



Study how AI can Provide Timely and Constructive Feedback to Students, Fostering a Growth Mindset and Resilience

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Abstract: The paper explores how the use of AI-driven feedback systems can enhance performance as well as other major psychological traits like a growth mindset and resilience in the students. The AI feedback systems are quick and personalized in giving a response that leaves the student with no option but to identify her or his mistake correctly, thereby improving their academic performance significantly. Highlighting effort and learning from mistakes, AI nudges the students into viewing challenges as opportunities for growth; it is the principle of a growth mindset. The AI feedback also promotes resilience as, serving the students with continuous support, it inspires the students to persist in difficulties and, therefore, reinforces the ideology that success is the outcome of effort and perseverance. However, the study further goes to reveal the limitations of AI in being able to provide emotional support. Such AI systems are effective at delivering constructive academic feedback but lack the emotional sensitivity that a human teacher provides. Emotional guidance remains essential in assisting students in dealing with frustration, maintaining confidence, and staying motivated during awkward conditions. Thus, findings highlight that there should be more of a hybrid approach toward utilizing AI systems-not to supersede human instruction-where such AI systems complement it. Education could provide best support to students in their academic and emotional development by combining the strengths of AI feedback and teachers' empathetic guidance, thus providing well-rounded and resilient learners.

Keywords: AI-driven feedback, growth mindset, academic performance, educational technology, student development, real-time feedback.

1. Introduction

This is coupled by the increasing role of Artificial Intelligence in education, changing the manner in which teaching and learning are accomplished. AI is now an integrated part of many realms of education. The technology of adaptive learning, the intelligent tutoring systems, and automated grading platforms make student learning much more personalized and accessible (Sain, 2024). The speed at which AI technology develops, particularly in natural language processing and machine learning, allows an AI system to tailor instruction and feedback to the needs of students for optimizing the learning experience. It means AI-powered systems in education analyze huge stores of student data, including learning habits, performance metrics, and even emotional engagement, to dynamically adjust content and feedback. These systems are intended to be learning paths that make students feel at ease. For instance, AI-driven platforms such as Carnegie Learning and Smart Sparrow use algorithms in real-time to adapt lessons to the strengths and weaknesses of the students (Kulik & Fletcher, 2016). AI also assists teachers by freeing time for more interaction with students and other creative instruction by automating tasks like grading and administrative work. One of the studies delineates the potentiality that AI can offer teachers in large classrooms to

overcome the scarcity of individual attention provided in such classrooms by giving automated yet personalized feedback, as presented in (Luan et al., 2020). AI use in reshaping education experiences has a wide scope, but the most promising domain is the area of feedback, where there is a possibility of giving timely and appropriate responses towards the enhancement of learning outcomes.

Feedback has been identified as the core of learning, and how timely it is received influences students a lot (Wisniewski et al., 2020). Constructive feedback refers to the type in which mistakes are identified; one can know what is wrong and is motivated to continue. The challenge, however, for instructors has been providing timely and personalized feedback, especially where there is the incapacity to have direct contact between instructors and students, such as in large classes or online settings (Anderson, 2018). Generally, time lag that occurs between the time when a student performs an activity and the time that the instructor delivers feedback interferes with the efficacy of feedback, thus missing the opportunity for immediate correction or improvement. This problem can be addressed through the immediate constructive feedback using AI, as intelligent systems scan to continually monitor the development of the student (Gui et al., 2023). Such AI systems analyze the work in real time and give feedback that is timely and diagnostically adjusted for the learning process of an individual. For example, Gradescope uses AI to score assignments based on a broad spectrum of material within a minute of submission. This gives students the capacity to reflect effectively while they still remember what they just created.

Constructive feedback from AI systems is especially effective because it can often be more informative and precise than what a teacher would provide, given the time constraints they face (Roll et al., 2021). AI feedback focuses on the content as well as the process of learning, that is, the learner not only correct his or her wrongs but also understand why those wrongs occurred. This can be very critical for fostering deeper learning and ensuring that students build the skills required to overcome such problems in the future. Furthermore, AI can be designed to offer feedback that reinforces a focus on effort and improvement. This is in keeping with learning strategies aimed at developing growth mindsets (Japiassu, 2022).

