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AI-Supported Learning and Its Relationship with Academic Procrastination and Academic Anxiety among Students with Visual Impairment

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Abstract

Artificial Intelligence (AI) has emerged as a transformative technology in higher education, offering innovative solutions to improve accessibility, personalized learning, and academic support for students with disabilities. The present study investigated the influence of AI utilization on academic procrastination and academic anxiety among students with visual impairment. A longitudinal mixed-methods research design was employed involving 24 students with visual impairment from higher educational institutions in Kanpur, Uttar Pradesh, India. Participants were selected through purposive sampling and observed over one academic semester. Quantitative data were collected using standardized measures of AI utilization, academic procrastination, and academic anxiety at three different time points, while qualitative data were gathered through semi-structured interviews, reflective audio journals, and AI usage logs. Quantitative data were analysed using descriptive statistics, Pearson correlation, hierarchical linear modelling, and multiple regression analysis, whereas qualitative data were analysed using thematic analysis. The findings revealed that AI utilization increased progressively throughout the semester, while both academic procrastination and academic anxiety demonstrated a steady decline. Correlation analysis indicated strong negative relationships between AI utilization and academic procrastination ($r = -0.92$) and between AI utilization and academic anxiety ($r = -0.88$). Regression analysis further confirmed that AI utilization significantly predicted reductions in both academic procrastination and academic anxiety. Qualitative findings supported the quantitative results by identifying accessibility, improved time management, better assignment planning, increased learning confidence, and reduced academic anxiety as the major perceived benefits of AI-assisted learning. Although a few participants expressed concerns regarding excessive dependence on AI, the overall educational benefits substantially outweighed these concerns. The study concludes that AI-assisted learning has considerable potential to promote accessible, independent, and inclusive education for students with visual impairment. By enhancing academic organization, reducing psychological barriers, and improving learner confidence, AI contributes to both academic success and emotional well-being. The findings highlight the importance of integrating AI-based educational technologies into inclusive higher education while promoting responsible and ethical AI use through appropriate institutional support and digital literacy initiatives.

Keywords: Artificial Intelligence, Academic Procrastination, Academic Anxiety, Visual Impairment, Inclusive Education

INTRODUCTION

The rapid integration of Artificial Intelligence into higher education has created unprecedented opportunities for visually impaired students, fostering greater self-autonomy and inclusive access to academic resources (Elshaer et al., 2025). By leveraging large language models and assistive tools, these learners can bridge existing accessibility gaps, thereby enhancing their quality of life and overall educational engagement (Elshaer et al., 2025a,

2025b). Despite these benefits, students with visual impairments often struggle with academic procrastination and heightened anxiety, which stem from the unique cognitive and temporal demands of navigating inaccessible learning materials (Ram et al., 2026). While the transformative potential of generative AI to personalize learning and mitigate these challenges is recognized (Roy & Johnson, 2025), there remains a critical research gap regarding its specific influence on the psychological well-being of this population. Current scholarship has largely prioritized technological or legal accessibility frameworks, frequently neglecting the nuanced psychological dimensions—such as reliance-induced stress and cognitive offloading—that shape the educational experiences of students with disabilities (Kościelniak & Bielecki, 2024; Pierrès et al., 2024). Consequently, empirical investigations are required to determine whether AI-supported learning acts as a tool for academic empowerment or a catalyst for heightened psychological dependency and stress (Wang & Wang, 2026). Addressing this lacuna is particularly urgent given that overreliance on AI has been linked to potential deficits in critical thinking and problem-solving capacities (Zhang et al., 2024). By examining how these tools moderate academic anxiety and procrastination, this study aims to establish a more comprehensive understanding of the psychological trade-offs inherent in digital accessibility (Liu et al., 2026). This inquiry seeks to clarify whether AI integration facilitates effective self-regulation for these students or exacerbates avoidant behaviors associated with their unique academic pressures (Li, 2025; Xiong et al., 2024). Furthermore, given that visually impaired students often experience higher rates of anxiety and stress due to systemic institutional barriers and inadequate support services (Alsamiri, 2025; Sharma, 2026), understanding how AI interfaces mitigate or aggravate these underlying psychological burdens is essential. By systematically evaluating these dynamics, this research will contribute to a more inclusive pedagogical framework that prioritizes the mental well-being of visually impaired learners alongside technological accessibility (Chan & Hu, 2023). This study specifically investigates whether the strategic use of generative AI tools can function as a compensatory mechanism for students with visual impairments, potentially reducing the cognitive load that frequently triggers academic procrastination (Abbas et al., 2024).

Literature Review

Recent academic literature highlights that while AI can mitigate obstacles such as "writer's block" (Zhai et al., 2024), the psychological implications of its integration—specifically regarding dependency and stress—remain critically under-explored for students with disabilities (Ajlouni et al., 2025; Hwang & Wu, 2025). Existing research on students with disabilities indicates that concerns such as inaccurate output and the financial strain of subscription models further complicate their reliance on these technologies (Zhao et al., 2025). Furthermore, the tendency for students to form an over-reliance on generative models can impede critical cognitive development, as constant interaction with automated systems may displace essential problem-solving and self-regulatory processes (Huang & Wu, 2025; Wang et al., 2025). This phenomenon of "metacognitive laziness" suggests that if students rely exclusively on AI for content generation, they may bypass the cognitive disfluency necessary for deep learning, potentially exacerbating cycles of procrastination (Fan et al., 2024). Conversely, emerging evidence suggests that for visually impaired students, these tools often function as compensatory mechanisms that resolve accessibility barriers, thereby recovering academic agency and reducing the apprehension associated with inaccessible learning materials (Min & Lee, 2026). These speech recognition and synthesis systems provide a critical scaffolding function by enabling natural voice interactions, which significantly

diminishes the cognitive burden of navigating complex textual interfaces (Jukiewicz, 2025). The integration of these generative tools facilitates personalized adaptation and multimodality, which are essential for students who encounter significant barriers in low-resource environments (Khlaif et al., 2026). However, the efficacy of these tools remains contingent upon institutional support and the user's ability to maintain control over the writing process (Darvishy et al., 2024). While generative AI offers affordances such as plannability and expressibility that assist in organizing complex academic tasks, existing studies indicate that these systems often remain inadequate in addressing deeper challenges like time management and low learning motivation (Zhao et al., 2025). Moreover, the dual nature of these technologies—simultaneously functioning as a facilitator of inclusion and a potential source of cognitive dependency—necessitates a closer examination of how they influence self-regulated learning in visually impaired students (Riley et al., 2025; Skulmowski, 2024). Theoretical frameworks, such as the Cognitive Load Theory and Self-Determination Theory, provide a lens for understanding how this dependency may either alleviate task-induced anxiety or, conversely, undermine the autonomy required for sustained academic perseverance (Chan & Colloton, 2024). By situating these frameworks within the context of generative AI, one can evaluate whether the shift toward automated assistance enhances a student's capacity for self-direction and self-reflection or merely displaces the productive struggles essential for academic development (Chiu, 2024; Wang, 2024). Furthermore, while AI-driven scaffolding can bolster self-efficacy by reducing cognitive barriers (Xu & Yu, 2025), there remains a distinct risk that such tools might inadvertently foster a sense of learned helplessness if students perceive the technology as an unavoidable requirement for overcoming their unique functional limitations (Eradze et al., 2026). Applying Vygotsky's Zone of Proximal Development to this dynamic, these AI systems should ideally function as scaffolds that promote active participation rather than passive reliance, ensuring that technology complements human effort without replacing the essential cognitive processes of independent learners (Maphoto et al., 2024). Additionally, recent inquiries into affordance theory identify "explainability" and "plannability" as critical levers that assist disabled students in structuring their writing processes, yet caution that these benefits are frequently undermined by concerns regarding AI hallucinations and the loss of one's own academic voice (Zhao et al., 2025). Integrating these technologies requires a shift toward co-regulation models, where AI acts as a partner in managing academic tasks rather than a substitute for the student's cognitive agency.

