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Bridging The Gender Gap: Investigating Disparities In Student Communication Skills In The Digital Education Era

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Abstract:
Communication skills are one of the primary skills that students need to have. Previous research indicates a tendency for differences in communication skills based on gender. For this reason, this research investigates how learning in the digital era can enhance communication skills in students aspiring to become prospective teachers and explores whether there are differences in communication skills based on gender. The research employs a comparative descriptive method to assess the level of student's communication skills, considering gender as one of the influencing factors. The sample consists of 19 male and 19 female students selected through quota sampling. Data analysis conducted using SPSS reveals that overall communication skills are 'good,' except multilingual skills, which are 'sufficient.' Surprisingly, digital technology, particularly translator apps, negatively impacts students' ability to communicate in foreign languages. Gender differences in communication skills were found insignificant when educational opportunities were equal, showing similar skill levels among both genders. This study contributes to scholarship by demonstrating that using digital technology in the learning process can enhance students' communication skills. Additionally, this research proves that, with equal education, gender differences do not affect communication skills. This finding can assist in designing more inclusive and effective learning strategies for developing communication skills in the digital era.

Introduction

In general learning activities, there is observed disparity in communication patterns, where some students are more active in participating and interacting with the learning material. In contrast, others tend to be passive or less engaged in classroom discussions. It is also evident that the communication patterns between students and teachers tend to differ, with some students more inclined to ask questions or express their opinions, while others prefer to remain silent or only provide brief responses (O'Connor et al., 2017; Yashima et al., 2016). These differences in communication patterns are assumed also to be influenced by gender factors (Allen, 2023; Hall & Sandler, 1982; Ruthotto et al., 2020). To begin with, communication derives from the Latin word 'communis,' which can be interpreted as 'together' (Etkin et al., 2022; de Moor et al., 2022). In this context, communication refers to the exchange of information collectively (Huh, 2020). Conceptually, communication is disseminating knowledge, thoughts, values, and news with a specific purpose (Yeşil, 2010; Nurhalizah et al., 2020; Mahanal et al., 2022). The specific goals of communication may include expanding information distribution, inspiring participation, or

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reaching agreements on matters of common interest. In general, communication is closely related to Interaction.

Interaction/communication between teachers and students is crucial in learning (Asrar et al., 2018; Batista et al., 2021; Priadi, 2020; Šejtanić & Ilić, 2016). Communication skills involve students actively expressing thoughts, ideas, knowledge, or new information to construct new knowledge and achieve learning goals. A successful learning process includes effective communication between teachers and students and among students (Munna & Kalam, 2021; Šejtanić & Ilić, 2016; Xie & Derakhshan, 2021). Students in the Tadris Physics study program are projected to become prospective teachers, emphasizing the need for solid communication skills. In the future, they will serve as facilitators, training and nurturing communication motives in the students they teach. Therefore, lecturers need to focus on training communication skills with students. Additionally, a LinkedIn survey of labor recruiters revealed that communication skills are the most needed soft skills by future workers (Polakova et al., 2023). We live in the digital era, where the education sector implements digital technology. The rapid development of technology drives this shift (Sudibjo et al., 2019). Learning characteristics in the digital era include prioritizing digital learning resources, utilizing various digital applications and platforms, and incorporating digital tutoring services (Mudjijanti & Srimulyani, 2023; Sutiah & Supriyono, 2024). Given the distinct nature of digital-era learning compared to conventional methods, it is crucial to study how learning in the digital era shapes students' soft skills, particularly communication skills.

Research indicates that gender influences language processing and communication skills. Studies have found that during phonological tasks, men tend to activate the left inferior frontal gyrus, whereas women engage both left and right inferior frontal regions, suggesting differing neural strategies between genders (Gregersen & Røyneland, 2009; Holmes, 2013; Kusters & Lucas, 2022). In terms of communication skills, Yavuz and Güzel (2020) discovered that both male and female teachers scored highly, with women slightly outperforming men, though the difference was not statistically significant. This highlights the universal importance of effective communication in education. Furthermore, Lovell et al. (2009) reported that female physicians employed more process-oriented and perceptual communication skills, feeling more adept in non-verbal and culturally sensitive interactions compared to their male counterparts. These distinctions may stem from women's preference for a psychosocial communication style, while men often adopt a biomedical approach. Collectively, these findings underscore how gender can shape both cognitive processing and interpersonal communication across various professional contexts.

