# TELEGRAM AND WHATSAPP IN BLENDED LEARNING: IMPACT ON ONLINE COMMUNITY AND ACADEMIC ACHIEVEMENT AMONG GRADUATE STUDENTS

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**ABSTRACT**

Applied Modern Instant Messaging applications (MIM) including WhatsApp and Telegram bring expanded possibilities for teaching strategies while improving student integration and university expansion for immigrant students. The study investigated the effectiveness of MIM within graduate-level educational technology courses. to explore the benefits it provides for discussions along with social presence development and student engagement growth. The research demonstrates MIM enables instant classroom analyses while supporting real-time student feedback which results in an engaging interactive learning environment. This research combined quantitative and qualitative methods to conduct surveys among 65 graduate students from diverse academic majors in Pakistan through online platforms and course announcements and an evaluation grounded in social science of Mobile Instant Messaging (MIM) applications telegram and WhatsApp in blended learning. The use of MIM tools in student coursework led to improved student satisfaction levels and greater motivation and deeper engagement. According to research findings MIM demonstrates ability to revamp online education by improving student-to-student communication. Further research needs to analyze MIM's effects on learning achievements alongside best practice creation for instructors and access evaluation for virtual education programs. Modern MIM application optimization holds great potential to boost digital curriculum methods.

**Keywords:** Mobile Instant Messaging, WhatsApp, Telegram, online learning, student engagement, educational technology

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## 1. Introduction

The landscape of tertiary education has undergone significant transformation in recent years, driven by the integration of technology into teaching and learning processes. Tertiary education, which encompasses education provided by universities, colleges of education and plays a pivotal role in fostering economic growth, reducing poverty, and promoting shared prosperity (Arnhold, 2021). A highly skilled workforce, equipped with lifelong access to quality post-secondary education, is essential for innovation and sustainable development. Individuals with tertiary education are more employable, productive, and resilient to economic shocks, earning higher wages and contributing positively to societal well-being (World Bank, 2021). In the contemporary era, the acquisition of skills and knowledge necessary for societal advancement is increasingly dependent on the integration of technology into the educational system. Modern technologies have revolutionized how students socialize, learn, and interact, presenting both opportunities and challenges for educators, policymakers, and parents. The rapid growth of online learning platforms and the widespread adoption of digital tools by tertiary institutions have reshaped the delivery of education. This shift has been further accelerated by the COVID-19 pandemic, which necessitated a global transition to remote learning. According to distance learning statistics from 2020, 97% of students enrolled in bachelor's degree programs shifted to online education, while 43% of academic institutions invested in new resources to support remote instruction (Global Monitoring Report Team, 2020). This unprecedented shift highlighted the need for dynamic and flexible educational systems capable of addressing diverse learning needs and overcoming barriers to access. Among the technological tools that have gained prominence in tertiary education are social media platforms such as Telegram and WhatsApp. These platforms have emerged as valuable tools for fostering collaborative learning, enhancing communication, and supporting academic achievement. Telegram, a cross-platform messaging app, is widely recognized for its enhanced privacy features, encryption, and support for large group chats, making it a preferred choice for educational purposes (Johnson, 2021). Its features, including high security, video calls, chat groups, channels, polls, and bots, provide a versatile environment for teaching and learning (Durov, 2020). For instance, Telegram allows students to send private inquiries or assignments to instructors without exposing their interactions to peers, thereby maintaining privacy and fostering effective communication (Hibah, 2021). Additionally, the platform's ability to hide users' phone numbers aligns with the preferences of both students and educators who prioritize privacy (Durov, 2020).

Similarly, WhatsApp has been widely adopted in educational settings due to its accessibility and user-friendly interface. Studies have demonstrated its effectiveness in enhancing student achievement and facilitating collaborative learning. For example, Safitri (2021) found that WhatsApp significantly improved student performance compared to other platforms, while Ilobeneke et al. (2018a) reported no significant difference in achievement between students using WhatsApp and Facebook for instruction. These findings underscore the potential of social media platforms to complement traditional teaching methods and create engaging, student-centered learning environments.

The integration of Telegram and WhatsApp into blended learning approaches has further expanded their utility in tertiary education. Blended learning, which combines online and face-to-face instruction, leverages the strengths of both modalities to enhance learning outcomes. Technology enriches this approach by providing flexible and interactive ways to deliver instructional content, enabling educators to communicate through voice, images, and text (Falode & Mohammed, 2023; Mohammed & Ogar, 2023). Moreover, the use of multimedia tools in blended learning caters to diverse learning styles, particularly for visual learners who benefit from technology-enhanced presentations and resources (Azman et al., 2018). By making learning more engaging and interactive, technology fosters a deeper understanding of course material and supports the development of critical thinking and problem-solving skills (Mohammed et al., 2023).

The COVID-19 pandemic underscored the importance of adaptable and inclusive educational systems, prompting a global appreciation for distance learning and the role of technology in overcoming barriers to education. As tertiary institutions continue to embrace digital tools, platforms like Telegram and WhatsApp are likely to play an increasingly central role in shaping the future of education. This study explores the impact of Telegram and WhatsApp on online community building and academic achievement among graduate students, contributing to the growing body of research on the role of social media in blended learning. By examining the

effectiveness of these platforms in fostering collaboration and enhancing learning outcomes, this research aims to provide insights into best practices for integrating technology into tertiary education.

The findings of this study provide valuable insights into the dimensions of student engagement, social presence, and learning outcomes across various age groups and genders. The results highlight both strengths and areas for improvement, offering a comprehensive understanding of how different factors influence student engagement and academic performance. This discussion contextualizes the findings within the broader literature and identifies implications for educational practices.

### 1.1 Strengths in Communication and Belonging

The study revealed that "Communication with Instructors" and "Belonging in Discussions" were among the strongest dimensions of student engagement, with high average scores and positive perceptions. This aligns with the findings of Alshahrani (2022), who emphasized the role of instant messaging tools in fostering effective communication between students and instructors. Similarly, Aisyah et al. (2021) demonstrated that platforms like Telegram enhance academic performance by facilitating seamless communication and collaboration. The strong sense of belonging observed in this study is consistent with Gray's (2021) assertion that a sense of belonging is critical for student engagement and academic success. These findings suggest that leveraging communication tools and fostering inclusivity can significantly enhance student engagement.

### 1.2 Challenges in Social Engagement and Presence in Learning

Despite the positive trends in communication and belonging, the study identified challenges in "Social Engagement" and "Presence in Learning." The relatively lower scores in these dimensions indicate that students face difficulties in maintaining active involvement in learning activities and building peer connections. This is consistent with the findings of Alharthi (2023), who highlighted the challenges of integrating WhatsApp in education, particularly in fostering meaningful social interactions. Similarly, Johnson and Davis (2023) noted inclusivity challenges in mobile instant messaging (MIM) tools, which can hinder social engagement. To address these issues, the study recommends implementing interactive teaching methods and group activities, as suggested by Williams and Roberts (2021), who emphasized the importance of collaborative learning strategies in enhancing engagement.

### 1.3 Age and Gender Differences in Engagement and Learning Outcomes

The analysis of learning outcomes by age and gender revealed distinct trends. Females consistently outperformed males across all age groups, with higher median scores and less variability. This finding aligns with the study by Oteyola et al. (2021), which found that female students exhibited higher engagement levels in micro-teaching contexts. Additionally, participants aged above 30 demonstrated the highest performance, suggesting that maturity and experience may contribute to stronger learning outcomes. However, the 22–25 age group exhibited the most variability, indicating mixed performance. This variability may be attributed to the transitional nature of this age group, as they navigate academic and professional challenges. Targeted interventions, such as peer mentoring and personalized learning approaches, could help address these disparities.