RESEARCH METHODS

This study employed a longitudinal mixed-methods research design to examine the relationship between the use of Artificial Intelligence (AI), academic procrastination, and academic anxiety among students with visual impairment over the course of one academic semester. The mixed-methods approach enabled the integration of quantitative measures of academic behavior with qualitative insights into students' experiences, thereby providing a comprehensive understanding of the influence of AI-assisted learning on academic functioning. The study was conducted in Kanpur, Uttar Pradesh, India, involving students enrolled in higher education institutions that provide educational support services for learners with visual impairment. A total of 24 students with visual impairment participated in the study. Participants were selected through purposive sampling, with the inclusion criteria requiring that they be enrolled in undergraduate or postgraduate programmes, regularly use screen-reader technology (such as NVDA or JAWS), and have prior experience using AI-powered learning tools, including Large Language Model (LLM)-based platforms (e.g., ChatGPT, Microsoft Copilot, or Google Gemini), for academic purposes. The sample included

students with varying degrees of visual impairment to capture diverse learning experiences. Ethical approval for the study was obtained from the institutional ethics committee before data collection commenced. Informed consent was obtained from all participants using accessible formats, including Braille documents, large-print forms, and screen-reader-compatible digital files. Participants were assured of confidentiality, voluntary participation, anonymity, and the right to withdraw from the study at any stage without any academic consequences.

The intervention focused on the educational use of Large Language Model (LLM)-based Artificial Intelligence applications integrated with existing assistive technologies. Participants were encouraged to utilize AI tools throughout the semester for activities such as information retrieval, literature searching, concept clarification, note preparation, academic writing support, assignment planning, text summarization, proofreading, structural outlining, and examination preparation through voice-command and screen-reader-compatible interfaces (Lodge et al., 2023; Ram et al., 2025; Rappa et al., 2026). Usage patterns varied naturally according to students' academic needs rather than being experimentally controlled, allowing the investigation of authentic AI-supported learning behaviors. Data collection was undertaken using multiple complementary methods. Quantitative data were collected at three points during the semester (beginning, midpoint, and end) using standardized measures of Academic Procrastination and Academic Anxiety, together with an AI Learning Utilization Scale developed for the study to assess the frequency, duration, and perceived usefulness of AI-assisted learning. Demographic information, including age, gender, level of visual impairment, programme of study, and prior experience with assistive technology, was also collected.

To enrich the quantitative findings, qualitative data were gathered through semi-structured interviews, weekly reflective audio journals, and AI usage logs that documented students' interactions with AI platforms during routine academic activities (Aruleba et al., 2025). These sources provided detailed evidence regarding students' perceptions of AI-assisted learning, challenges encountered, perceived reductions in academic stress, and concerns related to dependence on technology and self-regulated learning. Quantitative data were analysed using descriptive statistics (mean, standard deviation, frequency, and percentage) to summarize participant characteristics and study variables. Changes in academic procrastination and academic anxiety across the semester were examined using Hierarchical Linear Modelling (HLM) to evaluate longitudinal trends associated with the frequency and intensity of AI use (Kim et al., 2024). Pearson correlation analysis was employed to determine relationships among AI utilization, academic procrastination, and academic anxiety, while multiple regression analysis was conducted to identify the predictive contribution of AI use after controlling for demographic variables. Qualitative data obtained from interviews and reflective audio journals were transcribed verbatim and analyzed using thematic analysis following Braun and Clarke's six-phase framework. Coding focused on themes related to self-regulated learning, time management, cognitive independence, accessibility, emotional well-being, and the perceived balance between technological assistance and learner autonomy (Nguyen et al., 2024). The integration of quantitative and qualitative findings through methodological triangulation enhanced the credibility, validity, and depth of the study, providing a holistic understanding of how AI influences academic procrastination and academic anxiety among students with visual impairment.

Data Analysis and Interpretation

The collected data were analysed using both quantitative and qualitative procedures to comprehensively examine the influence of Artificial Intelligence (AI) on academic

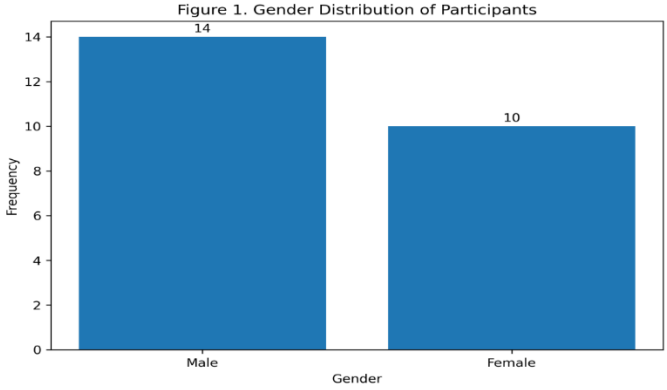
procrastination and academic anxiety among students with visual impairment. Prior to hypothesis testing, the data were screened for completeness, missing values, and outliers to ensure accuracy and consistency. Descriptive statistics, including frequency, percentage, mean, and standard deviation, were computed to summarize the demographic characteristics of the participants and the overall levels of AI usage, academic procrastination, and academic anxiety. The internal consistency of the research instruments was examined using Cronbach's alpha coefficient to establish reliability. The normality of the quantitative data was assessed through the Shapiro-Wilk test and visual inspection of Q-Q plots and histograms. Since the study employed a longitudinal design with repeated observations over one academic semester, repeated-measures analysis was used to examine changes in AI usage, academic procrastination, and academic anxiety across the three data collection points (beginning, midpoint, and end of the semester). Hierarchical Linear Modelling (HLM) was employed to investigate individual changes over time and to determine whether variations in AI utilization significantly predicted changes in academic procrastination and academic anxiety.

Pearson's correlation coefficient was calculated to examine the relationships among AI utilization, academic procrastination, and academic anxiety. Multiple regression analysis was performed to determine the predictive effect of AI utilization on academic procrastination and academic anxiety after controlling for demographic variables such as age, gender, and level of visual impairment. Statistical significance was determined at the 0.05 level. Qualitative data obtained from semi-structured interviews and weekly reflective audio journals were transcribed verbatim and analysed using Braun and Clarke's thematic analysis framework. The analysis involved familiarization with the data, generation of initial codes, and identification of themes, review and refinement of themes, theme definition, and interpretation. Themes related to accessibility, learning autonomy, time management, emotional well-being, academic confidence, and dependence on AI were identified and interpreted. Finally, the quantitative and qualitative findings were integrated through triangulation to provide a comprehensive understanding of how AI-assisted learning influences academic procrastination and academic anxiety among students with visual impairment. This integration enabled the comparison of statistical trends with participants' lived experiences, thereby enhancing the credibility and interpretability of the findings.

