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Original Article

Uncovering Student Perspectives on the Transformative Impact of Generative AI in Education

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Abstract *- The use of Generative AI(GAI) as an embedded tool in traditional teaching processes has brought about new revolutionary ways that are changing the nature of educational activity. As we continue to evolve through phases of innovation, an increasing number of educators are seeking to incorporate AI into their teaching to enhance student creativity, streamline certain aspects of the teaching/learning process, and improve overall learning outcomes. Although existing research focuses on academic performance and engagement, the objective of this research is to identify the impact on the creative quotient of students in a real-time learning environment. Through an extensive real-time survey, students' perceptions and experiences of AI-driven educational tools were assessed. Therefore, the results collectively provide an all-encompassing perspective of how GAI is transforming education and offer potential paths toward future innovations and developments within the teaching and learning environment. An integration of both AI and traditional teaching methods will promote a balanced and forward-thinking educational model. There is insufficient real-time evidence on whether GAI influences creativity or leads to dependence on the technology. The novelty of this research aims at measuring and comparing the influences of GAI with traditional learning methods and outcomes. This proposed research work will be evaluated using real-time data collected from various university students via a research study. Real-time analysis of the data will provide insight into how GAI has impacted the creative quotient of students who prefer to utilize modern tools over the traditional teaching-learning methodology.*

Keywords *- AI, Education, Generative AI (GAI), Innovation, Learning, Survey.*

1. Introduction

The technology developments have significantly changed all the sectors, including the educational sector as well. Amongst the most innovative progress is the integration of AI technology into the educational field, by changing the conventional learning mechanisms into a transformative shift. GAI, which creates the new content based on previous data and training, is increasingly used by students to improve creativity, apply learned concepts, and eventually improve the learning outcomes [1]. As technological advancement picks up the pace, the possibility of AI transforms education into a different dimension, giving educators personalized experiences in learning, automating the real - time feedback and routine tasks [2]. The integration of these technologies is not the adoption of new technologies, but the way in which education is delivered and experienced. This paper will explore the inferences of integrating GAI into the educational domain [3], with particular focus on identifying the changes in teaching and learning practice.

This research work investigates what encompassing GAI in education involves and its impact on educational practice and learning model for students [4]. It critically analyses how AI tools are being accepted and used, while throwing a light on how these technologies are transforming educational institutions. An extensive survey insight was directly collected from the stakeholders about their experiences in GAI, along with perceived benefits and challenges.

This study provides further knowledge about AI in the educational domain, thus providing the positive competencies and risks in use. Further, they evolve into a new path with clear outlines of innovation direction towards how GAI should be integrated further with educational institutions to bring higher outputs [5]. Since AI and institutions continue to explore their potential, this research indicates a thoughtful and strategic way through which the technology serves not to detract but add to the educational experience.

The significance of this work is its potential to discuss an immediate requirement to know how GAI in educational settings and its positive integration compares with the conventional approach to teaching [6]. Previous studies focused only on the technical aspects of GAI and ignored the implications it has on its students, such as engagement, creativity, and skills. This work examines the ways GAI

affects education with the hope of bridging this gap by taking an integrated approach. Furthermore, the research attempts to rationalize the dynamic correlation that exists between GAI and traditional teaching methods [7]. This extensive study will explore the patterns by which GAI influences learning and teaching experiences by involving stakeholders across domains and countries. Illustrating such a complex process, the research will enlighten educators, policymakers, and stakeholders about the possible benefits and challenges of infusing GAI into educational practices.

2. Background Study

Technology has not been new to the educational circles. Indeed, the technology has changed drastically the way we think and work [8]. The advent of the PC and the integration of online technology paves the way for new avenues and challenges for both the educator and student. However, AI and GAI have changed how educational content gets created, delivered, and consumed.

The added role of GAI in critical thinking and enhancing creativity is increasingly recognized. For instance, research on Brezovec et al. [9] suggests the potential of using AI to establish engaging learning environments that involve critical and creative thinking and challenge students to apply critical thinking and creativity in appropriate ways.

GAI has shown significant improvement in student learning processes. Zhang et al. [10] have researched the efficacy of AI-driven personalized learning platforms, in which they found that students who used AI platforms found them quite engaging, and learning outcomes were enhanced compared to conventional learning approaches.

An important concern in the literature relates to the ethical implications of the integration of AI in education. Holmes et al. [11] discuss the algorithmic bias that exists in AI-generated content, thus exhibiting the inequalities in educational outcomes. The study calls for the need for transparency in AI algorithms and for educators to critically evaluate AI-generated materials to ensure that they are free from bias.

Zuboff et al. [12] suggests and discusses the privacy factors in implementing AI in educational institutions where data will be collected and monitored. AI-based technologies will be a potential threat to students' autonomy and lead to some unpredictable technical and security issues when they are not handled properly. For this reason, the call is for adequate data-protection frameworks for protecting privacy in AI-based educational scenarios.

The recent research has tried to explore the consequences that GAI has on students' learning experiences. The efficacy of an AI-driven personalized learning platform was indicated by the results, which showed that students' involvement and the outcomes associated with their learning experience were far more effective than traditional procedures used in classes [13]. According to them, the most vital reason behind this shift is the capacity of AI for real-time feedback, which can adjust according to every learner's needs.

The implementation of GAI in creating the most immersive and interactive environments was discussed in their research work [14], which indicates the opportunities for AI to simulate many aspects of real-world complexity, such that students can apply their learning in practical contexts. As this mode of learning is enhanced through critical thinking and problem-solving skills, it has improved learning. The experimental study [15] finds the positive impact of GAI on graduate students' learning with the smart digital content across multiple skills. This study also emphasizes the impact of GAI as a partner to upgrade their skills and job- ready environment with the enhanced designed curricula.

Cho et al. [16] discusses the integration of AI in collaborative learning, which eventually increased students' creativity in comparison with the conventional pedagogy. Students experienced the participatory learning challenges as well as the coordination issues. The study enforces that the use of GAI as a thinking partner to empower education with creativity, rather than as a tool.

Huang et al. [17] examined the effect of GAI for students grouped in digital game development projects. The research finds that there is an improvement in creative thinking, motivation, and enhanced performance levels. The outcome of this research supports the fact that GAI impacts the student's creativity.

J.V et al. [18] suggested the GAI framework for creative and adaptive learning in the education domain. The framework combined the features of personalised learning, learning content generated from AI, and a feedback system to understand the learner's impact. This study shows that GAI fosters critical thinking amongst students.