A growth mindset is an ideology developed by Carol Dweck (2006), in which ideas about intelligence and abilities could be developed through effort and perseverance and even based upon learning from failure. More likely to embrace challenges and persist through difficulties, and see failure as an opportunity to learn instead of a reflection of fixed abilities (Dweck, 2021). Students with a fixed mindset tend to avoid challenges and may interpret setbacks as strengthening their belief about limitations. Results have been found to indicate that students who have a growth mindset are apt to be more motivated, better at taking responsibility for their learning, and have superior performance over time (Boaler, 2019). AI has tremendous potential for the development of a student's growth mindset because it allows for constant effort-based feedback that emphasizes learning and improvement over correctness (George, 2023). For example, AI-based models monitor student learning over the passage of time to give instant feedback that would bring out effort and areas of improvement so that students are motivated to hold on with challenging tasks (Xu, 2024). Such feedback then helps the student look at problems as a chance for improvement, thus convincing them that their abilities are not fixed but might change due to effort.

Resilience relates to bouncing back from failures and hardships in life to reach goals. In education, resilience has to do with mastering the academic challenges that a student face. In this regard, a poor result on an examination or failure to understand some complex subject could be a significant academic challenge for a student. Artificial intelligence systems can play a great role in developing resilience by making normal the actual process of learning as including failure, receiving feedback, and improving. Constructive continuous feedback by AI can make the students think about the mistakes that they are making as part of learning rather than failure thereby reducing the fear of failure and increasing persistence (Fonagy et al., 2024). Real-time AI feedback build resilience as soon as it informs the students on how they performed so that they can correct themselves in a timely and efficient manner (Byers, 2024). This reduces frustration and discouragement emanating from delayed feedback. In addition, AI systems can provide positive reinforcement with regard to students who might be boosted and encouraged to remain motivated even after setbacks. Gradually, such actionable, encouraging feedback enables a mindset that accepts risks and endures hardships-challenges critical to the definition of resilience (Graham & Weiner, 2012).

1.1 Purpose of the Study

This paper aims to explore how AI-driven feedback systems support students in developing a growth mindset and resilience. Although there is much evidence that AI systems improve academic performance by using personalized learning, how they create psychological impacts in students with regard to key traits such as a growth mindset and resilience is yet to be known or at least not well articulated to date. The paper, therefore, aims to bridge this gap

through an investigation of the extent to which AI feedback changes the way a student interacts or reacts to a challenge, perceives failure, and progresses their learning.

A focus of this research was how AI's mechanisms of immediate corrections, progress tracking, and comments focusing on effort impact the attitude students have towards learning. The study considered whether AI could do anything to alter the mindsets of the students from being fixed to growth oriented and whether AI can influence students' ability to push forward in the face of adversity (Yeager & Dweck, 2012). Furthermore, the research quantitatively analyzed the qualitative impact of AI on the emotional responses by students towards feedback received and, on the motivation, to improve.

2. Literature Review

The integration of AI in education history is long and dates back to early computer-assisted instruction in the 1960s. The first systems, like PLATO (Programmed Logic for Automatic Teaching Operations), were thought to be the precursors of AI's ability to support personalized learning as they provided students with an interactive educational experience. However, only with the advent of improved sophisticated algorithms in machine learning and powerful computer systems did AI become transformative in education during the 21st century. More recently, in education, AI has started to see greater influence in its settings through a personalized experience. AI-based technology itself, adaptive learning platforms, for example, work on the data of interactions that students make to personalize the material content in accordance with individual needs for learning. For instance, Knewton and DreamBox adjust the lessons real-time as per the performance of the learner concerning his level of understanding so that instruction is delivered at a suitable level that is congruent to that of his understanding by the student (Zawacki-Richter et al., 2019). These platforms use algorithms that learn about each student's behavior, gradually improving the personalization process over time.

Using AI in education is one of the most significant ways to offer personalized feedback. AI provides more frequent and custom-oriented feedback as compared to traditional classroom feedback. ITS, such as Cognitive Tutor, are supposed to mimic the human one-on-one tutoring by providing instant feedback to the learners while solving the problems (Holmes et al., 2019). Such systems can, based on response patterns made by the students, provide suggestions of alternatives through which specific problems can be solved and thus promote complex learning.

The present use of AI in teaching also transcends just delivering personalized content in learning, and with feedback. AI is employed in the assessment of the performance of students, forecasting the likelihood of future success, and in identifying possible underperformers. AI-learning analytics tools monitor the engagement, participation, and performance of students, hence allowing educators to intervene appropriately in time (Axelsen et al., 2020). This blend of personalized learning and predictive analytics is indeed at the forefront of AI in education, promising much change in these old ways of education.