### 1.4 Implications for Educational Practices

The study's findings underscore the importance of leveraging technology to enhance communication and inclusivity. Platforms like Telegram and WhatsApp, as highlighted by Aisyah et al. (2021) and Amran et al. (2024), can play a pivotal role in fostering engagement and motivation. However, educators must also address the challenges associated with these tools, such as ensuring equitable access and fostering meaningful interactions. Collaborative learning strategies, as recommended by Williams and Roberts (2021), can further enhance engagement by promoting peer-to-peer interactions and active participation.

### 1.5 Limitations and Future Research

While this study provides valuable insights, it is not without limitations. The reliance on self-reported data may introduce bias, and the cross-sectional design limits the ability to establish causal relationships. Future research could employ longitudinal studies to explore the long-term impact of engagement strategies on learning

outcomes. Additionally, qualitative approaches could provide deeper insights into the factors influencing social engagement and presence in learning.

In conclusion, this study highlights the critical role of communication, belonging, and social engagement in fostering student success. By addressing the challenges identified and leveraging the strengths observed, educators can create more inclusive and engaging learning environments. The findings contribute to the growing body of literature on student engagement and offer practical recommendations for enhancing educational practices.

### 1.6 Research Objectives

**1.** This research evaluates the effects Mobile Instant Messaging (MIM applications have on creating online social presence in learning environments.

**2.** The research will analyze how MIM applications impact student learning results.

**3.** This research focuses on discovering which factors determine how MIM applications function effectively.

## 2. Results

The study was conducted over six months, from August to January, during which graduate students utilized Telegram and WhatsApp for educational activities. The research design adopted mixed methodologies to study Mobile Instant Messaging (MIM) application effects on social presence, learning outcomes and satisfaction levels by utilizing quantitative surveys alongside qualitative interviews and observational data collection.

A total of 65 students who studied educational technology formed the research participant base. The research group contained 26 women, 26 men along with 12 participants who avoided disclosing their gender information and one additional participant did not provide an answer regarding gender. The 65 graduate students represented diverse ages as 6 individuals were under 22 years, 18 participants were between 22 and 25, and 21 participants fell within the 26 to 30 age bracket alongside 15 participants over 30 years old. The varied representation within the participant sample allowed researchers to evaluate different user perspectives on MIM applications.

The research used a blended methodology which combined quantitative and qualitative methods to fully study the effects that Mobile Instant Messaging applications specifically Telegram and WhatsApp have on graduate students' social presence and learning outcomes in educational technology courses as well as on their satisfaction rates. The methodology enabled researchers to merge quantitative numerical patterns found within survey responses with qualitative information collected from participants to create an extensive understanding of the research problem.

An online survey distributed by Google Forms collected data because it granted students convenient access to participation. The survey received responses from 65 graduate students studying in Social Sciences/Humanities, STEM, Arts, Business/Management and other subject areas. Graduate students joined the study voluntarily by using multiple channels such as course announcements and university communication networks and online platforms. They completed the survey questions that focused on their MIM experiences in blended learning contexts. The research structure allowed researchers to detect both statistical patterns alongside detailed assessments about how MIM applications shape education.

The developed survey questionnaire examined how participants reacted to Telegram and WhatsApp through the evaluation of their social presence alongside learning achievements and satisfaction ratings. The survey instrument contained both closed-ended questions together with open-ended questions to enable a combination of quantitative and qualitative data collection.

The survey included closed-ended questions which asked participants to rate their responses through a 5-point Likert scale (Strongly Agree to Strongly Disagree) for engagement, collaboration and satisfaction measures.

Through open-ended survey questions participants could provide extensive responses containing their feedback about MIM application usage in education.

Participants filled out the survey two times throughout the six-month duration so researchers could monitor their progress since the study start point.

### 2.1 Survey Questions and Responses

Topics encompassing this survey included:

#### 2.1.1 Demographics

● Age group (Below 22, 22-25, 26-30, Above 30)

● Survey participants could choose between Male, Female and Prefer not to say as their gender option.

● Studies of Primary Focus Include Social Sciences/Humanities along with STEM whereas Arts along with Business/Management fall under the other category.

#### 2.1.2 Social Presence and Engagement

● The MIM applications create important bonding pathways between myself and my classmates during my online educational journey.

● Online students can more easily reach their instructors through MIM applications during virtual classes.

● The MIM applications provide me with a platform to stay active in the online class discussion group.

● Thankfully MIM applications provide instant communication which improves my level of presence during my online learning sessions.

● MIM applications help me improve my peer relationship development when learning through online classes.

● I depend on MIM applications to interact socially in my online classes.

#### 2.2.3 Learning Outcomes and Satisfaction

● Through group discussions MIM applications enable me to enhance my knowledge of class materials.

● Applying MIM applications enables me to achieve better results with my assignments' deadlines.

● MIM applications support my success rate as a student in my virtual learning environment.

● The MIM applications increase my motivation levels to join online classes.

● The platform MIM applications creates effective opportunities for academic collaboration throughout online learning environments.

● I encounter less difficulty in my online studies since MIM applications provide great ease of access.

The survey included open-ended questions that helped researchers gain qualitative understanding about user experiences and find better ways to improve MIM applications for educational purposes.

### 2.2 Interview Questions

The researchers completed semi-structured interview sessions in the middle and at the conclusion of their research period. Participants received comprehensive examination through detailed interviews which investigated their real-life applications usage. Sample interview questions included:

● The use of messaging interfaces such as Telegram and WhatsApp impacts your classroom and teacher relations through privacy or quality of connection standards.

● Please describe the difficulties that have occurred when you use MIM applications for your academic assignments.

● Did MIM applications offer any particular time when they made your learning experience better?

● The way MIM applications function during online education time stands in comparison with regular communication channels.

### 2 .3. Observational Data

Auditors monitored participants without interference during their six-month use of the Telegram and WhatsApp platforms. The following aspects were analyzed:

● The patterns of communication along with interaction frequencies together with discussion classification (academic or social) make up Message Threads.

● The levels of group participation together with collaboration and member engagement in Telegram group discussions served as a data collection method.

● Students shared different types of resources including notes and articles and videos which directly related to class materials.

● Participants used their MIM applications to accomplish joint projects and group assignments and provide peer academic help.

● The observational data helped provide new information about user patterns and participant actions which extended the results obtained from survey data and participant interviews.

### 2.4 Participant Guide

The guide delivered to participants contained complete instructions which showed them how to utilize Telegram and WhatsApp for educational activities in school. The guide included instructions on:

● Users need guidance for establishing and setting up group chats which serve academic discussions.

● The system allows users to distribute numerous types of content including files, web resources and multi-media assets.

● Courses included useful information about engaging in academic discussions and team-based work activities.

● Proficiency and honorable conduct in scholarly communication remain vital during every interaction.

● The guide established comprehensive platform training for all participants which led to steady meaningful involvement within the framework of the research.

### 2.5 Evaluation

The research data collection spanned six months throughout which three stages were conducted.

● The participants employed Telegram and WhatsApp to maintain educational dialogues but additionally utilized both services for group discussions along with resource spread and joint tasks.

● The quantitative data collection through the survey took place during both initial and final stages of the research period.

● Two stages of semi-structured interviews occurred throughout the middle and at the conclusion to capture qualitative information.

● Research personnel tracked and documented user actions on platforms to study meaningful patterns and patterns of conduct.