Liu et al. [19] examined the influences of GAI on the creativity of students. The study discussed both the positive and the negative impact of the assisted learning experiences. However, the excessive usage might have a negative impact on learning outcomes; the authors have suggested that balanced integration is needed in this regard.

Mirea et al. [20] suggested that students' perceptions of GAI and its function of transformation in learning experiences. The study also explored the way students used GAI for their study, solving problems, and content creation. The research findings revealed that a positive approach towards the technology, particularly in study engagement and experiences, was found.

Martínez Casanovas [21] examined the effect of GAI on design thinking. The study compared the students' performance on different learning methodologies and concluded that there was a positive impact on students' creativity and improved problem-solving abilities in creative thinking education. The reviewed studies demonstrate that GAI has a very positive impact on students' learning, creativity, and content. Having said that, its effectiveness largely depends on the pedagogical practices, strategies, and its effective usage.

2.1. Inferences from the Review Study and Identification of Research Gaps

Apart from the prospects that have been highlighted by the extracts, ethical issues of adopting AI into education have also arisen. Concerns with regard to academic integrity, as well as the detection of plagiarism, raise even more questions with regard to programs like ChatGPT [22]. GAI technology may help to improve the construction of curricula and instructional strategies when the problems are of language diversity and scarcity of resources. Also, AI-based predictive analysis is used to better understand and control the behavior of students in poor rural communities.

However, although it appears to have such benefits, little is known about how it works in relation to conventional teaching methods or how it influences creativity in real time. Previous studies have mainly focused on discrete aspects of the influence of GAI on schooling, often without a holistic perspective and immediate data analysis. The dynamic interaction between GAI tools and traditional teaching methods has also not been well addressed, especially in the context of computer science education.

Hence, there is an imperative need for extensive research that outlines the effects of GAI on learning outcomes and students' engagement in learning settings. This kind of study will throw light on the potential benefits and refinements of the relationship between GAI and traditional teaching practices. Through rigorous empirical research that spans a variety of educational contexts and methods, researchers can illuminate the complex operations involved and identify strategies to optimize the integration of GAI into instructional strategies.

For several reasons, it is essential to bridge this knowledge gap. It is in this regard that maintaining and fostering student creativity is a first and foremost requirement that ensures the use of GAI does not constrain creative thought.

On the other hand, evidence-based policies depend on a deep comprehension of the consequences of emerging technologies, such as GAI, which empowers educational stakeholders to make well-informed decisions that are favourable to both educators and students. Ultimately, GAI's ability to improve teaching and learning results will depend on how well it is integrated into the educational system and how potential obstacles are addressed.

3. Methodology

The research study design employs techniques for gathering and analyzing qualitative data. This strategy allows for the in-depth investigation of the research problems and makes it easier to understand how GAI interacts with conventional teaching techniques. The Mixed-Methods Approach involves the use of Quantitative Data Collection [23] by the survey, with Likert scales provided to the students, and is meant to obtain a gauge of the opinion and experience on the usage of GAI. Experimental interventions were applied in testing how GAI was impacting the learning objectives as well as the ability for original problem-solving. The steps involved in this research study are given below,

3.1. Participant Selection

Participants of the study are selected in such a manner that they reflect a wide range of experiences and viewpoints by choosing them from various educational institutions, backgrounds, and geographic areas. This study engages students across different educational settings.

3.2. Data Collection

These involve using both descriptive statistics and inferential statistics for summarizing the survey response to Likert scales and assessing trends or patterns that emerge in perceptions across the participants. It also discusses the impact of GAI on creativity and problem-solving and compares this impact with more traditional methods of education while discussing the ethical considerations behind its use.

The questionnaire also tries to find the future preferences and recommendations it can give for a well-rounded understanding of the place and implications of GAI in the educational spectrum. The extensive questionnaire was divided into different subsections covering the topics (76 Questions), Experience with GAI, Impact of GAI on Learning, Impact of GAI on Learning, Creativity and Problem-Solving, Comparison with Traditional Methods, Ethical Considerations, Future Preferences, and Recommendations. The collected data is pre-processed by converting the Likert scale into a numerical value(encoding), treating null values, and case conversion of the responses.

3.3. Data Analytics

These mathematical tools examine the relationship links between many aspects in the educational environment, including the learning outcome, creative quotient, and the use of GAI. Coefficients allow the interpretation of the strength and direction of the linear relationships that exist between the variables in question. The strength and direction of the relationship that exists between the variables can be measured:

the variables are the learning outcome, creativity, and the use of GAI [24]. Descriptive statistics is a method of summarizing responses to a survey for finding trends, averages, and distributions. It makes use of mean, median, mode, standard deviation, and frequency distribution.

Statistical tests are then applied in order to measure the importance of observed trends and patterns through chi-square tests when analyzing differences and relationships [25, 26].

Correlation coefficients [27] are used to measure the strength and direction of relationships between variables such as learning outcomes, creativity, and use of GAI. Heatmaps [28] are used to visualize correlation coefficients to understand relationships between variables. The graphs and charts are used to present descriptive and inferential statistics clearly.

4. Result Analysis

The questionnaire was circulated through the mail, and the responses were collected in the google form. The survey consists of 76 questions framed under discussion topics like how well GenAI influences their study and outcomes. Around 299 people responded to the survey of different age groups from other countries. The demographic details are given in Figure 1(a)-(d).