Given the observed differences in communication skills influenced by gender, this study hypothesizes that gender significantly affects the communication abilities of prospective physics teacher students at UIN Imam Bonjol Padang. Furthermore, considering the shift towards digital learning environments, it is posited that the digital learning experiences of these students also play a crucial role in shaping their communication skills. Therefore, the study aims to investigate the extent to which gender and digital learning experiences collectively influence the communication competencies of these future educators.

Method

This study uses a comparative descriptive method to evaluate students' communication skills and analyze the influence of gender factors in the context of digital technology-based learning in the Physics Education Study Program (Guillen-Gamez et al., 2021; Qazi et al., 2022). Sampling was done through the quota sampling method, a non-probability technique in which researchers determine a certain number of subgroups representing specific population characteristics. In this study, a quota of 19 male and 19 female students was set, so the total sample was 38 people. This

limited sample size is due to the focus of the study, which only involved physics education students at UIN Imam Bonjol Padang. Although quota sampling allows for the representation of specific subgroups, it is important to remember that this method has limitations, such as the potential for selection bias and the lack of generalizability of the results to the broader population.

This study collected data through a questionnaire instrument designed to measure students' communication skills. The questionnaire was developed based on seven leading indicators. First is understanding, managing, and creating effective communication, including those utilizing digital technology. Second, the level of confidence in conveying ideas or concepts. Third, appropriate language to the content and context is adjusted to the intended audience. Fourth, an honest and responsible attitude towards the information, ideas, or thoughts conveyed. Fifth is the ability to listen to and respect the opinions of others. Sixth, the use of logical and structured thinking patterns by applicable rules. Seventh, skills in communicating using more than one language. These indicators reflect relevant communication competencies in the context of digital technology-based learning, as emphasized in 21st-century education.

Furthermore, the student communication skills scores obtained from the questionnaire will be calculated and analyzed with the assistance of the SPSS application. The analysis using SPSS is conducted to test the hypotheses. The hypotheses in this research are as follows:

Hypothesis (Ho): There is no significant difference between the average communication skills of male and female students
I have: $ц_A = h_B$

Alternative hypothesis (Ha): there is a significant difference between the average communication skills of male and female students
I have: $ц_A \neq h_B$

Before performing an independent samples t-test, it is important to ensure that the data meet the assumptions of normality and homogeneity of variance. The normality assumption requires that the data within each group are normally distributed. This can be tested using tests such as the Shapiro-Wilk or Kolmogorov-Smirnov. If the data are not normally distributed, the t-test results may not be valid. The assumption of homogeneity of variance, or equality of variances, means that the two groups have similar variances. Levene's Test is one standard method used to test this assumption. If this assumption is violated, the standard t-test may give misleading results, and alternatives such as Welch's t-test may be considered. Ensuring these two assumptions are met is critical to the validity and reliability of the independent samples t-test results.

Results and Discussion

Student Communication Skill Level

Students in the Tadris Physics study program are individuals whose primary graduate profile is geared toward becoming prospective Physics teachers. In addition to receiving instruction in various competencies related to the teaching profession, such as pedagogical, personality, social, and professional competencies, students are also equipped with various soft skills, including communication skills. This emphasis on communication skills is vital for educators, mainly when undertaking roles as facilitators, tutors, motivators, and learning engineers for students. The lecture process plays a pivotal role in honing these competencies and skills.

The lecture process within the Physics Study Program adheres to the curriculum's recommended student-centered approach (Schreurs & Dumbraveanu, 2014; Dunbar & Yadav, 2022). In this approach, lecturers guide students to construct their knowledge actively. This process, combined with integrating digital technology, helps students develop proficiency in communication. As previously mentioned, research data were obtained by distributing

questionnaires to active Physics Education Study Program students who had attended lectures utilizing digital technology. The following section (table 1) presents the findings obtained from the data collection process, specifically focusing on evaluating students' communication skills across seven distinct indicators. These indicators have been analyzed using differentiation based on gender factors.