#### 2.5.1 Quantitative Analysis

Research data acquired from survey questions underwent evaluation with descriptive analytics and inferential statistical procedures. The description of statistics examined both participant demographic descriptions and the general direction of survey response patterns. We conducted paired t-tests alongside ANOVA to determine changes in online social presence together with learning outcomes and satisfaction which students underwent before and after implementing MIM applications. Python programming facilitated the analysis, with the following libraries:

● **Pandas:** During data manipulation Python enabled the proper cleaning together with reorganization of data sets.

● **NumPy:** Numerical computations performed tasks that determined means and standard deviations.

● **Matplotlib and Seaborn:** The applications enable the creation of static visualizations and interactive visualizations in sequential order. Interactive data visualizations displayed to the team data patterns showing how satisfaction ratings shifted throughout monitored periods.

#### 2.5.2 Qualitative Analysis

An analysis of qualitative data from interview sessions and open-ended survey participant responses applied thematic analysis techniques. The steps included:

**Familiarization**: The research team performed two steps for analyzing interview data: first they transcribed and read the interviews to find repeating themes and then assigned specific codes for each segment.

**Coding:** Research analysts use code systems to identify key ideas and concepts within specific segments of collected data.

**Theme Development:** The researcher organized discrete codes into major themes including "perceived benefits of collaboration" while also developing "technological challenges.".

**Reviewing Themes:** The research team performed additional theme refinement to match them with the study objectives.

**Final Interpretation:** The analysis combines various research findings to construct a descriptive account about participant interactions with MIM applications.

### 2.6 Validity and Reliability

A pilot phase including ten participants was executed before the primary study to test the validity and reliability aspects of the survey instrument and interview guidelines. Results from the pilot phase needed a few adjustments to the material which enhanced clarity alongside relevance. The reliability check verified that the measurement tools kept a consistent relationship between items through a Cronbach's alpha value of 0.89 showing strong internal cohesion.

### 2.7 Limitations and Delimitations

Self-reported data collection stands as a primary study limitation since participants could show bias toward socially desirable statements. The study limits its generalization potential because it concentrates on graduate students enrolled in educational technology courses. Future scholarly investigations need to employ increased varied research samples together with studies examining extended repercussions of MIM application usage The study leverages strong quantitative along with qualitative methodology to deliver an extensive analysis of the way Telegram and WhatsApp influence academic presence and educational achievements and student fulfillment. Study results indicate that MIM applications effectively improve graduate student abilities in collaborative learning as well as critical thinking and problem-solving. These methodologies establish transparency while offering researchers the ability to replicate results that support the expanding field of technology-enhanced education.

The radar chart illustrates various dimensions of student engagement and their corresponding scores, providing insights into areas of strength and improvement as shown in figure 1. The strongest dimension is Communication with Instructors (2.74), indicating that students feel relatively connected and comfortable interacting with their instructors. However, the weakest dimension is Presence in Learning (2.23), reflecting challenges in maintaining active involvement in learning activities. Moderate scores are observed in areas like Belonging in Discussions (2.71), Connected to Classmates (2.46), Building Relationships (2.46), and Social Engagement (2.38), suggesting that while there is some level of engagement, there is room for enhancement, particularly in fostering peer connections and social interactions. To improve overall engagement, efforts could focus on enhancing Presence in Learning through interactive teaching methods, as well as boosting Social Engagement and relationship-building through group activities and informal networking opportunities.

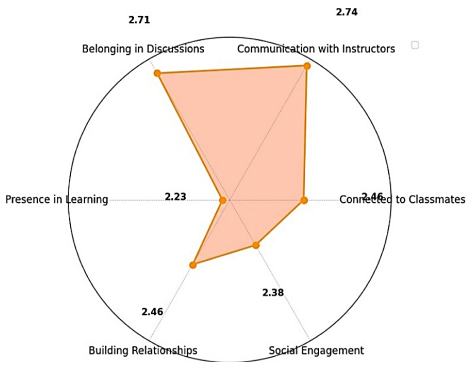


**Figure 1: Student Engagement**

The heatmap illustrates the frequency distribution of responses across four metrics: "Connected to Classmates," "Sense of Belonging," "Feeling Present," and "Social Engagement," categorized into five levels: "Strongly Disagree," "Disagree," "Neutral Responses," "Agree," and "Strongly Agree." A majority of respondents feel positively about these metrics, with "Feeling Present" showing the strongest agreement (31 responses), indicating high engagement. "Sense of Belonging" also shows significant agreement (29) and strong agreement (17), reflecting a strong sense of inclusion. Similarly, many respondents agree (27) or strongly agree

(13) about feeling connected to classmates, though a smaller proportion express disagreement (6 strongly disagree, 8 disagree). "Social Engagement," however, has a relatively balanced distribution, with a peak in neutral responses (19), suggesting room for improvement in fostering engagement.

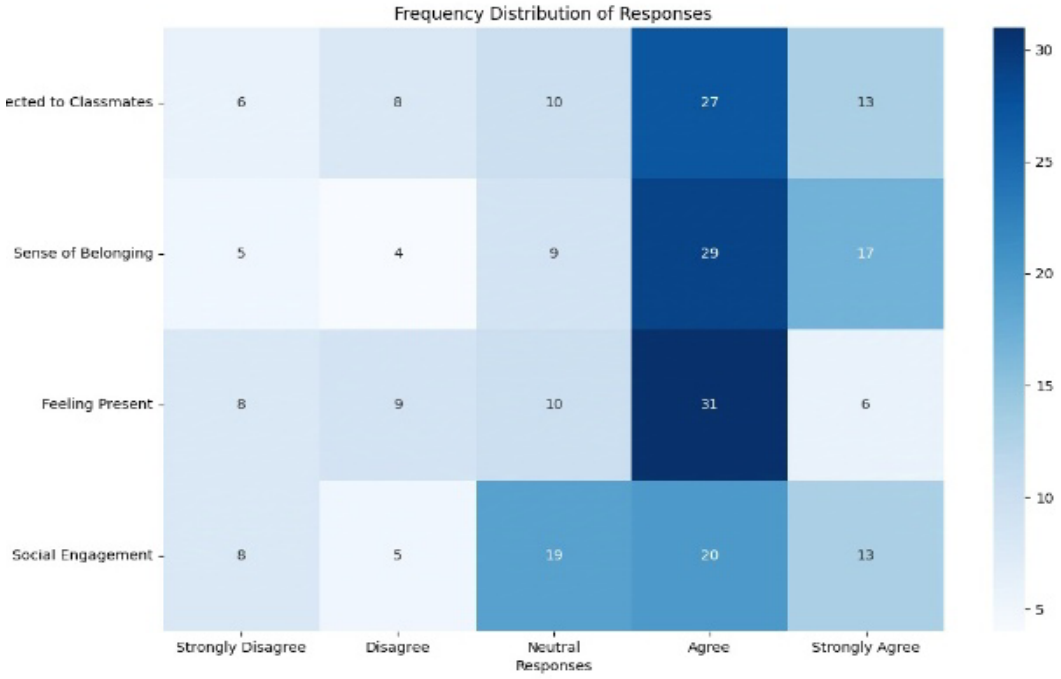


**Figure 2: Frequency Distribution**

Overall, disagreement levels are minimal across all metrics, while agreement and strong agreement dominate, pointing to a positive overall perception as shown in figure 2. Recommendations include focusing on enhancing social engagement, leveraging strong trends in "Feeling Present" and "Sense of Belonging," and addressing gaps in peer connection to further strengthen community ties.