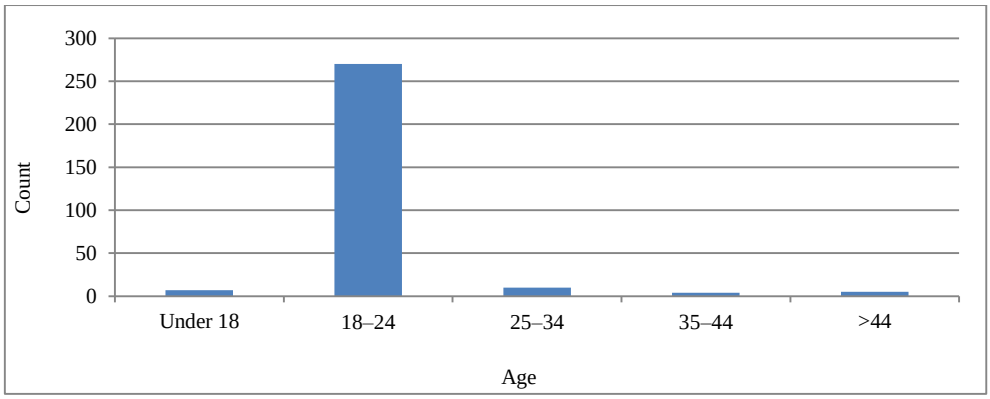

Fig. 1(a) Age

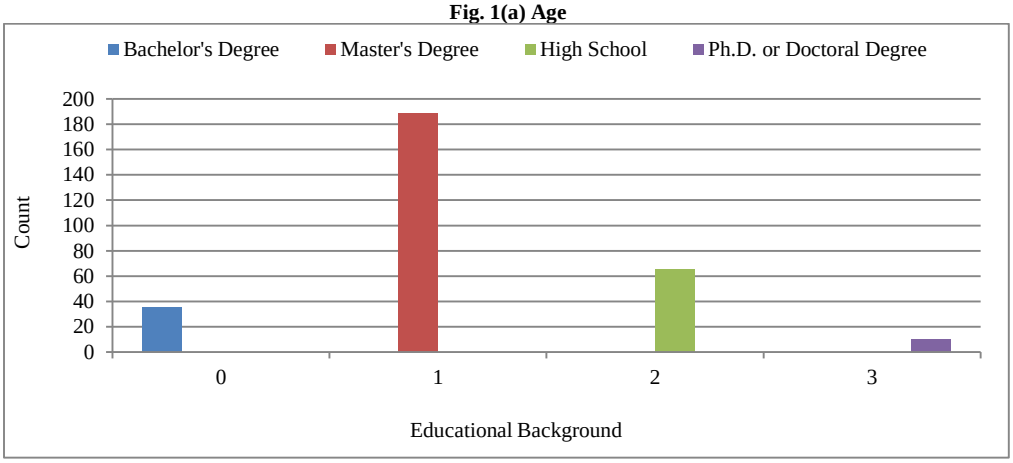

Fig. 1(b) Educational background

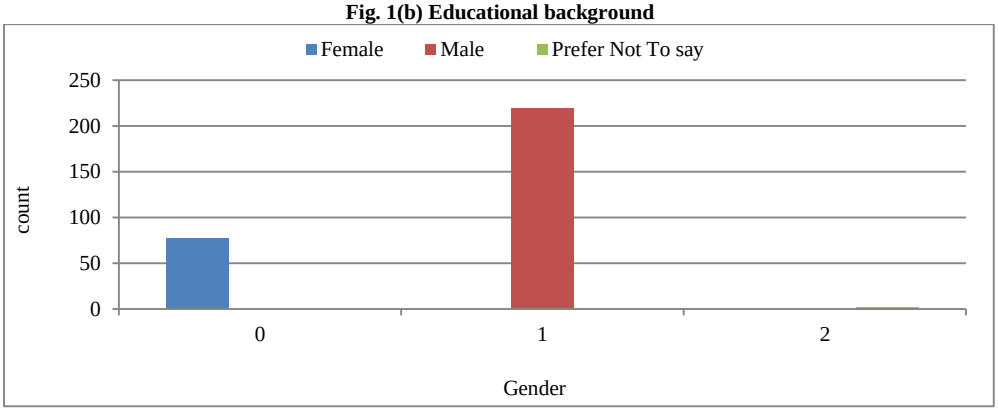

Fig. 1(c) Gender

These results implies that Age and Educational Background are the most significant variables, especially in determining the progress of people in their careers. In contrast, Gender is highly correlated with very few factors, which implies a lesser role for Gender in influencing outcomes for this population set.

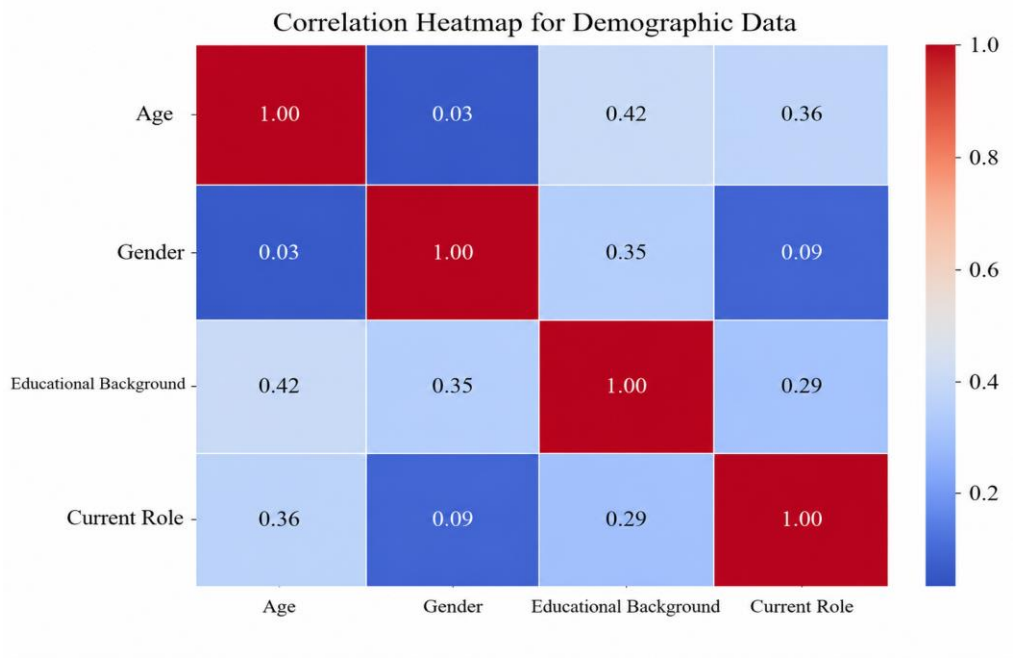

Fig. 1(d) Heatmap – demographic data.

4.1. Experience with GAI

The respondents were asked questions related to their familiarity with GAI tools, their confidence level, the kinds of platforms they use, how they enhanced their ability using these tools, whether they recommend the tools for academic purposes, satisfaction level, and the importance of GAI in academic studies. Some of the inferences are given in Figure 2(a)-(c).