Table 1. Evaluation of Students' Communication Skills by Gender

No.	Indicator	Average Score	
		Male	Female
1	The ability to understand, manage, and create effective communication, including communication that utilizes technology,	3,58	3,53
2	Confidence in expressing ideas	3,42	3,42
3	Language usage in line with content context and adapted to the audience	3,47	3,63
4	Demonstrating an honest and responsible attitude towards conveyed information, ideas, or thoughts,	3,42	3,26
5	Listening and respecting others' opinions	3,10	3,26
6	Using logical and structured thought processes according to applicable rules	3,26	3,37
7	Multilingual communication skills.	2,68	2,79

Communication skills indicators are an important basis for assessing the quality of individual communication. The ability to understand, manage, and create effective communication, including the use of technology, is crucial in the digital era. Confidence in conveying ideas shows clarity and self-confidence, influencing how messages are delivered. Using language appropriate to the content, context, and audience ensures that messages are conveyed with the intended meaning. An honest and responsible attitude towards the information conveyed builds trust in communication. The ability to listen and respect the opinions of others reflects healthy interpersonal relationships. Logical and structured thinking processes support preparing coherent and easily understood messages. Communicating in multiple languages is becoming increasingly important in today's global environment.

Based on Table 1 and Figure 1, the communication skills of male and female students showed similar average scores, namely 3.28 and 3.32. Male students excelled in honesty and responsibility, while female students excelled in using appropriate language, adaptation to the audience, and logical and structured thinking patterns. This finding aligns with previous studies that showed no significant differences in interpersonal communication skills between male and female students. However, educators and education stakeholders need to be aware of this finding and develop learning strategies that support the development of interpersonal communication skills for both genders.

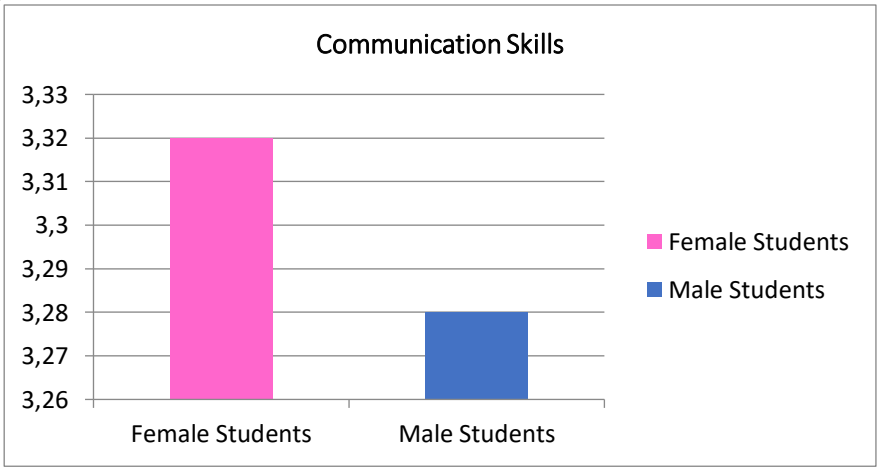

Figure 1. Communication Skills of Male and Female Students

The average scores for communication skills are above 3 for both male and female students, precisely 3.28 for male students and 3.32 for female students. Students affirm that the lecture process significantly enhances their communication skills. During the lecture process, students often engage in discussions, which fosters the development of verbal and non-verbal communication skills. Milawati et al (2022) distinguishes between verbal and non-verbal codes in communication, with verbal code representing spoken language and non-verbal code encompassing supportive signals like facial expressions and intonation. When participating in discussions, students articulate their opinions using verbal code, complemented by intonation, facial expressions, and even body movements, constituting non-verbal codes in communication. Upon closer examination, students reported that these discussion activities effectively honed their verbal communication skills (Iverson, 2010; Hömke et al., 2017). This finding aligns with Ahmad Muslim's research, which asserted that participatory learning through focus group discussions significantly improved students' communication skills (Muslim, 2020). Additionally, the question-and-answer sessions within the discussions cultivate students' proficiency in active listening, respect for diverse opinions, and accountability for the ideas or information conveyed.

Not uncommonly, students must conduct small group discussions and write papers before engaging in more extensive discussions, producing informative scientific papers. This practice underscores that the lecture process enhances oral communication and cultivates practical written communication skills. Hikmawati et al. also asserted that the communication skills of prospective teacher students can improve through the analysis of scientific journal articles (Hikmawati et al., 2021). Hence, it is evident that the lecture activities at the Tadris Physics Study Program enhance students' communication skills.