Figure 3 visualizes the average responses across six categories related to social and academic engagement: "Connected to Classmates," "Communication with Instructors," "Belonging in Discussions," "Presence in Learning," "Building Relationships," and "Social Engagement." The highest averages are observed for "Belonging in Discussions" and "Communication with Instructors," indicating strong perceptions of inclusivity and effective communication. In contrast, "Presence in Learning" has the lowest average, suggesting less active engagement in academic activities. "Social Engagement" and "Building Relationships" show moderate responses, reflecting some level of connection but with room for improvement. The data highlights strengths in communication and inclusivity while pointing to potential gaps in fostering active learning and peer-to-peer interactions. Recommendations include enhancing "Presence in Learning" through interactive teaching strategies and technology, promoting peer bonding via group activities and discussions, and sustaining effective communication practices to maintain inclusivity and belonging.

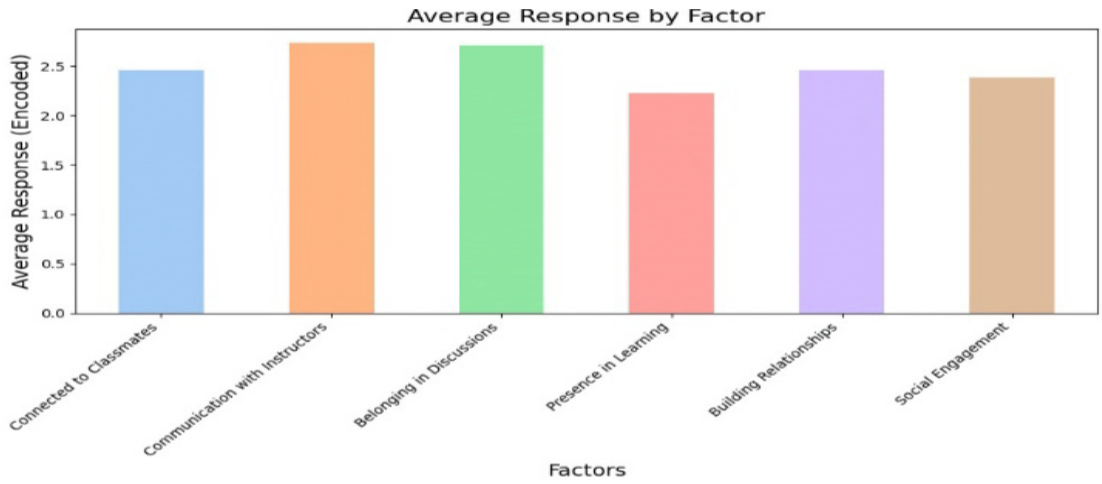


**Figure 3: Average Response by Factor**

The violin plot illustrates the distribution of responses across six factors: "Connected to Classmates," "Communication with Instructors," "Belonging in Discussions," "Presence in Learning," "Building Relationships," and "Social Engagement." The response scale ranges approximately from -2 to 5, with the violin plots visualizing the spread, density, and variability of the data. Most factors have medians concentrated in the 3 to 4 range, indicating moderate to high levels of agreement or engagement. "Communication with Instructors," "Belonging in Discussions," and "Social Engagement" show medians skewed toward higher responses, highlighting strong positive perceptions. Conversely, "Presence in Learning" has a wider distribution, with responses ranging from very low to high, reflecting diverse experiences and polarized opinions. Factors like "Connected to Classmates" and "Building Relationships" exhibit narrower distributions, suggesting more consistent perceptions. Key insights include strengths in communication, inclusivity, and social engagement, as well as consistent peer connectivity as shown in figure 4. However, the variability in "Presence in Learning" reveals a need to address disengagement among some participants. Recommendations include tailoring strategies to address the diverse experiences in "Presence in Learning," such as implementing personalized learning approaches and active participation techniques. Leveraging the strengths in communication and belonging is essential to maintain positive perceptions, while further initiatives to enhance peer connectivity could foster deeper engagement.

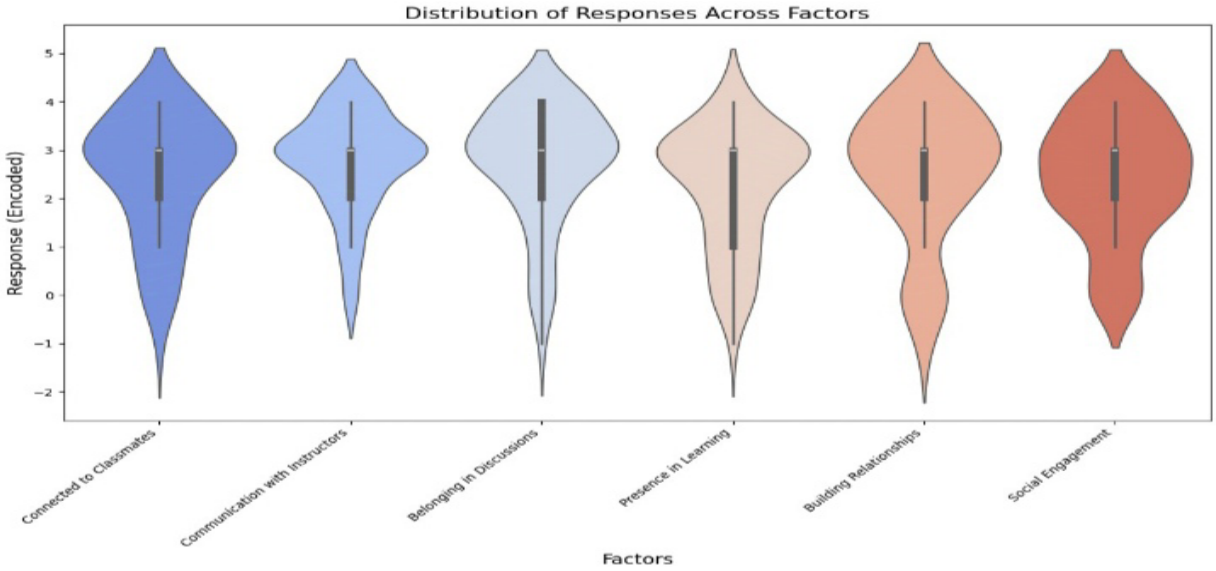


**Figure 1: Distribution of Response Across Factors**

The heatmap illustrates the distribution of responses across four survey questions: "Enhance Understanding," "Improve Performance," "Enhance Overall Performance," and "Increase Motivation," categorized into five options: "Strongly Disagree," "Disagree," "Neutral," "Agree," and "Strongly Agree." The data shows that "Enhance Understanding" It has the highest agreement (41.54%), indicating a strong association with improved comprehension, though 23.08% responded neutrally. For "Improve Performance," most respondents agree (45.31%), with 18.75% strongly agreeing, while disagreement levels are minimal, reflecting a positive perception. "Enhance Overall Performance" also shows substantial agreement (41.34%), though it has relatively high neutral responses (24.82%), suggesting some hesitation. The question "Increase Motivation" has significant agreement (38.46%) but a higher proportion of neutral responses (35.38%), indicating mixed opinions about its motivational impact. Overall, agreement and strong agreement dominate, reflecting positive feedback, while neutral responses highlight areas with divided opinions, particularly regarding motivation as shown in figure 5 . Disagreement levels are generally low across all questions, showing minimal negative feedback.

