iceri.2020.0533

Komba, W. L. M., & Mnkandla, E. (2024). Gender and digital technology use in higher education: A case study of distance learners in Tanzania. *Journal of Research Innovation and Implications in Education*, 8(1),1–16. https://www.ajol.info/index.php/jriie/article/view/288833

Lin, Y., Yu, Z. Extending Technology Acceptance Model to higher-education students' use of digital academic reading tools on computers. *International Journal Education Technology in Higher Education* 20, 34 (2023). https://doi.org/10.1186/s41239-023-00403-8

López Vicent, P., Serrano, J.L. & Gutiérrez Porlán, I (2022). Personal Management of Digital Information in University Students from a Gender Perspective. J. *New Approaches Educ. Res*. 11, 114–129 https://doi.org/10.7821/naer.2022.1.734

López-Nuñez, J.-A., Alonso-García, S., Berral-Ortiz, B., & Victoria-Maldonado, J.-J. (2024). A Systematic Review of Digital Competence Evaluation in Higher Education. *Education Sciences*, *14*(11), 1181. https://doi.org/10.3390/educsci14111181

Maon, S. N., Mohd Hassan, N., Mohamad Yunus, N., Abdul Kader Jailani, S. F. S., & Suzila Kassim, E. (2021). Gender Differences in Digital Competence Among Secondary School Students. *International Journal of Interactive Mobile Technologies (iJIM)*, *15*(04), pp. 73–84. https://doi.org/10.3991/ijim.v15i04.20197

Martin, F., Gezer, T., Anderson, J., Polly, D., & Wang, W. (2021). Examining Parents Perception on Elementary School Children Digital Safety. *Educational Media International*, 58(1), 60–77. https://doi.org/10.1080/09523987.2021.1908500

Sadiku, M. N. O., Shadare, A. E., & Musa, S. M. (2016). Digital identity. *International Journal of Innovative Science, Engineering & Technology*, 3(12), page 192 – 193, Retrieved from https://ijiset.com/vol3/v3s12/IJISET_V3_I12_23.pd

Moallem, A. (2018). Cyber Security Awareness Among College Students. In T. Z. Ahram & D. Nicholson (Eds.), Advances in Human Factors in Cybersecurity (AHFE 2018, Vol. 782, pp. 79-87). *Springer, Cham.* https://doi.org/10.1007/978-3-319-94782-2_8

Na-Nan, K., Roopleam, T., & Wongsuwan, N. (2020). Validation of a digital intelligence quotient questionnaire for employees of small and medium-sized Thai enterprises using exploratory and confirmatory factor analysis. *Kybernetes, 49*(5), 1465–1483. https://doi.org/10.1108/K-01-2019-0053

Kavut, S. (2021). Digital Identities in The Context of Blockchain and Artificial Intelligence. *Selçuk İletişim*, 14(2), 529-548. https://doi.org/10.18094/josc.865641

Pangrazio, L., & Sefton-Green, J. (2021). Digital Rights, Digital Citizenship and Digital Literacy: What's the Difference?. *Journal of New Approaches in Educational Research*, 10(1), 15-27. doi: https://doi.org/10.7821/naer.2021.1.616

Pangrazio, L., & Sefton-Green, J. (Eds.). (2021). *Learning to Live with Datafication: Educational Case Studies and Initiatives from Across the World*. Routledge. https://doi.org/10.4324/9781003136842

Peters, M., Elasri Ejjaberi, A., Jesús Martínez, M. ., & Fabregues, S. (2022). Teacher digital competence development in higher education: Overview of systematic reviews . *Australasian Journal of Educational Technology*, *38*(3), 122–139. https://doi.org/10.14742/ajet.7543

Ahmead, M., El Sharif, N., & Abuiram, I. (2024*). Risky online behaviors and cybercrime awareness among undergraduate students at Al Quds University: A cross-sectional study. Crime Science, 13, Article 29. https://doi.org/10.1186/s40163-024-00230-w*

Romero-López, M. A., Rodríguez-García, A. M., & García-Holgado, A. (2022). Personal management of digital information in university students from a gender perspective. *Journal of New Approaches in Educational Research*, 11(1), 22–37. https://doi.org/10.7821/naer.2022.1.734