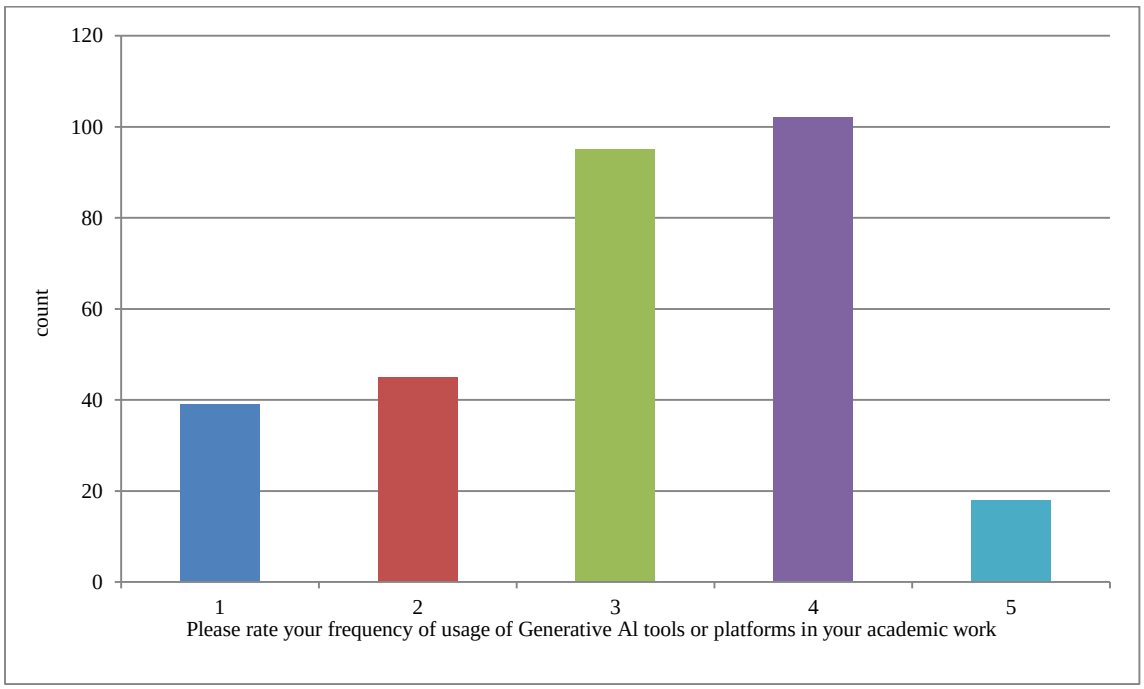

Fig. 2(a) Frequency of usage

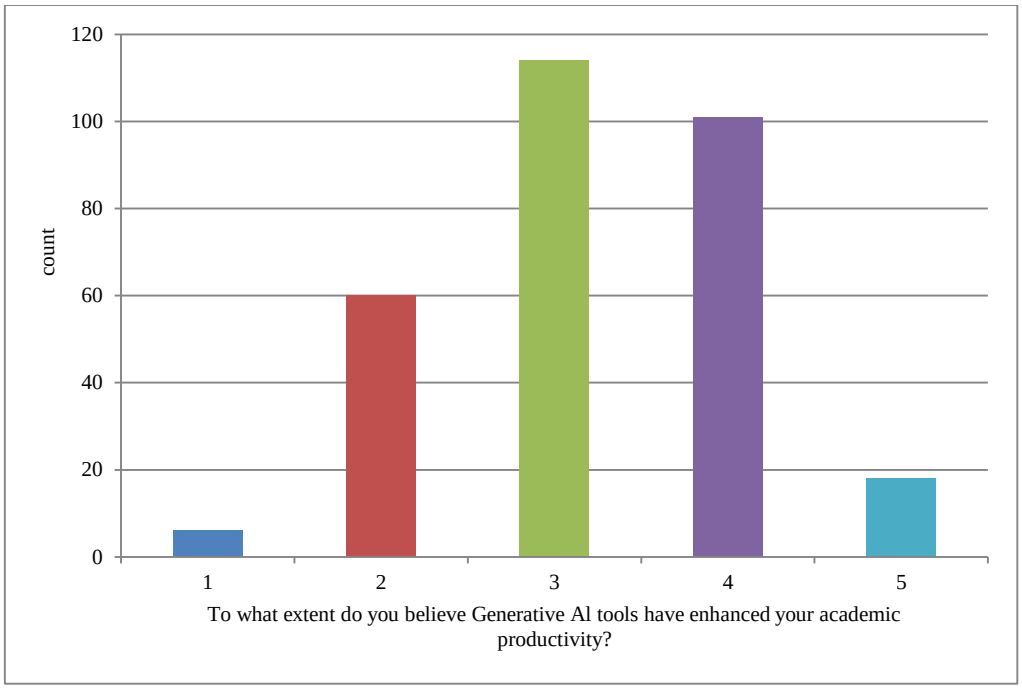

Fig. 2(b) Academic productivity

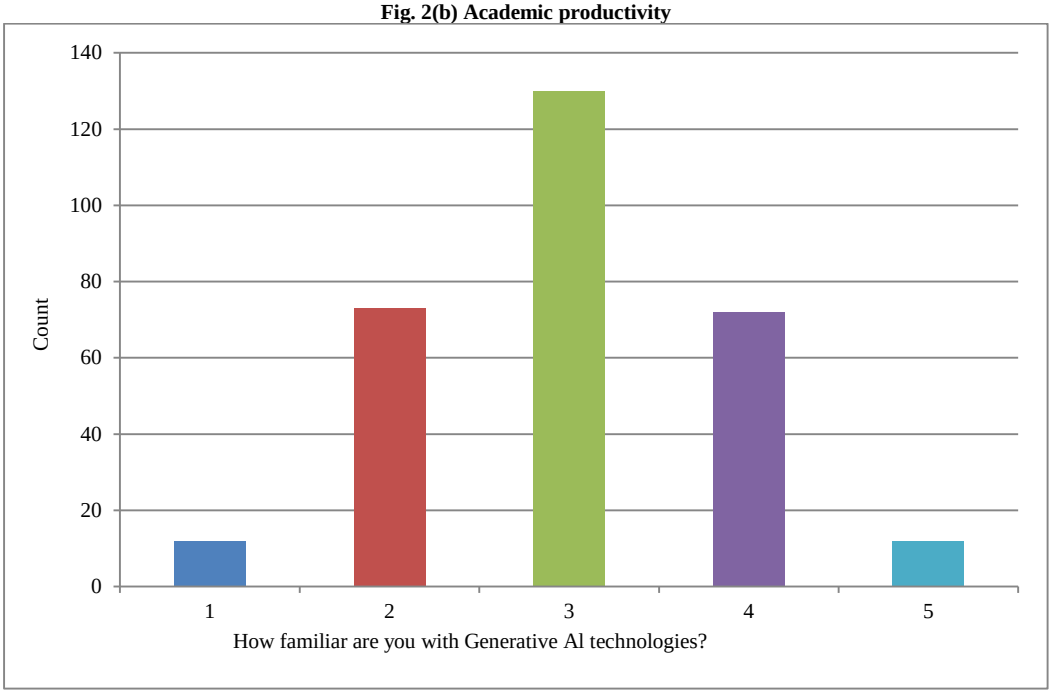

Fig. 2(c) Familiarity of GAI tools.