As aspiring Physics teachers, students in the Physics Education Study Program are also trained to perform scientific communication related to scientific process skills, such as creating graphs and diagrams. This aligns with the findings of Nurlaelah's research, which suggests that skills such as reading, collecting, and presenting information in tables, diagrams, or graphs, interpreting data, compiling systematic reports, making conclusions, and identifying patterns from natural phenomena are integral to communication skills (Nurlaelah et al., 2020).

Regarding integrating digital technology in lecture activities to support communication skills training, previous research indicates that familiarity with digital technology/digital literacy positively influences critical thinking, communication, collaboration, and creativity (Sasabillah et al., 2023). Students corroborate this by stating that, in writing scientific papers, they commonly use digital technology to gather information, such as searching for scientific journal articles or obtaining data from reputable websites. The accessibility of digital technology significantly facilitates the composition of scientific papers. In addition to expressing their ideas, students must be honest and responsible in their writing by providing proper citations and acknowledging sources. Digital technology simplifies the citation process with various citation applications such as EndNote and Mendeley (Feinstein, 2008; Taylor, 2002; Aksnes et al., 2019).

Furthermore, students are often tasked with creating PowerPoint presentations (PPTs) or videos for class discussion activities. With the advancement of technology, students can quickly generate engaging PowerPoint presentations or educational videos (Craig & Amernic, 2006; Penciner, 2013). As prospective teachers, becoming adept at producing PPTs or videos as discussion materials is highly beneficial for practicing communication skills and honing the ability to develop learning materials and media. Examining the role of lecturers in digital technology-based lecture activities on student communication skills, research respondents stated that lecturers serve as effective facilitators (Smith & Francis, 2022; Eckhaus et al., 2024). By guiding students through discussions, lecturers stimulate communication motives. Communication motives can be categorized as either conscious or subconscious. Motives from the conscious mind

are generally proactive and planned, while those from the subconscious mind are reactive, unplanned, and can arise spontaneously (Dabengwa et al., 2024; Alkathiri et al., 2024). Lecturers explicitly convey that active participation in discussions, including asking questions, responding, and expressing opinions, is an assessed aspect, motivating students to communicate effectively.

At the conclusion of discussion activities, lecturers typically review the discussions undertaken. This may involve expressing appreciation to students who articulate opinions effectively or provide insights on the principles of effective communication. Lecturers consistently emphasize the essential elements of effective communication in discussions, including maintaining eye contact, speaking audibly and clearly, and adhering to proper grammar usage (Hawken et al., 1991; Qureshi et al., 2021; Dahmani et al., 2024; Tegegne & Wondimu, 2024). Another aspect of communication skills analyzed in this research is students' proficiency in multilingual communication. Findings indicate that the average student rates their multilingual communication skills as only 2.68. Among the 38 respondents, only 10 expressed confidence in actively and passively communicating in languages other than Indonesian. Despite lecturers often encouraging students to refer to articles in international journals that use English, students still perceive their multilingual communication skills to be at a basic level.

While the presence of digital technology has been shown to enhance various communication skills in previous indicators, technology has not positively impacted multilingual communication skills. Students mentioned that the availability of Google Translate and other translation applications has led to complacency in learning English, creating a dependency on translation tools. This observation aligns with research by Endang Sholihatin et al., which highlights the influence of translator applications on students' motivation and independence in learning foreign languages (Bin Dahmash, 2020; Van Nguyen, 2023).

Student Communication Skills Viewed From a Gender Perspective

Previous research indicates differences in the neuropathological processes of various aspects of language from a gender perspective. Functional magnetic resonance imaging studies have shown that during phonological tasks, men primarily activate the left side of the brain, while women exhibit neural activity in both the left and right inferior frontal gyrus (Gregersen & Røyneland, 2009; Holmes, 2013; Kusters & Lucas, 2022). In the book "Introduction to Language Studies," Gregersen states that examining neuropathological process differences between men and women does not reveal significant disparities in language efficiency (Gregersen & Røyneland, 2009; Holmes, 2013; Kusters & Lucas, 2022).