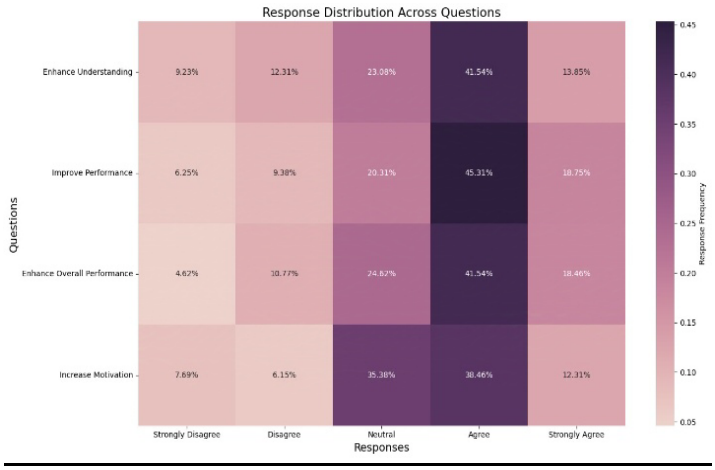


**Figure 5: Response Distribution**

This research depicts the distribution of responses for four questions evaluating learning outcomes: "Enhance Overall Performance," "Enhance Understanding," "Improve Performance," and "Increase Motivation." Each question is categorized into five response types: Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree.

For "Enhance Overall Performance," the majority of responses fall into the Agree category, highlighting a positive perception of the intervention's impact on performance. Neutral responses are present but fewer, suggesting some uncertainty among participants, while Strongly Disagree and Disagree responses are minimal. Similarly, "Enhance Understanding" reflects a strong positive trend, with the Agree category dominating and Neutral responses indicating moderate agreement. Disagreement levels remain minimal, further confirming a favorable sentiment. "Improve Performance" also demonstrates robust agreement, with the highest responses in Agree and notable representation in Strongly Agree, signifying strong confidence in improved performance outcomes. Disagreement is rare, indicating a consensus among participants. In contrast, "Increase Motivation" shows the largest proportion of Neutral responses, suggesting mixed or less definitive perceptions about its impact on motivation. Despite this, Agree responses remain significant, though slightly lower compared to performance-related aspects. Strongly Disagree responses are negligible across all questions, underscoring minimal negative sentiment. Overall, the data reveals a predominantly positive impact on understanding and performance, with motivation being less conclusively perceived. The consistently low levels of disagreement indicate general satisfaction, while the higher neutrality in motivation suggests an area for potential enhancement to ensure stronger participant confidence and clarity.

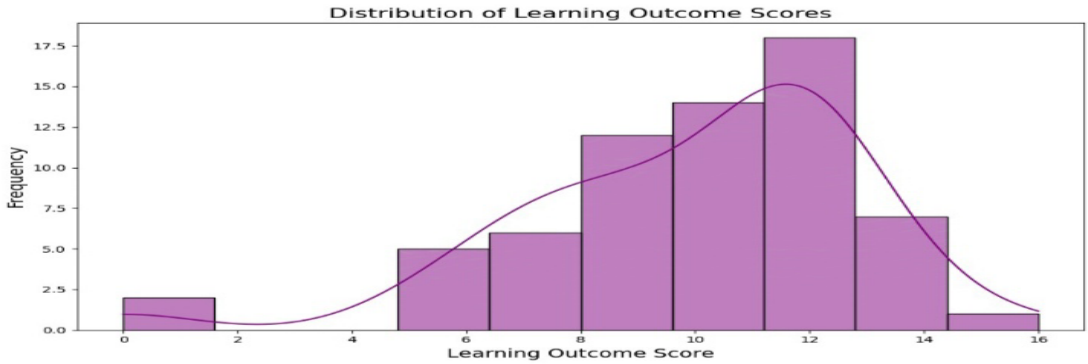


**Figure 6: Distribution of Learning Outcome Scores**

The histogram illustrates the distribution of learning outcome scores across participants, accompanied by a density curve that highlights the frequency trends. The distribution exhibits a right-skewed bell shape, with most scores concentrated in the range of 8 to 12, indicating that the majority of participants achieved above-average learning outcomes as shown in figure 6. The density curve emphasizes this concentration around a mean of approximately 12, tapering off towards both extremes. The scores range from 0 to 16, reflecting variability in learning outcomes, though the lower end (0–4) comprises very few participants, suggesting minimal instances of poor performance. The frequency steadily rises from scores near 4, peaks around 12, and gradually declines towards 16, with the peak frequency demonstrating that most participants performed well, likely due to the effectiveness of the intervention or activity. A small subset of participants with lower scores slightly skews the distribution, highlighting an area for improvement. Overall, the data suggests a successful intervention with the majority of participants achieving strong learning outcomes, while also pointing to the need for targeted strategies to support those at the lower end of the spectrum. Sustaining the practices that have led to the high concentration of scores around 12 and addressing the challenges faced by the lowest scorers would ensure more inclusive and consistent results.

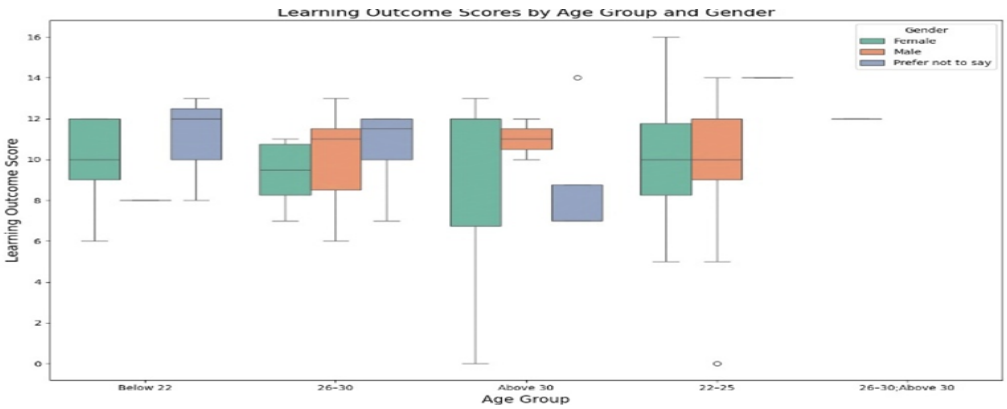


**Figure 7: Learning Outcome Score by Age Group and Gender**

The analysis of learning outcomes based on age and gender reveals distinct trends and variations across groups as shown in figure 7. Among participants below 22, females demonstrate a higher median score close to 12, with a compact interquartile range (IQR), indicating consistent performance and minimal variability. No outliers or low scores are observed in this group. Males in this age group have slightly lower median scores, around 10-11, with greater variability as indicated by a larger IQR and whiskers. Overall, females outperform males in this age group with more consistent scores. For participants aged 22–25, females have a median score of around 11 but show higher variability, as reflected in the wider IQR, and some low outliers are present, indicating a few participants performed poorly. Males exhibit a similar median score, with slightly less variability than females. Participants identifying as "Prefer not to say" in this age group show sparse data and lower scores around 6, indicating poorer performance. This age group overall exhibits the highest variability and

mixed performance across genders. In the 26–30 age group, females and males both show a median score of around 10, with moderate variability; however, males exhibit slightly wider whiskers and IQR compared to females. Participants in the "Prefer not to say" category again have sparse data and slightly lower scores. This group reflects stable performance overall, though less consistent than younger groups. Participants aged above 30 demonstrate the highest performance, with females achieving a median score of 12-13, the highest among all groups, and a compact IQR indicating consistent high performance with no outliers. Males in this group also perform well, with slightly lower median scores than females but greater variability. Overall, this group shows strong performance, particularly among females, who consistently outperform males in terms of both median score and variability. General trends highlight that females generally exhibit higher median scores and less variability across all age groups, reflecting more consistent learning outcomes, while males tend to have slightly lower median scores with greater variability, especially in younger age groups. Younger participants (below 22) achieve higher and more consistent scores, while participants aged above 30 perform best overall, with the highest median scores and consistency. The 22–25 age group exhibits the most variability and outliers, suggesting mixed performance. Participants identifying as "Prefer not to say" show sparse data and lower scores, particularly in the 22–25 and 26–30 age groups. These findings suggest that learning interventions are most effective for participants aged above 30, especially females, and strategies could be refined using this group as a model to support younger participants. Targeted efforts are needed to address the variability and outliers in the 22–25 age group and to ensure inclusivity for participants identifying as "Prefer not to say," given their lower performance.