The analysis of responses (n=299) regarding experiences with GAI tools shows the following trends:

Frequency of Use, Familiarity, and Confidence: Mean scores (~3.0) indicate moderate levels. Ease of Use: Rated lower (mean: 1.73), suggesting usability challenges. Impact on Productivity, Recommendation Likelihood, and Satisfaction: Scores (means: ~3.2–3.6) reflect positive perceptions. A mean of 3.41 attests to its value, which is recognized in academic studies. Overall, participants indicate a neutral to positive experience. Satisfaction and importance scores were higher than ease of use. Respondents in general are neutral to positive with their ratings, although more satisfaction and importance would be placed on the role of GAI in education. Ease of use (Q4) ['How would you rate the ease of use of the GAI tools or platforms you have used?'] shows the lowest mean score, which implies the area where the tool usability could improve.

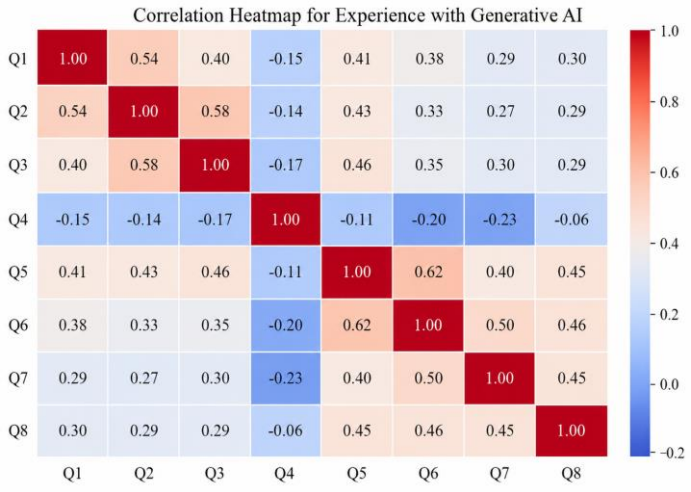

Fig. 3 Correlation heatmap - experience with GAI

The Correlation Heatmap for Experience with GAI is given in Figure 3.

Strong positive correlations have been found between Q2 (Familiarity) and Q3 (Confidence) (r = 0.58), as well as between Q5 (Productivity) and Q6 (Likelihood of Recommendation) (r = 0.62). These findings, therefore, indicate familiarity/confidence and perceived productivity and likelihood of recommendation to be strongly related.

Moderate positive correlations between Q1 (Frequency of Usage) and other variables, like Q2 (Familiarity), r = 0.54, and Q5 (Productivity), r = 0.41, indicate that a more frequent usage frequency is indeed associated with the benefits of being familiar and productive.

A slightly to very weak negative correlation exists between Q4, Ease of Use across various variables (Q1 through Q3), as its ease of use does not strongly correspond to other characteristics. Most variables are showing mild to moderate positive correlations, stressing a tight relationship between usage, familiarity, confidence, and perceived value in using GAI.

4.2. Impact of GAI on Learning

The respondents were asked questions related to their learning experience with GAI, understanding, problem solving, solving assignment problems, effectiveness over the traditional learning methods, quality of academic work, etc. The correlation map is given in Figure 4.

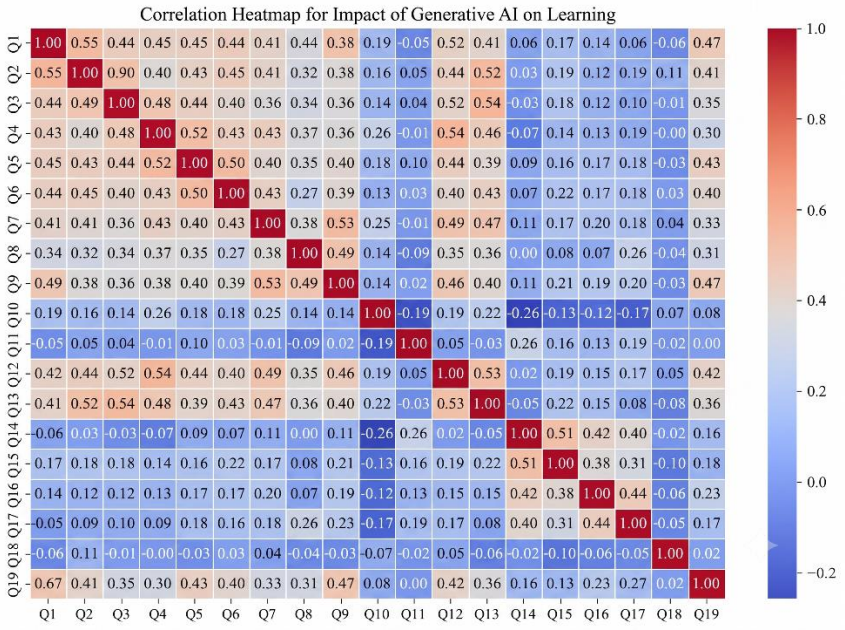

Fig. 4 Correlation heatmap – impact of GAI on learning

The interconnections are highlighted by the heatmap between impact on GAI in understanding, problem-solving, and academic quality aspects as being highly influential in general satisfaction. Challenges have minimally correlated associations with a largely positive perception.

The respondents were asked questions related to GAI supports learning and improves the quality of academic work (mean 3.81), problem-solving, and creativity. Understanding (mean 3.37) and engagement (mean 3.27) are moderately enhanced. GAI is perceived as transformative (mean 3.53). Challenges occur rarely (mean 0.30).

Overall satisfaction is high, but scope for improvement exists in comparison to traditional methods. Overall impact as perceived by the participants was rated to be positive (Q1: mean 3.51) and satisfaction (Q19: mean 3.53), with most responses scoring between 3 and 4. GAI improved the comprehension of abstract ideas slightly (Q2: mean 3.37) and interaction with course content (Q4: mean 3.27).