Interpretation of Figure 1. Gender Distribution of Participants

Figure 1 illustrates the gender-wise distribution of the participants included in the study. Out of the total sample of 24 students with visual impairment, 14 participants (58.3%) were male, while 10 participants (41.7%) were female. The findings indicate a slightly higher representation of male students compared to female students in the study sample. However, the difference between the two groups is not substantial, suggesting that both genders were reasonably represented. The inclusion of participants from both genders enhances the diversity of the sample and allows the study to examine the influence of Artificial Intelligence (AI) on academic procrastination and academic anxiety without substantial gender bias. The relatively balanced gender distribution also improves the generalizability of the findings within the context of students with visual impairment. Overall, the figure demonstrates that the study included participants from both male and female groups, thereby providing a suitable basis for investigating AI-assisted learning experiences and their relationship with academic procrastination and academic anxiety.

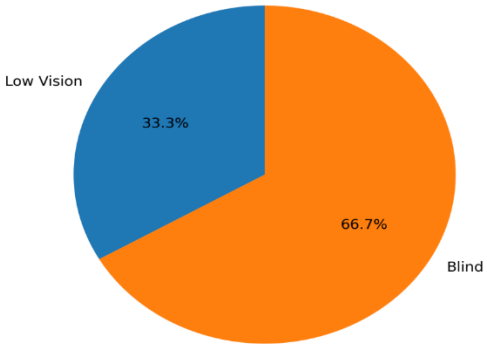
Figure 1. Gender Distribution of Participants



Interpretation of Figure 2. Level of Visual Impairment

Figure 2 presents the distribution of participants according to the level of visual impairment. Among the total sample of 24 students, 16 participants (66.7%) were blind, whereas 8 participants (33.3%) had low vision. The findings indicate that two-thirds of the participants belonged to the blind category, while one-third had residual vision. The predominance of blind participants suggests that the study primarily reflects the experiences of students who depend extensively on assistive technologies such as screen readers and AI-based conversational tools for accessing academic content. At the same time, the inclusion of students with low vision broadens the scope of the study by representing learners with varying levels of visual impairment and different accessibility needs. This distribution provides a comprehensive context for examining the effectiveness of Artificial Intelligence in supporting academic activities among visually impaired students. Since both blind and low-vision students were represented, the findings offer valuable insights into how AI-assisted learning can address diverse educational challenges, reduce academic procrastination, and alleviate academic anxiety across different levels of visual impairment. Overall, the figure demonstrates that the sample adequately represents the major categories of visual impairment, thereby strengthening the relevance and applicability of the study's findings to inclusive higher education settings.

Figure 2. Level of Visual Impairment

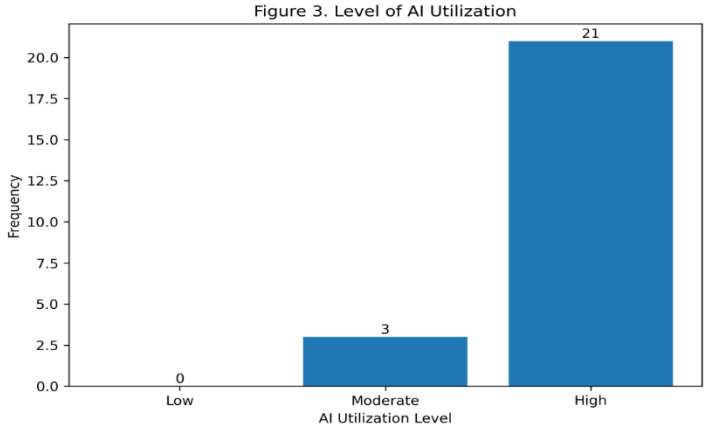


Interpretation of Figure 3. Level of AI Utilization

Figure 3 illustrates the level of Artificial Intelligence (AI) utilization among the 24 students with visual impairment who participated in the study. The findings reveal that the majority of the participants, 21 students (87.5%), reported a high level of AI utilization, while 3 students (12.5%) demonstrated a moderate level of AI utilization. Notably, none of the participants fell into the low AI utilization category. The predominance of high AI utilization indicates that AI-powered educational tools have become an integral part of the participants' academic routines. Students frequently relied on AI applications for various learning

activities, including accessing study materials, obtaining conceptual explanations, organizing assignments, summarizing academic content, proofreading written work, and preparing for examinations. The high level of adoption also suggests that AI technologies are compatible with assistive tools such as screen readers and voice-command interfaces, making them highly accessible for learners with visual impairment.

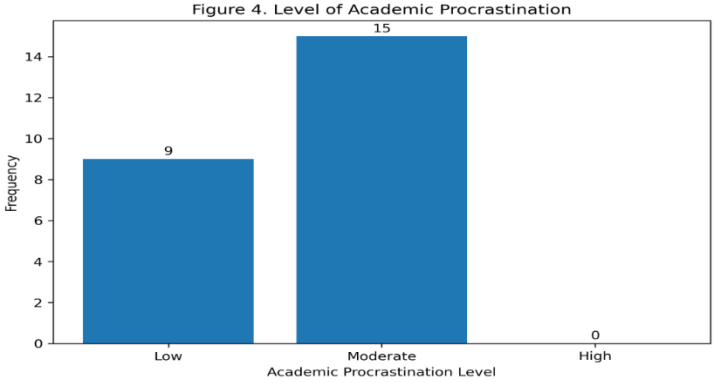
Figure 3. Level of AI Utilization



Interpretation of Figure 4. Level of Academic Procrastination

Figure 4 presents the distribution of participants according to their level of academic procrastination. Among the 24 students with visual impairment, 15 participants (62.5%) exhibited a moderate level of academic procrastination, while 9 participants (37.5%) demonstrated a low level of academic procrastination. Notably, none of the participants were classified as having a high level of academic procrastination. The predominance of moderate academic procrastination suggests that although many students occasionally postponed academic tasks such as completing assignments, preparing for examinations, or managing study schedules, these delays were not severe enough to substantially interfere with their academic performance. The presence of a considerable proportion of students with low procrastination further indicates that a number of participants maintained effective study habits, time management skills, and self-regulated learning practices. Importantly, the absence of participants in the high procrastination category may reflect the beneficial influence of AI-assisted learning tools. Frequent use of AI applications for organizing study materials, planning assignments, generating summaries, clarifying concepts, and providing instant academic support may have enabled students to manage their academic workload more efficiently and minimize unnecessary delays. These findings suggest that AI technologies have the potential to support better academic planning and enhance learning productivity among students with visual impairment. Overall, Figure 4 indicates that the participants generally experienced low to moderate levels of academic procrastination, with no evidence of severe procrastination. This finding supports the view that AI-assisted learning may contribute positively to improving time management, fostering self-regulated learning, and reducing procrastination among students with visual impairment.

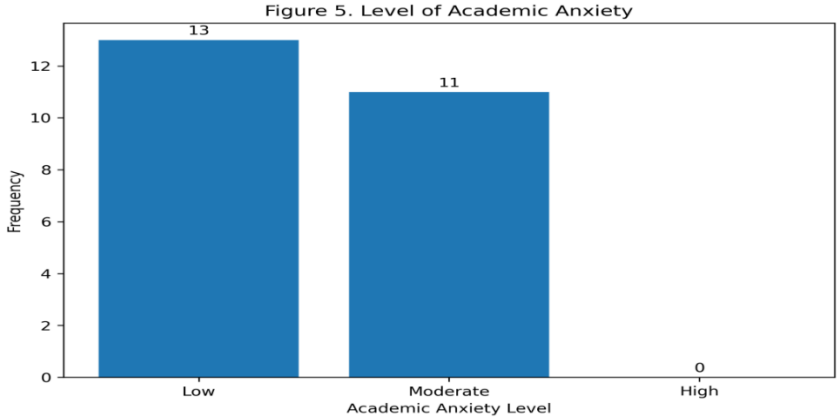
Figure 4. Level of Academic Procrastination