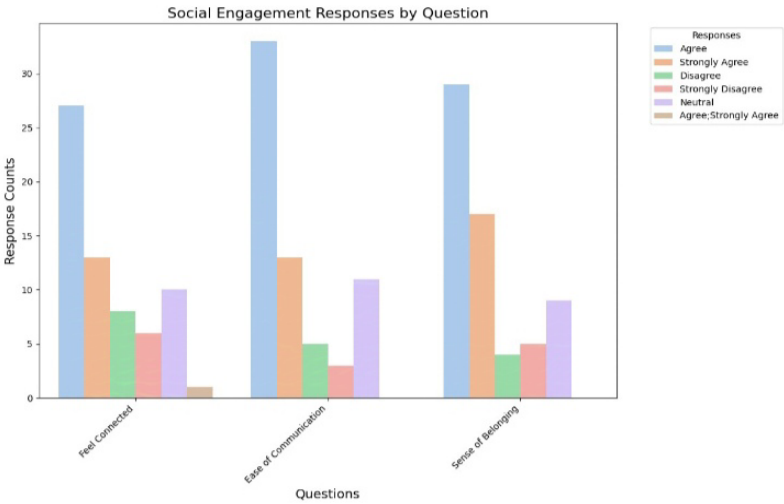


**Figure 8: Social engagement Responses**

The bar chart illustrates Social Engagement Responses categorized by three questions: Feel Connected, Ease of Communication, and Sense of Belonging, each divided into five response categories: Strongly Agree, Agree, Neutral, Disagree, and Strongly Disagree. Across all three questions, the Agree category consistently dominates, with the highest response counts, reflecting an overall positive perception of social engagement as shown in figure 8. For Feel Connected, the majority of participants agree (~30 responses), with a moderate number strongly agreeing (~15), suggesting a strong sense of connection. Neutral responses (~10) indicate some indecisiveness, while minimal Disagree and Strongly Disagree responses show very few participants feel disconnected. Similarly, Ease of Communication sees the highest agreement (~30 responses), slightly higher than Feel Connected, suggesting smooth and accessible communication is a significant strength. Strongly Agree responses (~10–15) reinforce this sentiment, with Neutral responses (~10) showing some hesitancy and only a small fraction of participants expressing dissatisfaction. For Sense of Belonging, Agree responses are again the highest (~25), indicating most participants feel included, supported by Strongly Agree (~15) responses. Neutral responses (~10) are consistent across questions, reflecting a segment of participants with mixed opinions, while Disagree and Strongly Disagree responses remain minimal, indicating very low dissatisfaction. Overall, the data highlights high agreement levels, demonstrating effective social engagement strategies, particularly in communication ease, which is the strongest area. However, the consistent Neutral responses (~10 across questions) suggest room for improvement in fully engaging some participants. The minimal negative responses,

although low, warrant further investigation to address any specific barriers to connection, communication, or belonging. To build on these strengths, it is recommended to maintain the high levels of agreement while addressing Neutral and negative feedback to ensure all participants feel strongly connected, communicative, and a sense of belonging.

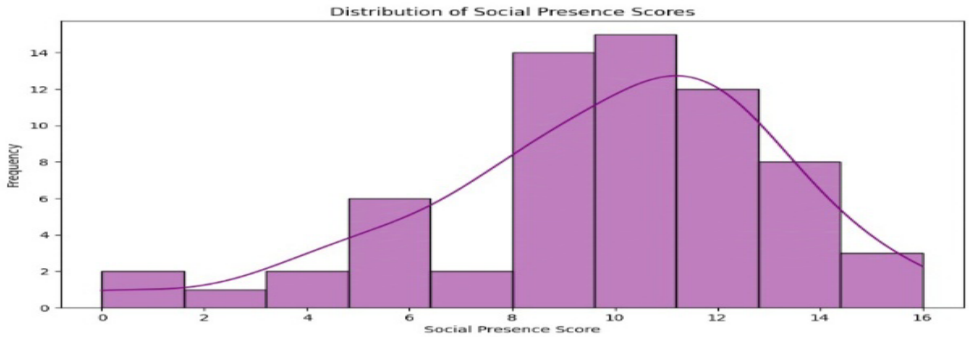


**Figure 9: Distribution of Social Presence Scores**

The histogram represents the distribution of Social Presence Scores, with a fitted curve suggesting an approximately normal distribution, though slightly skewed. The majority of participants scored within the range of 10 to 12, which marks the peak frequency (mode) with around 14 individuals, indicating moderate social presence levels for most participants as shown in figure 10. Frequencies are lower at the extremes (0–2 and 14–16), reflecting fewer individuals with very low or very high social presence scores, and the slight right-skew of the distribution is visible through the tail extending towards higher scores. The scores span a wide range, from 0 to approximately 16, highlighting significant variability in social presence levels among participants. The fitted curve aligns closely with the histogram, supporting the assumption of normality, though formal statistical tests like the Shapiro-Wilk test could confirm this. Overall, the data suggests moderate engagement for most individuals, with minimal outliers or uncommon scores. Further analysis, including statistical measures like mean, median, standard deviation, and skewness, would provide a deeper understanding, while exploring outliers and incorporating boxplots could enhance the robustness of the findings.

The correlation matrix visualizes relationships between four variables: Connection to Classmates, Sense of Belonging, Feeling Present, and Engagement, with values ranging from -1 to 1, where 1 indicates a perfect positive correlation, 0 indicates no correlation, and -1 indicates a perfect negative correlation. Key findings reveal that Connection to Classmates has a moderate positive correlation with Engagement (0.40) and Sense of Belonging (0.32), suggesting that fostering connections among classmates can enhance both engagement and belonging as shown in figure 10. . There is also a weak positive correlation between Connection to Classmates and Feeling Present (0.30), as well as between Sense of Belonging and Engagement (0.35). The weakest correlation is between Sense of Belonging and Feeling Present (0.12), indicating these variables are largely independent. Engagement appears to be positively influenced by both Connection to Classmates and Sense of Belonging, making these critical areas to target for improvement. Feeling Present shows weak correlations with the other factors, suggesting it operates more independently. Strengthening social relationships and fostering a sense of belonging could lead to higher engagement, while further statistical analyses, such as regression or factor analysis, could provide deeper insights into these dynamics. Future studies could also explore causality to determine whether improving specific variables, such as Sense of Belonging, directly impacts Engagement. This analysis highlights the importance of social dimensions in promoting engagement and informs strategies for fostering better group dynamics.