The tools were useful for creative solutions to problems (Q3: mean 3.22) and had a positive impact on problem-solving skills (Q5: mean 3.38). Respondents feel that the quality of academic work is positively affected (Q6: mean 3.81). Agreement with the revolution in academic approaches brought about by GAI (Q7: mean 3.53) and effectiveness over traditional methods (Q8: mean 3.08) shows a moderate to positive trend. Challenges are reported with Q18 showing a mean of 0.30, but less frequently; GAI is impactful on learning by enhancing the quality, engagement, and creativity of the process involved, but more effort in addressing usability challenges and their comparison with traditional methods may be needed.

4.3. Creativity and Problem Solving

The respondents were asked questions related to the use of GAI in problem solving and creativity. The descriptive analytics show the following inferences: The mean values for all the questions (Q1–Q10) fall between 3.05 and 3.51. This reflects the fact that the majority of respondents rated the effects of GAI on creativity and problem-solving as moderately positive.

The standard deviations ranged between 0.76 and 0.97, thus signifying moderate response variability. Areas Rated the Highest Q9: "Has GAI usage helped improve your confidence when faced with difficult academic issues?" is scored highest with a mean of 3.52. This area was rated to show that people were most confident. Q8: "Does GAI help improve creativity in thinking and solving problems?" This question has been scored with an average score of 3.29.

Lowest Ranked Areas: Q1: "Degree to which GAI improves creativity of academic assignments" has the least mean score, as 3.06, this area therefore gets a relatively lesser ranking. Q7: "Percentage of utilization of GAI in order to create novel concepts" is moderately low, i.e., a mean score of 3.05. Range of Responses: All questions have a full range of responses, and the minimum score is 1, while the maximum score is 5. The mean of the median and 75th percentiles was always at 3 and 4, respectively, during all the questions, showing a central tendency to be on the positive side.

Consistency Across Questions The data is pretty uniform and has most questions showing around the same interquartile ranges, showing consistency with participant perceptions across various aspects of creativity and problem solving.

The summary indicates that even though generally perceived to be good with respect to creativity and problem solving, areas such as how it impacts creativity directly and the frequency of use could be improved further. The correlation map is given in Figure 5.

The correlation values span from around 0.36 to 0.66; most of these pairs are indeed moderately positively correlated. There were no correlations greater than about 1, and nothing negative. Maximum Correlations: Q3 with Q4(correlation =0.66).

These questions possess the highest relationships, and, therefore, their participants tend to rate GAI highly with respect to discovering alternative perspectives(Q3) just as they tended to rate it for encouraging experimentation with new concepts (Q4). Q5 to Q6 were reported to have a high correlation of 0.60, whereas confidence in its use in generating possible solutions (Q5) would be strong correlated with how often it promotes joint work or teams (Q6).

The second lowest is related to how strong the effect has been in thinking creatively, and how often they resort to creative applications of GAI for seeking solutions. Moreover, this came across as having very low correlations, about 0.36 for questions Q8 and Q2. Clusters of Stronger Correlations: Questions Q3, Q4, Q5, and Q6 form a cluster of moderately high correlations (above 0.5), indicating these aspects of creativity (e.g., experimentation, confidence, and collaboration) are interrelated.

Weaker Relationships: Q9 ("Confidence in solving complex academic challenges") tends to reveal weaker correlations between questions, perhaps indicating that there is less confidence in dealing with complex problems tied to other elements of creativity. Q10(To what extent do you believe Generative AI tools have expanded your creativity beyond traditional academic boundaries) is scored to an average score of 3.13.

This area was rated to show that respondents felt GAI moderately expanded their creativity, though less strongly than its impact on confidence (Q9) or direct problem-solving

ability (Q8). There was always a positive, consistent pattern to the association observed within the positive heatmap for creativity and problem solving, insofar as participants evaluated GAI as having strong positive effects for creativity and the solving of problems. Further strong correlations among chosen questions imply associations between experimentation, teamwork, confidence, and creativity, with frequency and total creativity possibly being more categorical.

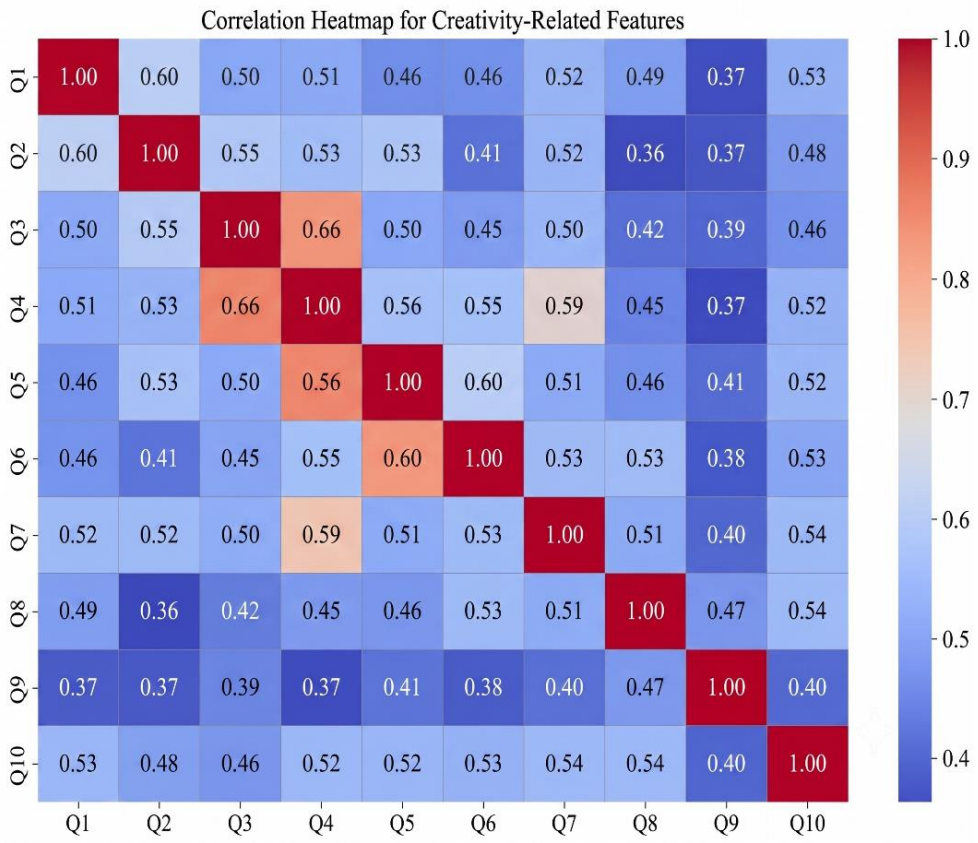

Fig. 5 Correlation heatmap – creativity and problem solving

4.4. Comparison with Traditional Methods

The respondents were asked questions related to GAI comparison with traditional methods. Mean scores for all the questions (Q1–Q9) vary from 3.17 to 3.29, meaning most respondents find GAI to be moderately to positively effective in comparison to traditional teaching methods.