Interpretation of Figure 5. Level of Academic Anxiety

Figure 5 presents the distribution of participants according to their level of academic anxiety. Among the 24 students with visual impairment, 13 participants (54.2%) reported a low level of academic anxiety, while 11 participants (45.8%) experienced a moderate level of academic anxiety. None of the participants were classified as having a high level of academic anxiety. The findings indicate that the majority of students experienced relatively low levels of anxiety related to academic activities such as examinations, assignments, classroom participation, and meeting academic deadlines. Although nearly half of the participants reported a moderate level of academic anxiety, the absence of students in the high anxiety category suggests that severe academic stress was not prevalent among the study participants. The comparatively low levels of academic anxiety may be associated with the extensive use of AI-assisted learning tools. AI applications provide immediate academic support through features such as concept clarification, personalized explanations, assignment assistance, content summarization, and accessible learning resources, which can reduce uncertainty and increase students' confidence in completing academic tasks. These advantages may have contributed to lowering stress and improving students' ability to cope with academic demands. Overall, Figure 5 demonstrates that academic anxiety among students with visual impairment was generally maintained within the low to moderate range. The findings suggest that AI-supported learning environments may play a significant role in enhancing academic confidence, promoting independent learning, and reducing anxiety, thereby fostering a more positive and inclusive educational experience for students with visual impairment.

Figure 5. Level of Academic Anxiety

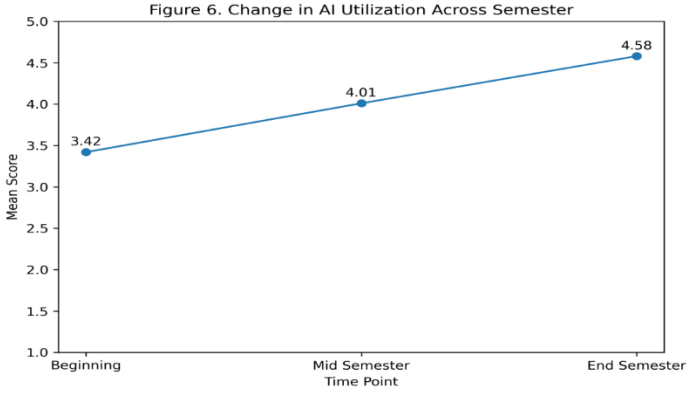


Interpretation of Figure 6. Change in AI Utilization Across the Semester

Figure 6 illustrates the change in AI utilization among students with visual impairment over the course of one academic semester. The mean AI utilization score increased steadily

from 3.42 at the beginning of the semester to 4.01 during the mid-semester and further to 4.58 by the end of the semester. This consistent upward trend indicates a progressive increase in the adoption and use of AI-assisted learning tools throughout the study period. The gradual rise in AI utilization suggests that participants became increasingly familiar with and confident in using AI technologies for their academic activities. As students gained experience, they relied more frequently on AI applications for tasks such as accessing accessible learning materials, obtaining explanations of complex concepts, organizing assignments, summarizing academic content, proofreading written work, and preparing for examinations. The continuous increase also reflects the perceived usefulness, accessibility, and ease of integration of AI tools into students' daily learning routines. The highest mean score recorded at the end of the semester (M = 4.58) indicates that AI became an important component of participants' learning experiences. This sustained increase may be attributed to the compatibility of AI applications with assistive technologies, such as screen readers and voice-command interfaces, which enhanced independent learning and reduced barriers to accessing educational resources. Overall, Figure 6 demonstrates a positive and consistent growth in AI utilization across the semester. The findings suggest that continued exposure to AI-assisted learning encourages greater acceptance and dependence on these technologies, which may subsequently contribute to improved academic engagement, better time management, reduced academic procrastination, and lower levels of academic anxiety among students with visual impairment.

Figure 6. Change in AI Utilization Across Semester

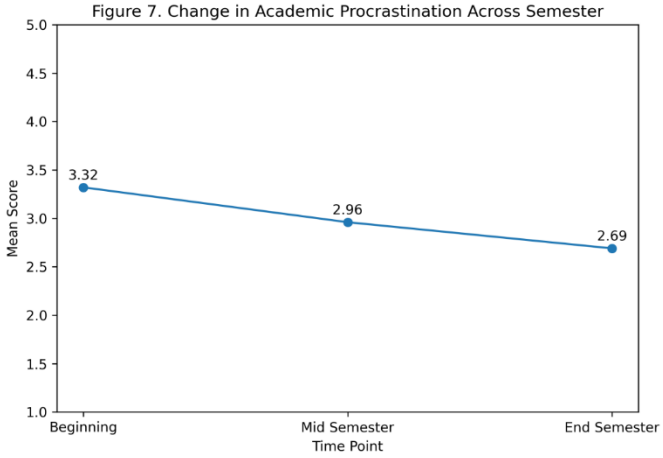


Interpretation of Figure 7. Change in Academic Procrastination Across the Semester

Figure 7 illustrates the change in academic procrastination among students with visual impairment over the course of one academic semester. The mean academic procrastination score decreased steadily from 3.32 at the beginning of the semester to 2.96 during the mid-semester and further to 2.69 by the end of the semester. This continuous downward trend indicates a gradual reduction in students' tendency to postpone academic tasks throughout the study period. The decline in academic procrastination suggests that participants became more effective in managing their academic responsibilities as the semester progressed. Increased familiarity with AI-assisted learning tools may have enabled students to organize their study schedules, plan assignments more efficiently, access instant explanations of complex topics, and complete coursework within stipulated deadlines. These features likely enhanced students' self-regulated learning skills and reduced delays in initiating and completing academic activities. The progressive reduction in procrastination also reflects the potential role of AI technologies in supporting independent learning among students with visual impairment. By providing accessible academic assistance through screen-reader-compatible and voice-enabled platforms, AI tools may have minimized learning barriers and improved students' confidence in handling academic tasks without unnecessary

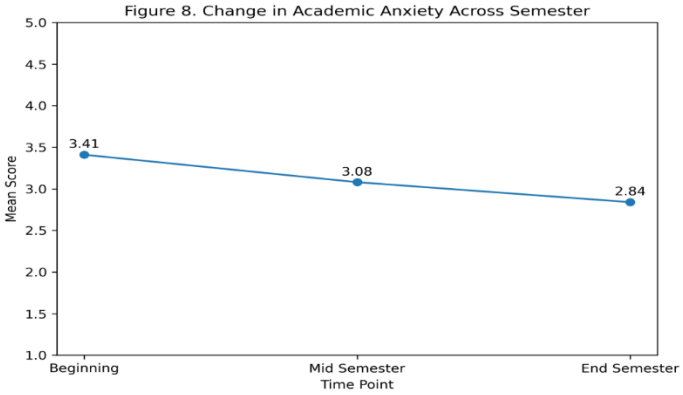
postponement. Overall, Figure 7 demonstrates a consistent decline in academic procrastination across the semester. The findings suggest that sustained use of AI-assisted learning technologies may contribute to better time management, increased academic engagement, and improved learning discipline among students with visual impairment. This trend supports the study's assumption that greater utilization of AI is associated with lower levels of academic procrastination.