Timely and constructive feedback, therefore, forms an integral part of effective learning; yet in traditional educational environments, such feedback can be hard to provide, especially in big classes. This practice can hinder the students from learning correct mistakes and increasing performance if the time gap is a considerable amount of time between the completion of assignments and the provision of feedback. For example, evidence shows that the most powerful effect of feedback occurs when it is prompt, specific, and actionable (Wisniewski et al., 2020). Such feedback is effective because it can allow students to correct their beliefs early, it then strengthens the appropriate knowledge and enhance retention of the learned concept (Anderson, 2018). Another capability of AI that offsets the limitations of the traditional methods used is instantaneous feedback. Intelligent systems available in AI-powered grading tools and learning platforms to answer student inputs in real-time. Through this, the students adapt their learning behaviors in real-time because the adaptation of those behaviors promptly affects the reinforcement of concepts whose freshness in the minds of the learners is very significant (Dou et al., 2023). For example, Gradescope and OpenEdX allow the learners to get rich feedback on quizzes and assignments shortly after they submit them; in turn, this boosts active engagement with self-correction.

Psychological attributes- The psychological qualities are very important for education because these do not only influence short-term academic outcome but also play a significant role in long term success. This means the students with a growth mindset are more likely to engage in lifelong learning because they believe their abilities can always be improved at any time (Sideridis, 2009). Lastly, resilience helps assist students in coping with the ever-changing circumstances of their academic and professional lives and overcoming the challenges that are bound to occur all through such careers. Both are increasingly being realized to be the right abilities that would lead to

success in the 21st century where adaptability and continuous learning hold the key to any kind of growth (Fonagy et al., 2024).

AI may serve as a powerful tool in cultivating a growth mindset and resilience by the nature of the feedback that AI can give. Continuous positive reinforcement by AI helps develop students' understanding of learning as a process rather than an outcome. For example, AI-based apps such as Duolingo give instant feedback on the practices from which one learns a language encouraging continuous practice and learning through errors (Alenezi, 2023). Such feedback encourages the development of a growth mindset, as the message conveyed is that one cannot do it without practice, effort, and substantial trial, yet nothing is impossible with time. AI-based systems of feedback make students even more resilient as they are exposed to failure as part of the process. The AI systems differ from the human viewpoint, in which mistakes are viewed negatively. Instead, systems provide feedback that depicts mistakes as fields where one can develop and gain more. This is very effective in resilience development because it makes people realize that setbacks are not eternal and can be overcome with persistence (Ghaleb & Alshiha, 2023). Furthermore, when students believe they have been unsuccessful, the AI systems encourage them not to despair as their confidence keeps rising high to strive for their goals.

The other characteristic by which AI fosters resilience involves data-informed knowledge that enables monitoring of students' progression over time. While utilizing representations of progress, AI systems provide students with a better sense of intuition about their efforts paying off, even when improvement is gradual (Holmes et al., 2019). Such factors can truly inspire the students who would otherwise be disappointed with the lack of development made, thus emphasizing that practice does make perfect. Moreover, AI systems are not just reactive but proactive in nudging growth mind-set behaviors forward. For example, adaptive learning platforms give increasingly harder problems as students demonstrate mastery of a concept, nudging them to extend the boundaries of their ability and take on harder ones (Strielkowski et al., 2024). Continuously challenging students with supportive feedback creates an environment in which students are always challenging the limits of what they know and develop resilience to engage with complex tasks. Finally, worth mentioning is the future impact of AI on the growth mindset and resilience of students. By providing timely, personal, and constructive feedback, AI systems condition students to learn as if learning were an ongoing, dynamic process, thereby facilitating development in psychological orientations toward long-term achievement in academic and personal life.

2.1 Hypothesis

H1: AI-driven feedback improves students' academic performance.

H2: AI feedback fosters a growth mindset by focusing on effort and learning from mistakes.

H3: AI feedback promotes resilience by encouraging persistence through challenges.

2.2 Research Gap

While the majority of research into AI was carried out on technical aspects, that is how to enhance personalized learning, automate administrative tasks, and provide real-time feedback, the domain of how the influence of AI affected learners' psychological development, especially in terms of growth mindsets and resilience, left a lot under-researched. The majority of the works were oriented on AI roles within the optimization of academic achievement in the context of a customized learning experience and optimizing approaches to teaching through data analysis (Strielkowski et al., 2024). Yet, it was only a few works that explored the emotional and motivational impacts that arise from AI-based feedback in students, mainly on persistence inside challenges and a belief in personal development.