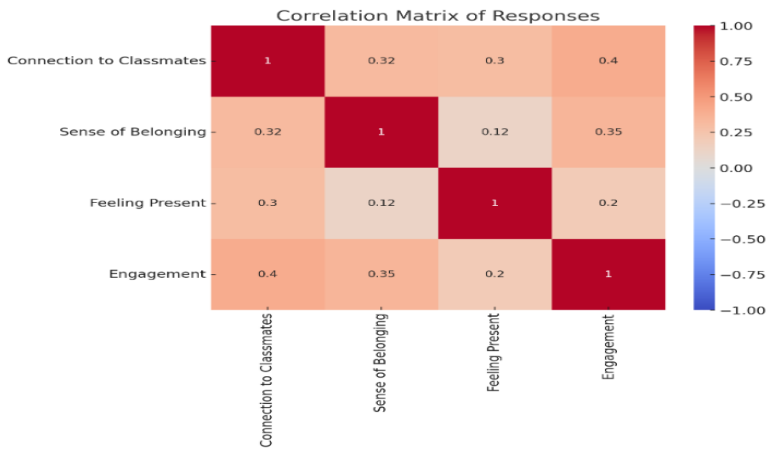


**Figure 10: Correlation Matrix of Responses**

The box plot illustrates "Social Presence Scores by Age Group and Gender," providing insights into how these factors influence social presence. The age groups are categorized as "Below 22," "22–25," "26–30," "Above 30," and a duplicate category labeled "26–30;Above 30," while gender is divided into Female, Male, and "Prefer not to say. "This categorization of age groups is shown in figure 11. Median scores are highest for both males and females in the "Above 30" group, indicating stronger social presence among older participants, whereas the "Below 22" group shows lower median scores, particularly for those who "Prefer not to say." The interquartile range (IQR) varies across groups, with females and males in the "22–25" and "Above 30" categories displaying smaller IQRs, reflecting consistent scores, while larger IQRs in the "Below 22" and "26–30" groups suggest higher variability. Outliers, represented by circles, are prevalent across most age groups, especially in "26–30" and "Above 30," highlighting occasional extreme scores. Females in the "26–30" and "Above 30" categories generally score higher than males, while males exhibit greater variability in some groups, such as "26–30." The "Prefer not to say" category consistently shows lower scores across age groups, indicating potential disparities. Social presence appears to increase with age, peaking in the "Above 30" group, while gender differences reveal females tend to have higher scores, particularly in older age groups. The lower and more variable scores among younger participants suggest developing social behaviors or less stable social engagement. Clarifying the "26–30;Above 30" label and exploring the factors driving variability in younger age groups, as well as the significance of outliers, could provide more precise insights into these trends.

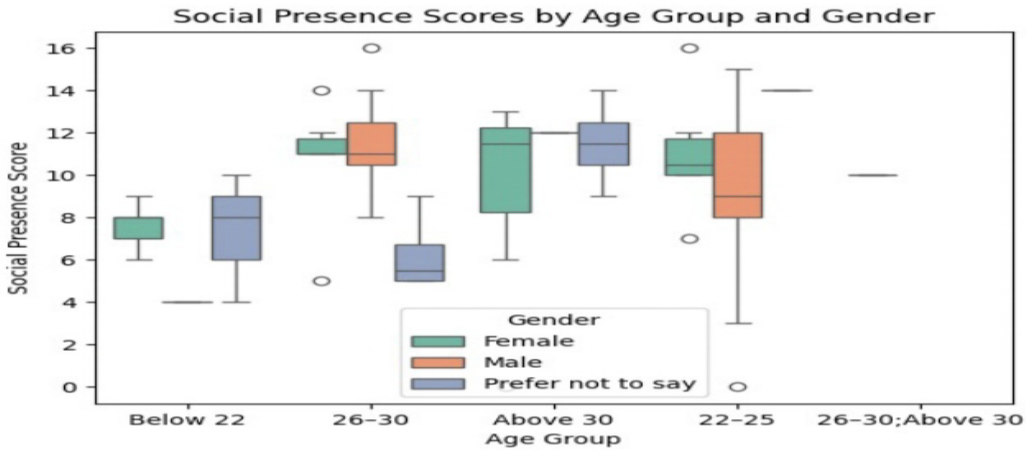


**Figure 11: Social Presence Scores by Age Group and Gender**

Figure 12 shows four bar charts those depict participants' responses across four dimensions: Connected to Classmates, Sense of Belonging, Feeling Present, and Social Engagement. For "Connected to Classmates," most

participants indicated agreement, with the highest count being around 25 participants who selected "Agree," and approximately 10–15 participants who selected "Strongly Agree." Neutral responses, at around 10 participants, were moderate, while minimal participants (2–5 combined) chose "Disagree" or "Strongly Disagree," indicating that most individuals feel connected to their classmates. Similarly, for "Sense of Belonging," the majority of participants also chose "Agree" (around 25) and "Strongly Agree" (approximately 10), with neutral responses being slightly significant at about 10, and minimal disagreement. This suggests that most participants experience a strong sense of belonging within their environment. The "Feeling Present" dimension shows a distribution pattern akin to the previous categories, with "Agree" responses leading at around 20–25 participants and "Strongly Agree" following at 10–15. Neutral responses remain consistent at around 8–10 participants, while disagreement is minimal. This indicates that most participants feel present and engaged, with few feeling disconnected. In the "Social Engagement" dimension, while "Agree" responses lead (around 15–20), the count is slightly lower than in other dimensions. "Strongly Agree" remains consistent at about 10, while neutral responses continue to be significant (8–10), and a larger proportion of participants (around 5) chose "Disagree," indicating some issues with social engagement. Across all dimensions, "Agree" consistently dominates, reflecting generally positive perceptions among participants, although "Strongly Agree" responses are less frequent, suggesting potential for improvement as shown in figure 13. Neutral responses are steady across all categories, suggesting that some participants are undecided or indifferent. Notably, "Social Engagement" has slightly weaker agreement and higher disagreement compared to other dimensions, indicating an area for improvement. Recommendations include addressing barriers to social engagement through initiatives that promote interaction, exploring reasons for neutral responses to convert them into positive engagement, and reinforcing existing strategies that promote connection, belonging, and presence to build upon current strengths.

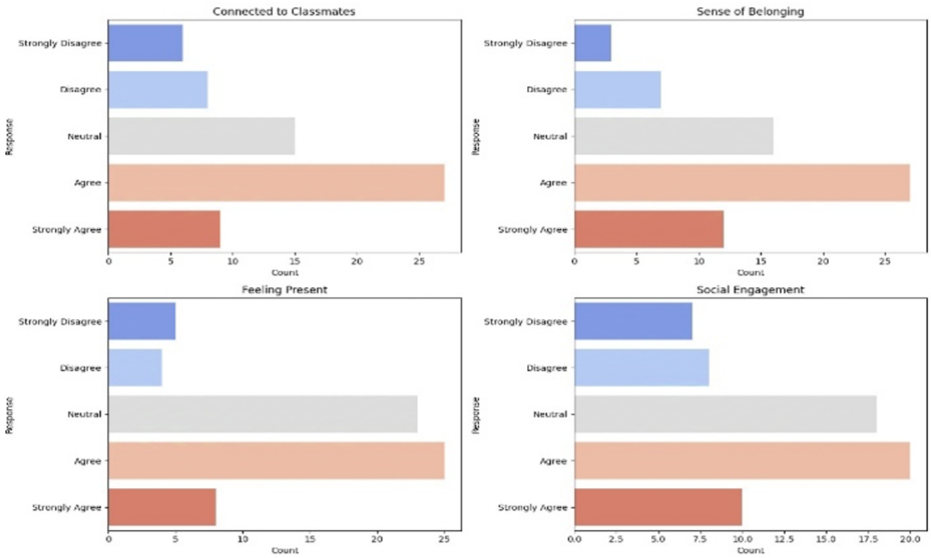


**Figure 12: Four-dimensional Response**

The stacked bar chart illustrates the distribution of responses by gender across four dimensions: Connected to Classmates, Sense of Belonging, Feeling Present, and Social Engagement. Responses are categorized into five levels: Strongly Agree, Agree, Neutral, Disagree, and Strongly Disagree, and grouped by three gender categories: Female (represented by purple shades), Male (blue-green shades), and Prefer not to say (lighter green and yellow shades) as shown in figure 13.