Standard Deviations: The standard deviations range from 0.81 to 0.92, indicating a moderate spread in responses. Thereby, there are differences of opinion but no extreme outliers. In summary, GAI is innovative, adaptable, and very effective in terms of personalization in learning. Interaction and collaboration, and overall preference over traditional methods, are a little weaker area, which might be an area of improvement. The heat map is given in Figure 6.

Relationship among responses to nine questions, Q1–Q9, comparing GAI with traditional teaching methods. Important observations are as follows: Strong correlations have several questions with moderate to high positive correlations in the range of 0.5–0.6. This means that those several questions have correlated responses: Q8 and Q9 have a relatively stronger correlation of 0.60. Lower correlations of below 0.4 are found in Q6 and Q7 in relation to the other questions; therefore, personalization and adaptability may not be as closely related to the other dimensions. The diagonal reveals perfect correlations, 1.0, as every question correlates perfectly with itself.

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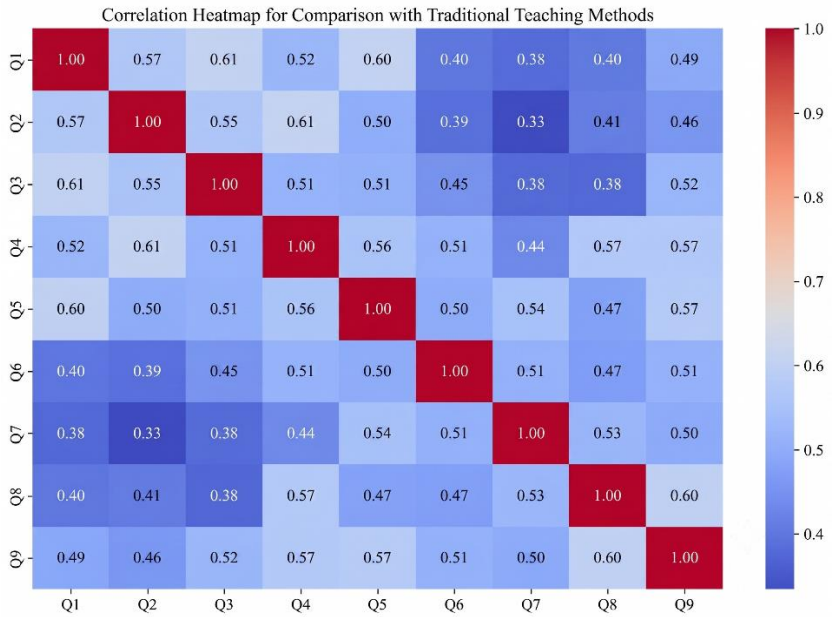

Fig. 6 Correlation heatmap – comparison with traditional learning methods

4.5. Ethical Considerations

The respondents were asked questions related to ethical considerations of using GAI, such as privacy and security of their personal data, misuse of GAI, and ethical standards. Respondents were moderately to highly concerned about the ethical implications, particularly with respect to academic dishonesty (Q3) and job displacement (Q7). Less variation in response was shown to confidence in institutional mitigation of ethical issues (Q9), as respondents seemed either to agree or not care about the issues at hand. Concerns are split between the fear of personal and systemic implications of GAI in education.

Ratings for the questions range from the two extreme ends to 1 to 5. This indicated that opinion was diversified about participants. The average concern overall is scored between about a range of 2.95 and 3.21 using a rating scale of 1 to 5.

Q7-the displacement or downgrading of humans in jobs-is the highest mean, being 3.21, very closely followed by Q3-potential malicious use of AI for academic integrity, with a mean of 3.18. The lowest mean concern was for Q2, privacy and security concerns at 2.95.

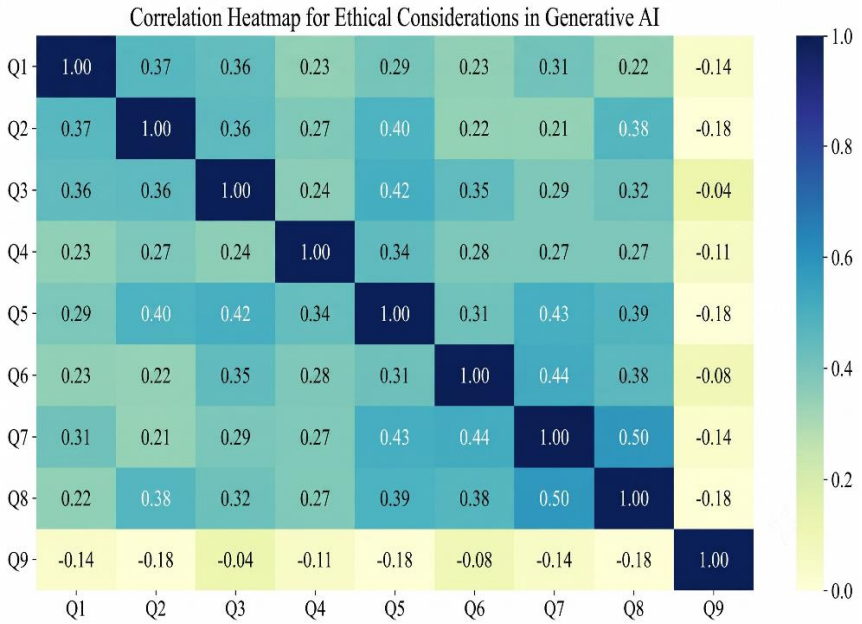

Fig. 7 Ethical considerations

The heat map is given in Figure 7. Positive Correlations: Some pairs of questions show moderate positive correlations, like Q2 and Q5, 0.40; Q5 and Q7, 0.43; Q6 and Q7, 0.44, which suggest shared concerns or even agreement between those questions. Weak Correlations: Most of the correlations are ranging from 0.2 to 0.4, which are weak to moderately related responses among questions. Negative Correlations: Q9 has weak negative correlations with all other questions, which means that responses for Q9 are slightly different from the others. Diagonal Values: The diagonal values are 1.00, meaning perfect positive correlation. The heatmap indicates that even though there are some common issues with certain questions, such as Q5 and Q7, on the whole, the correlations between questions are weak to moderate.

This implies that subjects may perceive the ethical issues of GAI in schooling as separate rather than closely interconnected themes.