The gap was thus filled by this research, as it incorporated the psychological effects that AI feedback may have on students. More precisely, the research studied how AI-created feedback promotes a growth mindset- the belief of a student, for instance, that their abilities can be developed with effort and resilience-the ability of the students to bounce back from the experiences of failure and continue trying for the same goals. Now, with its contribution to exploring these psychological impacts, the study aimed to add new insights regarding a wider role of AI in forming not only academic success but also emotional and motivational growth of students (George, 2023).

3. Methodology

This research is carried out through a qualitative methodology, based on case studies that focus on students and teachers. A qualitative approach is used here to obtain a deeper and more appropriate understanding of how AI-driven feedback influences the development of a growth mindset as well as resilience. Cases provide the detailed

view of their specific experiences, while interviews and focus groups are proven insightful about the cognitive and emotional psychology of AI in the education setting.

3.1 Sample Size

A total of 40 participants was included in the research-25 students and 15 teachers-all from two active educational establishments that use AI-based learning platforms. The sample was drawn through purposive sampling and was selective; only participants who have direct experience with respect to the AI system were considered. The sample size was sufficient to provide significant diversity in terms of perspective, and individual as well as group-level analyses were possible.

3.2 Data Collection

The data was collected through semi-structured interviews with both students and teachers. These interviews were aimed at gaining insight from the participants, regarding their experience about AI feedback, where the role it played was to change the learning behavior, motivation, and ability to cope with academic stress challenges. In addition, focus groups consisted of discussions between the students on their use of AI-based learning tools. The view given by these focus groups was a more comprehensive one, addressing how the AI feedback affected the group's perception of learning. Other analytical source of AI-executing data provided for proof of interview and focus group findings to help establish a connection between student's feedback and student's progress in learning.

3.3 Thematic Analysis

The interview and focus group data were analyzed through thematic analysis. In this, the data was coded, then categorized under key themes. In analysis, a number of consistent patterns emerged pertaining to how AI feedback generated a growth mindset and resiliency. From the data, salient themes emerged which include: "effort-based improvement," "persistence in the face of challenges," and "emotional support by AI." The coded themes are used to create a richer understanding of the role of AI-driven systems in developing the requisite qualities of resilience and a growth mindset.

4. Data Analysis

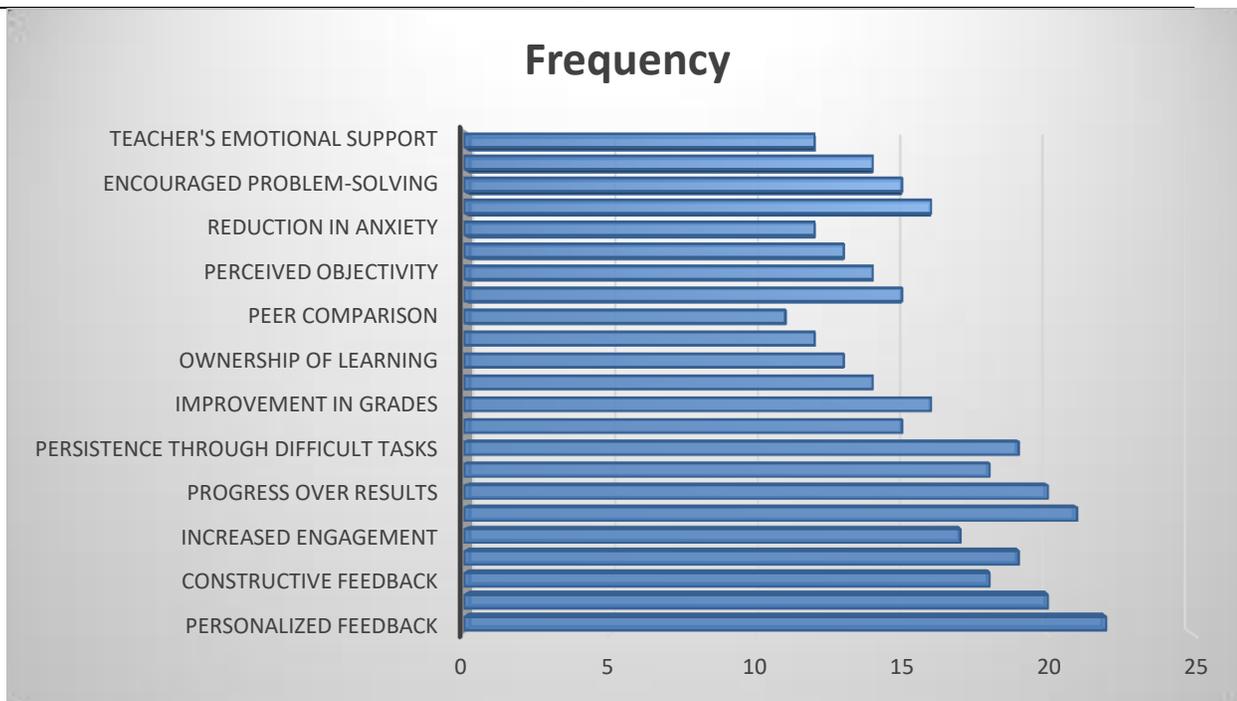
Data Analysis involved analyzing the impact AI-driven feedback has on academic performance, growth mindset, and resilience among both students and instructors, according to the three hypotheses of the study. Analysis both thematic and narrative to get into patterns and trends as to how the use of AI influences learning behaviors and psychological development. This study consisted of 40 participants, 25 being students and 15 teachers, for the exploration of how AI feedback might impact educational outcomes.