Seufert, A., Poignée, F., Hobfeld, T. (2022) Pandemic in the digital age: analyzing WhatsApp communication behavior before, during, and after the COVID-19 lockdown. *Humanities and Social Sciences Communication*, 9, 140. https://doi.org/10.1057/s41599-022-01161-0

Shao, Y., Wu, J., Li, Y. . (2025). The impact of digital technology use on EFL students' English academic performance: The mediating roles of emotional intelligence and learning engagement. *BMC Psychol* 13, 638 https://doi.org/10.1186/s40359-025-02967-8

Shin, H. K., & Kim, K. K. (2010). Examining identity and organizational citizenship behaviour in computer-mediated communication. *Journal of Information Science, 36*(1), 114–126. https://doi.org/10.1177/0165551509353376

Hong, K.-S., & Abdul Aziz, N. (2014). Technology Use and Digital Learning Characteristics Among Malaysian Undergraduates. *Sains Humanika*, *2*(1). https://doi.org/10.11113/sh.v2n1.384

Steinfeld, N. (2022). Adolescent gender differences in internet safety education. *Feminist Media Studies, 23*(3), 1024-1041. https://doi.org/10.1080/14680777.2022.2027494

Susanto, H., Setiana, D., Besar, N., Najib Ali, M., Susanto, A. K. S., Seruddin, R., & Ibrahim, F. (2024). Leveraging Technology Enhancement: The Well-Being Emotional Intelligence, Security Keys to the University Students' Readiness in Digital Learning Ecosystem. *Sustainability*, *16*(9), 3765. https://doi.org/10.3390/su16093765

TechTarget. (2024). What is digital identity? In TechTarget: WhatIs.com. Retrieved September 24, 2025, from https://www.techtarget.com/whatis/definition/digital-identity

Vázquez-Cano, E., Meneses, E.L. & García-Garzón, E. Differences in basic digital competences between male and female university students of Social Sciences in Spain. *International Journal Education Technology in Higher Education,* 14, 27 (2017). https://doi.org/10.1186/s41239-017-0065-y

Vuorikari, R., Kluzer, S., & Punie, Y. (2022). DigComp 2.2: The Digital Competence Framework for Citizens—With new examples of knowledge, skills and attitudes. *Publications Office of the European Union*. https://doi.org/10.2760/490274

Wajcman, J. & Rose, E. (2011). Constant connectivity: rethinking interruptions at work, Organization Studies 32(7): 941–961. *Sage Publication*, https://doi.org/10.1177/0170840611410829

Wan Mokhtar, W. N. H. ., Hussin, N. ., & Mohd Shahari, S. N. . (2024). Digital Literacy Impact on Students' Performance . *Journal of Information and Knowledge Management*, 14(2), 32–39. https://doi.org/10.24191/jikm.v14i2.3666

Weinberger, M., Zhitomirsky-Geffet, M., & Bouhnik, D. (2023). Sex differences in attitudes towards online privacy and anonymity among Israeli students with different technical backgrounds. *arXiv*, https://doi.org/10.48550/arXiv.2308.03814

Yaseen, K. A. (2022). Importance of Cybersecurity in the Higher Education Sector. *Asian Journal of Computer Science and Technology*, 11(2), 20-24. https://doi.org/10.51983/ajcst-2022.11.2.3448

Yildiz, E. P., Çengel, M. & Alkan, A. (2020). Determination of Digital Citizenship Levels of University Students at Sakarya University Turkey. *International Journal of Higher Education*. 9. https://doi.org/10.5430/ijhe.v9n3p300

Živković, D., Horvat, A., & Čučić, V. (2013). Digital rights for digitally literate citizens. In S. Kurbanoğlu, E. Grassian, D. Mizrachi, R. Catts, & S. Špiranec (Eds.), Worldwide Commonalities and Challenges in Information Literacy Research and Practice: Revised Selected Papers. ECIL 2013 (pp. 170-177). Springer. https://doi.org/10.1007/978-3-319-03919-0_21

Zulkifli, Z., Abdul Molok, N. N., Abd Rahim, N. H., & Talib, S. (2020). Cyber Security Awareness Among Secondary School Students in Malaysia. *Journal of Information Systems and Digital Technologies*, 2(2), 28–41. https://doi.org/10.31436/jisdt.v2i2.151