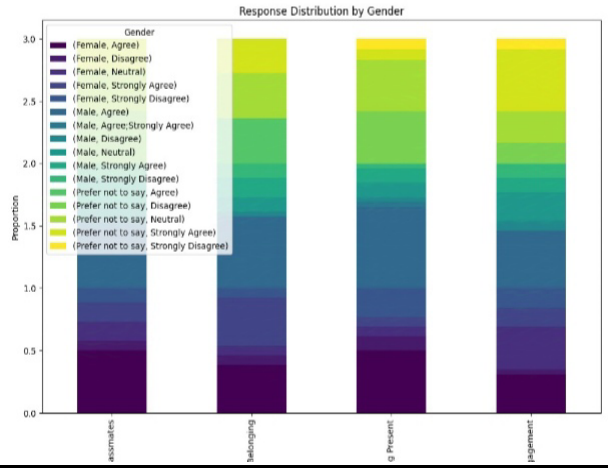


**Figure 13: Response Distribution by Gender**

Overall, Agree and Strongly Agree dominate responses across all dimensions, with Neutral responses moderately present and Disagree and Strongly Disagree responses being minimal. Female participants consistently exhibit the strongest positive responses, indicating high levels of connection, belonging, and engagement. Male participants follow a similar trend but show slightly more Neutral responses, particularly in "Social Engagement" and "Feeling Present." The Prefer not to say group demonstrates weaker positive responses, with greater variability and higher proportions of Neutral, Disagree, and Strongly Disagree responses, especially in "Social Engagement." While positive responses dominate across all groups, the "Social Engagement" dimension shows slightly more variability and disengagement. To address these patterns, it is recommended to investigate the challenges faced by the Prefer not to say group, implement inclusive opportunities to enhance their connection and belonging, and develop programs to foster interaction and reduce disengagement among male and Prefer not to say participants. Leveraging the strong positive responses from female participants can further support peer-led initiatives that promote belonging and engagement.

**Figure 14: Learning Outcome Score Distribution by Age Group**

This violin plot illustrates the Learning Outcome Score Distribution across five age groups: Below 22, 26–30, Above 30, 22–25, and a redundant overlapping category (26–30; Above 30) as shown in figure 15. Each violin represents the range, density, and central tendency of scores within its respective age group, with the plot width indicating score density (wider areas reflect more participants with similar scores), a black central bar

denoting the interquartile range (IQR), and a white dot marking the median. The Below 22 group has a median score of approximately 10, with scores ranging from 5 to 15 and a balanced distribution centered around the median. The 26–30 group also has a median of 10, but with a narrower range (7 to 13) and less variability. In contrast, the Above 30 group exhibits a higher median of 12, with a broader range (5 to 18) and more evenly spread scores, indicating greater variability. The 22–25 group stands out with the highest median score (~14), a broad range (5 to 20), and a concentration of participants achieving higher scores, signifying the strongest learning outcomes overall. The redundant 26–30; Above 30 group mirrors the "Above 30" category and provides limited additional insights. Comparisons reveal that learning outcomes peak in the 22–25 group, with younger participants (Below 22) and those aged 26–30 showing moderate but consistent performance, and older participants (Above 30) demonstrating greater diversity in scores. These trends suggest that academic or professional maturity may contribute to the strong outcomes in the 22–25 group, while the variability in older age groups could reflect diverse experiences. To enhance outcomes, resources and mentorship could support younger participants, while the strengths of the 22–25 group could be leveraged for peer mentoring initiatives. Additionally, targeted strategies may help address the variability observed in older age groups.

The research data reveals important knowledge about student engagement aspects and social presence and learning effects as they affect different age groups along with gender distinctions. The study identifies key advantages together with essential areas which need improvement to understand the relationship between different elements that affect student commitment and academic success. The findings receive further clarification by connecting them to relevant research documents which generates practical implications for educational activities.

### 2.8 Strengths in Communication and Belonging

Student engagement assessment showed "Communication with Instructors" together with "Belonging in Discussions" to be the study's most robust domains because students reported positive perceptions and high average scores. Alshahrani (2022) found that instant messaging tools enhance the effective communication which conforms to the research results mentioned in this study. Aisyah et al. (2021) showed how the Telegram platform supports academic success because it enables smooth communication between users for teamwork. Gray's (2021) research supports this study's findings because he identifies belonging as an essential element for student academic success and engagement. The study results indicate that combining communication technology with inclusive practices helps to substantially improve student involvement in academic activities.

### 2.9 Challenges in Social Engagement and Presence in Learning

The research discovered performance problems in "Social Engagement" and "Presence in Learning" despite noting positive trajectory in communication structures and sense of belonging. The lower readings in these scales show that students encounter obstacles when it comes to active involvement in learning activities along with building relationships with peers. The results prove similar to Alharthi (2023) who analyzed the problems of using WhatsApp for educational purposes and its ability to create genuine interpersonal connections. The findings of Johnson and Davis (2023) show that mobile instant messaging (MIM) tools present inclusivity challenges that block social engagement between users. The research suggests using the collaborative teaching strategies proposed by Williams and Roberts (2021) to implement group activities for improving student engagement.

Research showed that age together with gender influenced student participation levels and achievement results in online studies.The investigation of instructional results showed separate patterns between various age groups and genders. Throughout different age brackets women achieved better results than men did because they scored higher and had less scoring range variability. Similar to Oteyola et al. (2021) research results women students achieved higher engagement levels specifically during micro-teaching sessions. The data shows that older participants above thirty performed best in the study thus indicating experience and maturity are linked to superior learning achievement. The 22–25 age cohort presented the highest variability because their performance results were inconsistent. New students show performance variations since their developmental stage requires transitioning between academic pursuits and work-related challenges. Specialized intervention strategies which combine peer mentoring systems and individualized learning approaches will help resolve these inequality gaps in performance.

### 2.10 Implications for Educational Practices

The study proves that using technology effectively helps build communication systems which make learning more inclusive. The study demonstrates the essential role that Telegram and WhatsApp serve in enhancing student motivation based on research from Aisyah et al. (2021) and Amran et al. (2024). Tangible teachable challenges involving these electronic tools include guaranteeing universal accessibility together with the creation of substantive student-teacher relations. The implementation of team-based learning methods according to Williams and Roberts (2021) strengthens student involvement through student-driven group work and active scholarly involvement.

### 2.11 Limitations and Future Research

The presented study delivers essential insights yet it faces several restricting factors. This approach depends on participant self-reports which creates potential biases because the study uses a cross-sectional framework that prevents researchers from uncovering causality. Research should use longitudinal studies to study how engagement approaches shape students' academic performance across extended periods. Research approaches using qualitative methods would uncover the complete factors which shape social engagement alongside presence during learning processes.

This research underscores the necessary connection between communication alongside sense of belonging with social engagement to achieve student success. Educational professionals can produce more inclusive learning settings by solving detected problems while fully utilizing previous identified strengths. The research findings enhance knowledge about student engagement while providing specific suggestions to boost educational practices.

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