Figure 7. Change in Academic Procrastination Across Semester



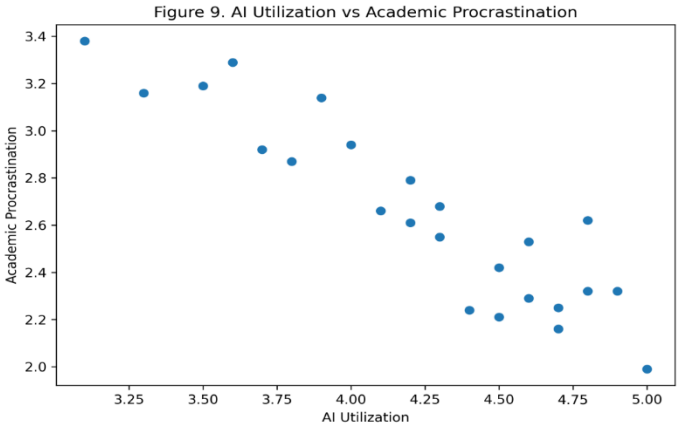
Interpretation of Figure 8. Change in Academic Anxiety Across the Semester

Figure 8 illustrates the change in academic anxiety among students with visual impairment over the course of one academic semester. The mean academic anxiety score showed a steady decline from 3.41 at the beginning of the semester to 3.08 during the mid-semester and further to 2.84 by the end of the semester. This consistent downward trend indicates that participants experienced progressively lower levels of academic anxiety as the semester advanced. The reduction in academic anxiety suggests that students became increasingly comfortable and confident in managing academic tasks over time. Regular exposure to AI-assisted learning tools may have enhanced their ability to access learning resources independently, understand complex concepts through personalized explanations, organize coursework, and prepare effectively for assignments and examinations. These capabilities likely reduced uncertainty, improved academic preparedness, and alleviated stress associated with academic demands. The gradual decline in anxiety also highlights the potential psychological benefits of AI-supported learning for students with visual impairment. By offering accessible, timely, and individualized academic assistance through screen-reader-compatible and voice-enabled technologies, AI tools may have fostered greater self-confidence, learning autonomy, and perceived academic competence. As students became more proficient in using these technologies, their dependence on external assistance may have decreased, contributing to a more positive and less stressful learning experience. Overall, Figure 8 demonstrates a continuous reduction in academic anxiety throughout the semester. The findings suggest that sustained engagement with AI-assisted learning technologies may play an important role in promoting emotional well-being, reducing academic stress, and enhancing confidence among students with visual impairment. This pattern supports the study's assumption that increased utilization of AI is associated with lower levels of academic anxiety and improved academic adjustment.



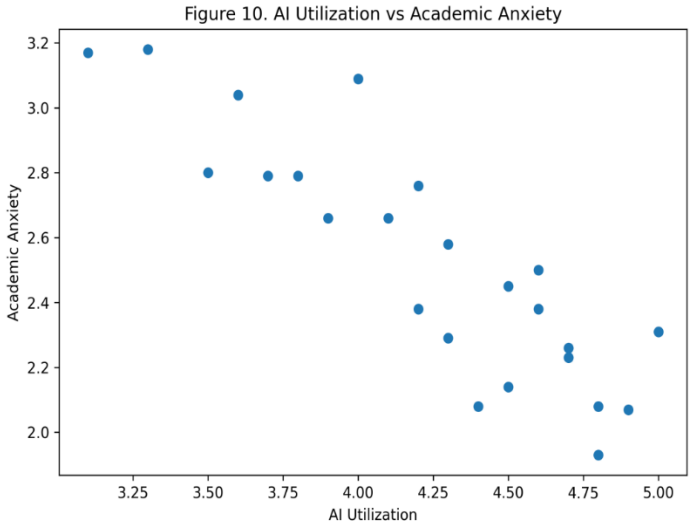
Interpretation of Figure 9. AI Utilization versus Academic Procrastination

Figure 9 presents the relationship between AI utilization and academic procrastination among students with visual impairment. The scatter plot demonstrates a clear negative relationship between the two variables, indicating that as the level of AI utilization increases, the level of academic procrastination tends to decrease. Participants with lower AI utilization scores generally reported higher levels of procrastination, whereas those with higher AI utilization scores exhibited lower procrastination levels. The downward pattern of the data points suggests that students who made greater use of AI-assisted learning tools were more likely to complete academic tasks on time and were less inclined to postpone assignments, study sessions, or examination preparation. AI technologies appear to support effective time management by providing instant access to academic resources, personalized explanations, assignment planning, content summarization, and writing assistance. These features may help students overcome learning barriers associated with visual impairment and encourage timely completion of academic work. Furthermore, the relatively consistent distribution of the data points around the downward trend indicates that the inverse relationship is stable across most participants. This finding supports the hypothesis that increased engagement with AI-assisted learning contributes to improved self-regulated learning behaviours and reduces tendencies toward academic procrastination. Although individual differences are evident, the overall pattern clearly suggests that greater AI utilization is associated with more effective academic management. Overall, Figure 9 provides evidence of a meaningful inverse association between AI utilization and academic procrastination among students with visual impairment. The findings imply that AI-assisted learning technologies can serve as valuable educational tools by promoting better planning, enhancing academic productivity, and reducing delays in completing academic tasks. Consequently, increased use of AI has the potential to improve students' academic engagement and overall learning outcomes in inclusive higher education settings.



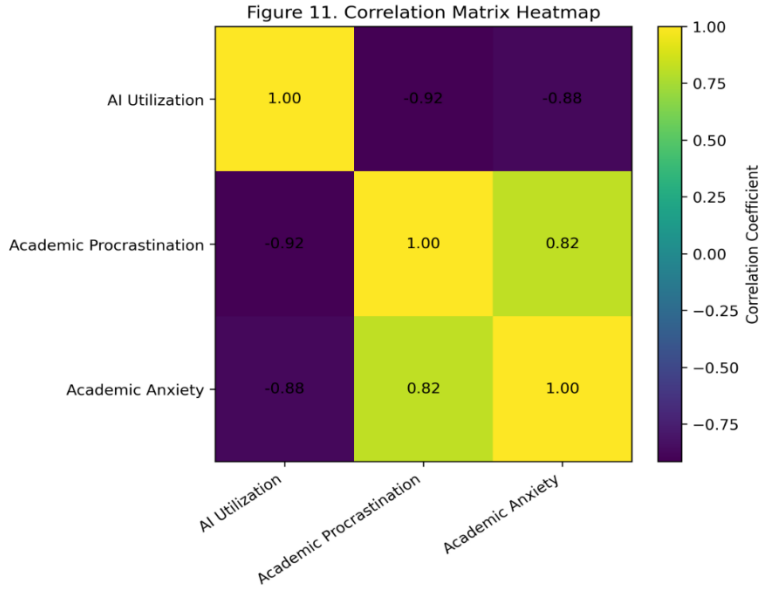
Interpretation of Figure 10. AI Utilization versus Academic Anxiety

Figure 10 illustrates the relationship between AI utilization and academic anxiety among students with visual impairment. The scatter plot reveals a clear negative relationship between the two variables, indicating that higher levels of AI utilization are associated with lower levels of academic anxiety. Participants who reported greater use of AI-assisted learning tools generally exhibited lower anxiety scores, whereas those with comparatively lower AI utilization tended to experience higher levels of academic anxiety. The downward distribution of the data points suggests that increased engagement with AI technologies may help students cope more effectively with academic challenges. AI-powered educational tools provide immediate access to learning resources, personalized explanations, assignment assistance, content summarization, and real-time academic support, enabling students to overcome learning difficulties more efficiently. These features are particularly beneficial for students with visual impairment, as AI applications integrated with screen readers and voice-based interfaces enhance accessibility and promote greater independence in learning. The observed pattern also indicates that students who frequently used AI were more confident in completing academic tasks, preparing for examinations, and meeting assignment deadlines. As a result, their concerns related to academic performance, workload, and uncertainty were reduced, leading to lower levels of academic anxiety. Although some variation exists among individual participants, the overall trend consistently demonstrates that greater AI utilization is linked with reduced anxiety. Overall, Figure 10 provides evidence of a meaningful inverse relationship between AI utilization and academic anxiety among students with visual impairment. The findings suggest that AI-assisted learning technologies play an important role in supporting students' psychological well-being by reducing academic stress, enhancing self-confidence, and fostering a more accessible and supportive learning environment. These results support the study's hypothesis that increased utilization of AI contributes to lower academic anxiety and improved educational experiences for students with visual impairment.