4.6. Future Preferences and Recommendations

Respondents are asked to give their future recommendations and inferences. The responses are given as a word cloud.

This is given in Figure 8. The chi square test of independence is done for the categorical variables to determine the significant relation between the variables. The following hypothesis are tested as follows,

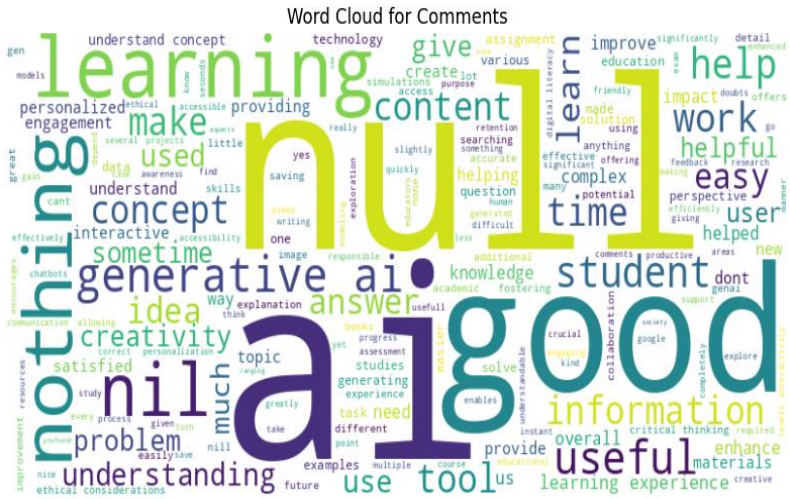

Fig. 8 Recommendations

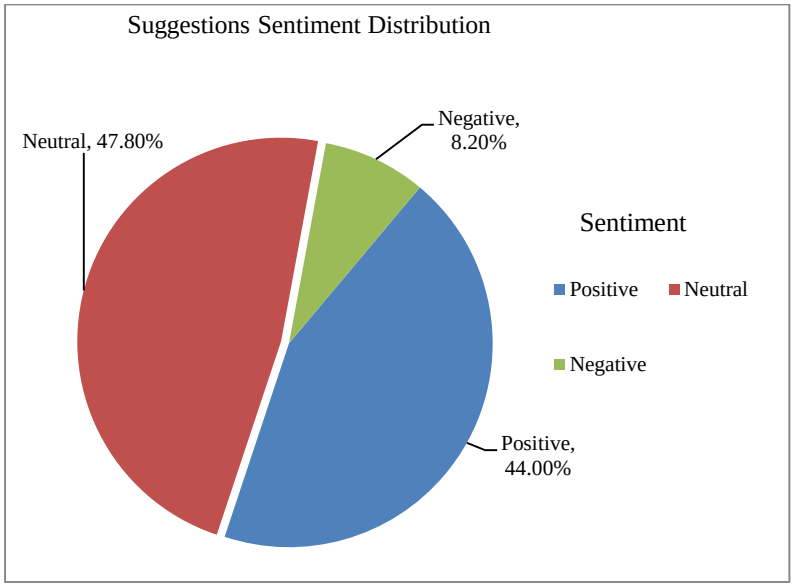

Fig. 9(a) Suggestions

The suggestions are taken, and sentiment analysis is done. This is given in Figure 9(a)-(b).

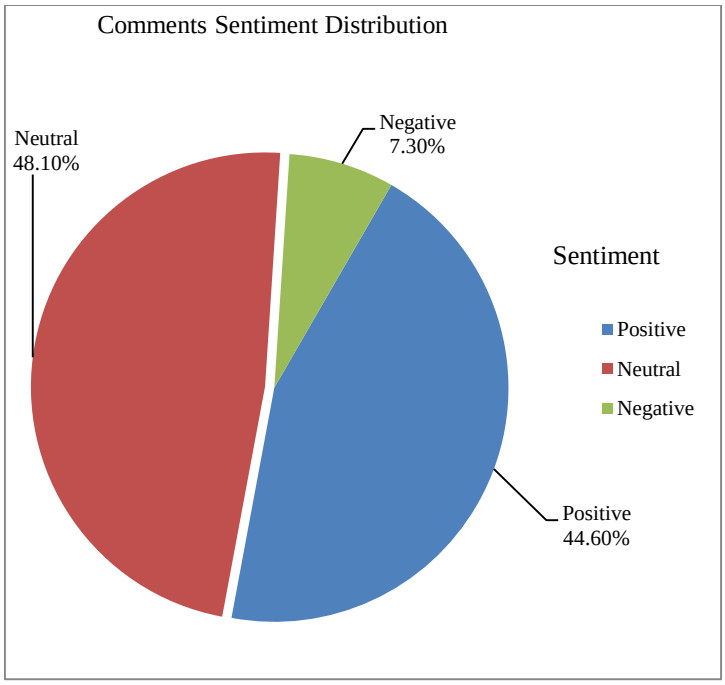

Fig. 9(b) Comments.

1. Gender Vs Please rate your frequency of usage of GAI tools or platforms in your academic work

2. Current Role: To what extent do you believe GAI tools have enhanced your academic productivity?

This gives a p-value of 0.4700. Since the calculated value is larger than the level of significance ($\alpha = 0.05$), we reject the null hypothesis. This implies that there is not enough evidence to assert that Current Role is associated with the belief that GAI tools have improved academic productivity.

3. Educational Background vs How likely are you to recommend GAI tools or platforms to your peers for academic purposes?

This gives a p-value of 0.7600, there is no significant association was found between Educational Background and satisfaction with the impact of GAI on the learning experience.

4. Educational Background vs How satisfied are you with the impact of GAI on your learning experience?

This gives a p-value of 0.9233, there is no significant association was found between Educational Background and satisfaction with the impact of GAI on the learning experience.

5. Current Role vs To what extent do you believe GAI tools have enhanced your creativity in academic tasks?

This gives the P-value of 0.3491, there is no significant association was found between Current Role and belief in the enhancement of creativity in academic tasks through GAI tools.

5. Conclusion

The research work represents the possibility of GAI in education related to different groups of the student community, where it demonstrates the ability to adapt the learning experience and positively affect several aspects of student engagement and skill building. From the inferences from the surveyed data, most of the responses were positive and neutral towards the usage of GAI for academic purposes. This work of research portrays the capability of GAI in education relating to different segments of the student community, reflecting its capacity for adapting learning experience and its effectiveness in various parameters of student engagement and skill acquisition.

Conflicts of Interest

The author(s) declare(s) that there is no conflict of interest regarding the publication of this paper.

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