However, historical evidence suggests variations in speaking styles between men and women. These differences may contribute to the observed patterns in communication skills, as shown by the research results that male students tend to perform slightly better in demonstrating an honest and responsible attitude towards conveyed information, ideas, or thoughts (with an average score of 3.42). In contrast, female students excel in language usage aligned with content context and adapted to the audience (with an average score of 3.63), as well as in listening and respecting others' opinions (average score of 3.26) and using logical and structured thought processes according to applicable rules (average score of 3.37).

Further investigations indicate that social factors, including education, influence these differences. More significant disparities in educational opportunities for boys and girls lead to more pronounced distinctions in their speaking styles (Gregersen & Røyneland, 2009; Holmes, 2013; Kusters & Lucas, 2022). In ancient times, women had fewer educational opportunities than men, reinforcing the perception that men held more power and prestige. Consequently, the words spoken by men were deemed more influential than those spoken by women. Additionally, cultural factors often placed women in subordinate roles, with men as leaders, maintaining dominance.

Therefore, the words of males were considered more critical and heard more frequently (Munira et al., 2020; Rafikova & Voronin, 2024).

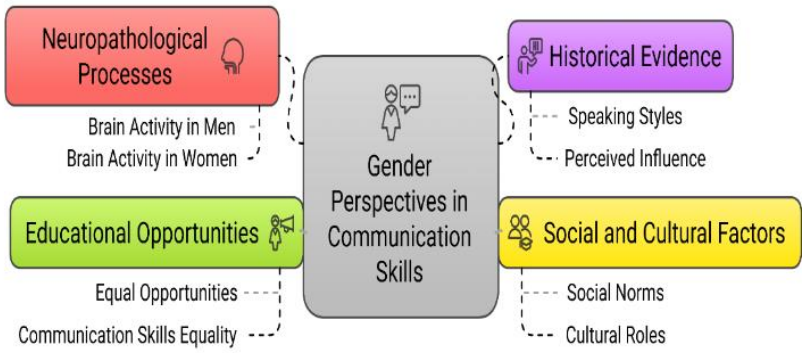

Figure 2. Gender Perspectives in Communication Skills

On the other hand, with equal educational opportunities, women tend to be more sensitive than men to language status norms (Gregersen & Røyneland, 2009; Holmes, 2013; Kusters & Lucas, 2022). This aligns with the findings of this study. A comparison of male and female students' average communication skill scores indicates that female students scored slightly higher on average. However, further analysis through an independent t-test yielded a two-tailed significance value of 0.763, greater than 0.05. This implies no significant difference between the average communication skills of male and female students.

Based on these research results, establishing an inclusive educational ecosystem without gender differentiation can foster gender equality, including equality in communication skills. These findings align with Cronin's assertion that building a fair and balanced educational ecosystem between genders is crucial (Cronin & Roger, 1999). The respondents in this study were students in the Physics Education Study Program who, during the lecture process, received equal treatment and learning opportunities through the use of digital technology. Therefore, when students receive equal educational opportunities, disregarding the notion that women are subordinates who must prioritize men's thoughts, women can exhibit communication skills as proficient as men.

Conclusion

The significant finding of this study is that the overall level of students' communication skills is generally categorized as 'good.' Proficient communication skills are evident in oral expressions, such as opinions, questions, or participation in class discussions and written forms, including assignments or scientific papers. The advancement of communication skills is influenced by the learning process utilizing digital technology. When considering gender differences, there appears to be no significant distinction between the communication skills of male and female students. Men and women can develop communication skills at relatively similar levels when afforded the same educational opportunities.

The study results show that students' communication skills are in the "good" category, with no significant differences between genders. This supports that digital technology-based learning can improve communication skills evenly, indicating that technology integration in the learning process can effectively develop students' overall communication competencies. Practically, these results encourage educators and policymakers to continue integrating digital technology into the learning curriculum to strengthen students' communication skills and create an inclusive and supportive learning environment.

This study's limitation is its limited sample size, as it focuses on physics education students at UIN Imam Bonjol Padang. To obtain more reliable research results, further research can be

conducted by taking a larger sample size and exercising more control over treatments in digital-era learning activities. Based on the findings that students' communication skills are classified as good without gender differences, further research is recommended to explore the role of digital media, collaborative contexts, self-development programs, and extracurricular activities in supporting communication improvement. This is important to formulate more effective and equitable development strategies.

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Author Contribution Statement

AAZ was responsible for conceptualization, design, analysis, and writing. KA was responsible for data analysis, editing and reviewing the manuscript.

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