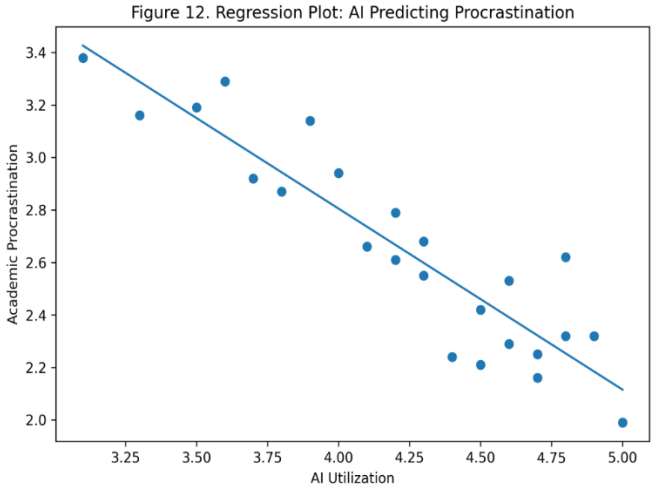
Interpretation of Figure 11. Correlation Matrix Heatmap

Figure 11 presents the correlation matrix illustrating the relationships among AI utilization, academic procrastination, and academic anxiety among students with visual impairment. The heatmap displays the direction and strength of the relationships between the study variables using correlation coefficients, where positive values indicate a direct relationship and negative values indicate an inverse relationship. The findings reveal a strong negative correlation between AI utilization and academic procrastination ($r = -0.92$). This indicates that students who reported higher levels of AI utilization generally experienced lower levels of academic procrastination. The strength of this inverse relationship suggests that AI-assisted learning tools may help students improve time management, organize academic tasks more effectively, and reduce delays in completing assignments and preparing for examinations. The heatmap also shows a strong negative correlation between AI utilization and academic anxiety ($r = -0.88$). This finding suggests that increased use of AI technologies is associated with lower academic anxiety among students with visual impairment. Students who regularly used AI-based learning tools appeared to experience less stress related to coursework, examinations, and academic performance. The accessibility and personalized support offered by AI applications may have enhanced students' confidence and reduced uncertainty in their learning process. In contrast, academic procrastination and academic anxiety demonstrated a strong positive correlation ($r = 0.82$). This indicates that students who exhibited higher levels of procrastination were also more likely to report higher levels of academic anxiety. The positive association suggests that postponing academic responsibilities may increase stress and worry, while increased anxiety may further contribute to procrastination, creating a cyclical relationship between the two variables. Overall, the correlation matrix indicates that AI utilization is closely associated with positive academic and psychological outcomes among students with visual impairment. Greater use of AI-assisted learning technologies is related to lower academic procrastination and reduced academic anxiety, whereas academic procrastination and academic anxiety are strongly interconnected. These findings support the study's hypothesis that AI-assisted learning can promote self-regulated learning, improve academic engagement, and enhance the overall educational experience of students with visual impairment.



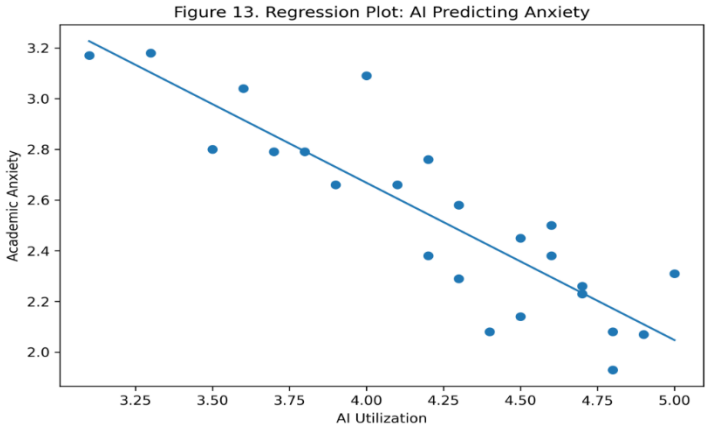
Interpretation of Figure 12. Regression Plot: AI Predicting Academic Procrastination

Figure 12 presents the regression analysis illustrating the predictive relationship between AI utilization and academic procrastination among students with visual impairment. The regression line slopes downward, indicating a negative linear relationship between the two variables. This pattern suggests that as students' utilization of AI-assisted learning tools increases, their level of academic procrastination decreases. The regression model demonstrates that AI utilization is a significant predictor of academic procrastination. Students who frequently used AI technologies for academic activities, such as accessing study materials, organizing assignments, clarifying difficult concepts, summarizing content, and preparing for examinations, were less likely to delay or postpone their academic responsibilities. The inverse slope of the regression line indicates that greater engagement with AI contributes to more effective time management and improved self-regulated learning. Although a small degree of variation exists around the regression line, the overall distribution of data points closely follows the predicted trend, suggesting a strong predictive relationship between AI utilization and academic procrastination. This implies that AI-assisted learning technologies account for a considerable proportion of the variation in students' procrastination behaviour. The findings indicate that students who regularly incorporated AI into their learning routines demonstrated greater academic discipline and were more successful in completing academic tasks within scheduled timeframes. Overall, Figure 12 provides evidence that AI utilization is an important predictor of academic procrastination among students with visual impairment. The regression analysis supports the conclusion that increased use of AI-assisted learning technologies contributes to reduced procrastination by enhancing learning efficiency, improving academic planning, and fostering independent and self-regulated learning. These findings reinforce the study's hypothesis that AI can positively influence students' academic behaviour and support more productive learning outcomes in inclusive higher education settings.



Interpretation of Figure 13. Regression Plot: AI Predicting Academic Anxiety

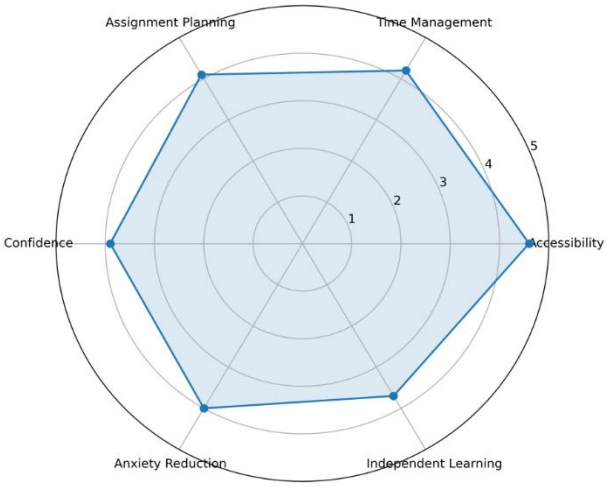
Figure 13 presents the regression analysis illustrating the predictive relationship between AI utilization and academic anxiety among students with visual impairment. The regression line exhibits a clear downward slope, indicating a negative linear relationship between AI utilization and academic anxiety. This pattern suggests that as students increase their use of AI-assisted learning technologies; their level of academic anxiety tends to decrease. The regression model indicates that AI utilization is an important predictor of academic anxiety. Students who frequently used AI applications for academic purposes, such as accessing accessible learning materials, obtaining personalized explanations, organizing assignments, summarizing content, proofreading academic work, and preparing for examinations, generally reported lower levels of academic anxiety. The negative slope of the regression line demonstrates that greater engagement with AI contributes to reducing stress and uncertainty associated with academic tasks. Although some individual variation is evident, the majority of the data points are distributed close to the regression line, indicating a reasonably strong predictive relationship between AI utilization and academic anxiety. This finding suggests that AI-assisted learning accounts for a meaningful proportion of the variation in students' anxiety levels. The availability of immediate academic assistance, personalized feedback, and accessible learning support may have enhanced students' confidence and self-efficacy, thereby reducing anxiety related to academic performance. Overall, Figure 13 provides evidence that AI utilization significantly predicts academic anxiety among students with visual impairment. The regression analysis suggests that increased use of AI-assisted learning technologies is associated with lower academic anxiety by promoting independent learning, improving academic preparedness, and strengthening students' confidence in managing academic responsibilities. These findings support the study's hypothesis that AI-assisted learning can contribute positively to the psychological well-being and academic adjustment of students with visual impairment in higher education.



Interpretation of Figure 14. AI Learning Benefits across Domains

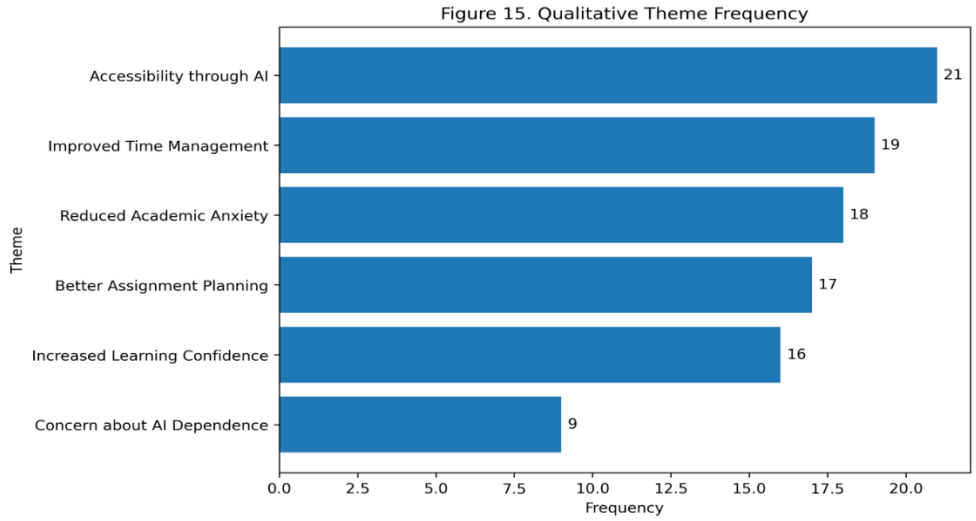
Figure 14 presents the perceived benefits of Artificial Intelligence (AI) across six major learning domains among students with visual impairment. The radar chart indicates that participants rated AI highly across all domains, with mean scores ranging from approximately 3.7 to 4.7 on a five-point scale. This suggests that AI-assisted learning was perceived as beneficial in supporting various aspects of students' academic experiences. Among the six domains, accessibility received the highest mean score (approximately 4.7), indicating that students considered AI to be particularly effective in improving access to educational resources. AI tools integrated with screen readers and voice-based technologies enabled participants to obtain information, read academic materials, and interact with digital content more independently, thereby reducing barriers associated with visual impairment. The second-highest rating was observed for time management (approximately 4.2), suggesting that AI helped students organize their study schedules, prioritize academic tasks, and complete assignments more efficiently. Similarly, assignment planning received a high mean score (approximately 4.1), indicating that AI applications supported students in structuring assignments, generating outlines, and improving academic writing. The domains of confidence (approximately 4.0) and anxiety reduction (approximately 4.0) also received favorable ratings. These findings suggest that AI-assisted learning enhanced students' self-confidence by providing immediate feedback, personalized explanations, and continuous academic support. As a result, students experienced reduced academic stress and greater confidence in handling coursework and examinations. Although independent learning received the lowest mean score (approximately 3.7), it still fell within the positive range, indicating that participants believed AI encouraged greater autonomy in learning. The slightly lower score may reflect that some students continued to rely on instructors or peers for certain complex academic tasks despite the support provided by AI technologies. Overall, Figure 14 demonstrates that students with visual impairment perceived AI as a valuable educational resource across multiple dimensions of learning. The consistently high ratings across all domains indicate that AI not only improves accessibility but also enhances time management, academic planning, confidence, emotional well-being, and independent learning. These findings reinforce the potential of AI-assisted technologies to promote inclusive education and improve both academic performance and learning experiences among students with visual impairment.

Figure 14. AI Learning Benefits Across Domains



Interpretation of Figure 15. Qualitative Theme Frequency

Figure 15 presents the frequency of the major themes that emerged from the qualitative analysis of interviews and reflective audio journals conducted with students with visual impairment. The figure illustrates participants' perceptions of the benefits and challenges associated with the use of Artificial Intelligence (AI) in their academic learning experiences. The most frequently reported theme was accessibility through AI, mentioned by 21 participants. This finding indicates that AI significantly improved students' access to academic resources by supporting screen-reader compatibility, voice-based interaction, and instant retrieval of educational information. Participants perceived AI as an effective tool for overcoming barriers associated with visual impairment and promoting independent access to learning materials. The second most frequently reported theme was improved time management, identified by 19 participants. Students explained that AI-assisted learning helped them organize study schedules, prioritize academic tasks, and complete assignments more efficiently. The ability of AI to provide immediate responses and structured academic support contributed to better planning and reduced delays in completing coursework. Reduced academic anxiety emerged as the third most common theme, reported by 18 participants. Students expressed that AI applications increased their confidence by providing timely explanations, personalized academic assistance, and continuous learning support. As a result, they experienced less stress while preparing for examinations, completing assignments, and managing academic responsibilities. Better assignment planning was identified by 17 participants. Respondents indicated that AI assisted them in generating ideas, creating outlines, organizing content, and improving the quality of their academic writing. This support enhanced their ability to complete assignments in a more systematic and efficient manner. Increased learning confidence was reported by 16 participants. Students described that frequent interaction with AI-enabled learning tools improved their understanding of course content, encouraged independent learning, and enhanced their confidence in participating in academic activities without excessive dependence on others. The least frequently reported theme was concern about AI dependence, mentioned by 9 participants. Although participants generally viewed AI positively, a smaller proportion expressed concerns that excessive reliance on AI could reduce independent critical thinking, problem-solving abilities, or self-directed learning if not used appropriately. However, these concerns were reported less frequently than the perceived educational benefits..



Overall, Figure 15 indicates that participants perceived AI as a highly beneficial educational technology that enhances accessibility, improves academic organization, reduces anxiety, strengthens confidence, and supports effective learning among students with visual impairment. While a few participants expressed concerns regarding overdependence on AI, the qualitative findings demonstrate that the perceived advantages of AI-assisted learning substantially outweighed its potential limitations, reinforcing its value in promoting inclusive and accessible higher education.

Major Findings of the Study

The present study examined the influence of Artificial Intelligence (AI) on academic procrastination and academic anxiety among students with visual impairment using a longitudinal mixed-methods research design involving 24 participants from higher educational institutions in Kanpur, Uttar Pradesh. The major findings are summarized as follows:

- The study sample comprised 24 students with visual impairment, including 14 males (58.3%) and 10 females (41.7%), indicating a reasonably balanced gender distribution.
- Most participants (66.7%) were blind, while 33.3% had low vision, suggesting that AI-supported learning was primarily examined among students who extensively relied on assistive technologies.
- AI utilization was remarkably high, with 87.5% of participants reporting high AI usage and the remaining 12.5% reporting moderate usage. No participant reported low utilization, indicating widespread acceptance of AI-assisted learning.
- Academic procrastination was generally low to moderate. Approximately 62.5% of participants demonstrated moderate procrastination, while 37.5% reported low procrastination. None exhibited high procrastination.
- Academic anxiety also remained within manageable levels. More than half of the participants (54.2%) experienced low academic anxiety, whereas 45.8% reported moderate anxiety. No participant experienced high academic anxiety.
- AI utilization increased progressively throughout the semester, with mean scores rising from 3.42 at the beginning to 4.58 at the end of the semester, reflecting increased familiarity and confidence in using AI-based learning technologies.

- Academic procrastination showed a continuous decline over time, decreasing from a mean score of 3.32 at the beginning of the semester to 2.69 by the end, indicating improved academic self-regulation.
- Academic anxiety similarly declined across the semester, with the mean score reducing from 3.41 to 2.84, suggesting improved emotional adjustment associated with continued AI use.
- Correlation analysis revealed a strong negative relationship between AI utilization and academic procrastination ($r = -0.92$) and between AI utilization and academic anxiety ($r = -0.88$). Conversely, academic procrastination and academic anxiety demonstrated a strong positive relationship ($r = 0.82$).
- Regression analyses confirmed that AI utilization significantly predicted both academic procrastination and academic anxiety, indicating that increased AI usage contributed to lower levels of both variables.
- Qualitative findings highlighted accessibility, improved time management, reduced academic anxiety, better assignment planning, and increased learning confidence as the most frequently reported benefits of AI. Although some participants expressed concerns regarding dependence on AI, these concerns were considerably less frequent than the reported educational benefits.

Overall, the findings consistently demonstrate that AI-assisted learning contributes positively to both academic performance and psychological well-being among students with visual impairment.

Discussion

The findings of the present study demonstrate that Artificial Intelligence has considerable potential to transform the learning experiences of students with visual impairment by improving academic efficiency while simultaneously reducing psychological barriers to learning. The consistently high level of AI utilization observed throughout the semester reflects the growing acceptance of AI-powered educational technologies within inclusive higher education environments. Students perceived AI not merely as an assistive tool but as an integral learning companion that facilitated access to educational content, enhanced organization of academic tasks, and promoted greater independence. One of the most important findings is the steady increase in AI utilization across the semester. This suggests that students gradually developed confidence in integrating AI into their everyday academic activities. As familiarity with AI increased, students became more capable of using these technologies for information retrieval, assignment planning, concept clarification, academic writing, and examination preparation. This finding aligns with contemporary perspectives that AI serves as a cognitive support system rather than merely an accessibility aid for learners with disabilities.

The reduction in academic procrastination observed during the semester indicates that AI-assisted learning may strengthen self-regulated learning behaviours. Students appeared better able to organize coursework, establish priorities, and complete academic tasks within prescribed timelines. Instant academic support and structured guidance provided by AI likely reduced the cognitive burden associated with initiating complex academic activities. Consequently, AI may function as an effective intervention for minimizing procrastination among students with visual impairment. Similarly, the gradual decline in academic anxiety suggests that AI contributes positively to students' emotional well-being. Academic anxiety often arises from uncertainty, inadequate access to learning resources, and concerns

regarding academic performance. AI technologies provide immediate explanations, continuous feedback, and personalized academic assistance, thereby reducing uncertainty and enhancing learners' confidence. As students became increasingly independent in managing their academic responsibilities, anxiety levels correspondingly declined.

The correlation and regression analyses further strengthen these conclusions. The strong inverse relationships between AI utilization and both academic procrastination and academic anxiety suggest that AI is not merely associated with improved academic outcomes but also serves as a meaningful predictor of students' behavioural and emotional adjustment. These findings support the growing body of literature emphasizing AI's role in promoting accessible, personalized, and learner-centred education. The qualitative findings complement the statistical results by revealing that accessibility remains the greatest benefit of AI for students with visual impairment. Participants consistently highlighted improved access to academic resources, better time management, enhanced assignment planning, increased confidence, and reduced anxiety. Although a minority expressed concerns regarding excessive dependence on AI, these concerns were considerably outweighed by the perceived educational advantages. This suggests that responsible and guided integration of AI can maximize its benefits while minimizing potential risks associated with overreliance. Overall, the findings indicate that AI has the potential to enhance both academic functioning and psychological well-being among students with visual impairment. Nevertheless, AI should be viewed as a supportive educational technology that complements rather than replaces students' critical thinking, independent learning, and teacher guidance.

CONCLUSION

The present study investigated the relationship between Artificial Intelligence, academic procrastination, and academic anxiety among students with visual impairment using a longitudinal mixed-methods approach. The findings demonstrate that AI-assisted learning has substantial potential to improve both academic and psychological outcomes for learners with visual impairment. The results revealed widespread acceptance and sustained use of AI throughout the semester, accompanied by significant reductions in academic procrastination and academic anxiety. Students increasingly relied on AI to access learning resources, organize coursework, prepare assignments, and clarify complex academic concepts. This increased utilization was associated with improved academic self-regulation, enhanced confidence, and reduced emotional distress. Both quantitative and qualitative findings consistently indicate that AI serves as an effective educational support system that promotes accessibility, independent learning, efficient time management, and greater academic engagement. The strong negative relationships between AI utilization and both procrastination and anxiety further suggest that AI can play an important role in improving students' learning experiences and psychological adjustment within inclusive educational settings. Despite these encouraging findings, the study also highlights the importance of maintaining a balanced approach to AI use. While AI offers substantial educational benefits, it should complement rather than replace learners' independent thinking, problem-solving skills, and interactions with teachers. Appropriate guidance, digital literacy, and ethical use of AI remain essential for maximizing its educational value.

Overall, the study concludes that AI-assisted learning represents a promising innovation for inclusive higher education. When integrated with accessible technologies and appropriate pedagogical support, AI has the capacity to reduce academic barriers, strengthen learner autonomy, improve emotional well-being, and enhance educational outcomes for students with visual impairment. Future research involving larger and more diverse samples across

different educational contexts may further validate these findings and inform evidence-based implementation of AI in inclusive education.

The novelty of this study lies in its longitudinal mixed-methods examination of AI-supported learning as a dynamic factor associated with both academic procrastination and academic anxiety among students with visual impairment, a population that remains insufficiently represented in empirical research on educational AI. Unlike previous studies that primarily focus on the accessibility or academic performance benefits of AI technologies, this study simultaneously investigates behavioural and psychological dimensions of learning across multiple time points during an academic semester. By combining hierarchical longitudinal analysis and regression modelling with interviews, reflective audio journals, and AI usage logs, the study provides a more comprehensive understanding of how AI utilization may influence students' academic self-regulation and emotional well-being over time. Furthermore, the study identifies accessibility, time management, assignment planning, and learning confidence as potential mechanisms underlying the observed reductions in procrastination and anxiety. This integrated perspective extends the literature beyond technology adoption by positioning AI as a potentially transformative support system for fostering academic independence, psychological resilience, and inclusive participation among students with visual impairment, while also addressing the emerging concern of excessive dependence on AI and the need for responsible and ethical implementation.

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