4.1 Thematic Analysis

An overall thematic analysis was carried out to present recurring themes based on the following aspects of AI feedback: its relationship with academic performance, student motivation, growth mindset, and resilience. Interview and focus group data were coded towards major patterns organized under each main theme and subtheme. These themes thus emerged as based on participants' experiences with AI-driven feedback systems and responses to that feedback within learning environments.

| Themes | Subthemes | Code |
|-----------------------------|-------------------------------------|--|
| AI Feedback | Personalized feedback | "Tailored responses to progress" |
| | Timely feedback | "Immediate error correction" |
| | Constructive feedback | "Step-by-step improvement" |
| Student Motivation | AI as a motivator | "Positive reinforcement" |
| | Increased engagement | "Motivated to participate actively" |
| Growth Mindset | Focus on learning from mistakes | "Mistakes as opportunities" |
| | Progress over results | "Effort praised over success" |
| Resilience | Ability to recover from setbacks | "Resilience after failure" |
| | Persistence through difficult tasks | "Staying committed through challenges" |
| Academic Performance | Problem-solving skills | "Enhanced problem-solving ability" |

| Themes | Subthemes | Code |
|------------------------------|---------------------------------|--|
| Self-Efficacy | Improvement in grades | "Grades improved over time" |
| | Confidence in abilities | "Boost in self-confidence" |
| | Ownership of learning | "Taking control of learning process" |
| Peer Influence | AI collaboration | "Shared feedback experience" |
| | Peer comparison | "Comparison with AI feedback to peers" |
| AI System Reliability | Trust in AI feedback | "Confidence in AI recommendations" |
| | Perceived objectivity | "AI is fair and unbiased" |
| Emotional Support | Emotional impact of AI feedback | "Encouragement from AI systems" |
| | Reduction in anxiety | "Less anxiety about errors" |
| Student Autonomy | Self-directed learning | "Learning independently with AI" |
| | Encouraged problem-solving | "AI fostered independence in learning" |
| Teacher's Role | Teacher's complementary role | "AI feedback allows teacher focus" |
| | Teacher's emotional support | "Teachers balance AI feedback" |



4.2 Narrative Analysis

The narrative study examined how AI-driven feedback helped students and teachers learn. Several students described how AI comments helped them progress in specific courses, embrace learning from mistakes, and persevere. One student said they struggled with math but learned complicated topics after receiving personalized and timely feedback from an AI system. AI feedback helped students' progress academically and persevere through challenges, boosting confidence and problem-solving skills.

4.3 Key Metrics

The key metrics analyzed are as follows to test the hypotheses of the study. Most of the respondents showed marked betterment in their grades over time where AI-based feedback was provided on time, specifically, and with regard to the problems resolved with the corrective action. Teachers also witnessed improvement in the problem-solving capacities of students who used AI systems with a regular frequency. In this way, AI-based feedback fostered a growth mindset where effort was kept under focus and mistakes were learned from. The majority of students reported a shift in attitudes toward learning: problems became ways to grow, not necessarily failure. The

pattern contrasted the hypothesis with which I started-the participants indeed had a more growth-mindset way of thinking after receiving AI-based feedback. Comparing resilience, where students' self-reported ability to bounce back more readily from setbacks in the academic domain was measured, the students who received AI-based feedback were significantly more resilient than those who did not. The AI systems continually encouraged the students, which indicates that there was stable development and that students remained committed to their objectives despite failures.

5. Discussion of Findings

The findings of this study are in line with recent literature that highlights the role of AI-driven feedback in fostering growth mindset, resilience, and the improvement of academic performance among the students. This study was based on thematic and narrative analysis, which identified themes regarding the impact of AI feedback on students' academic performance and psychological development. Results are discussed below in relation to the hypotheses of this study and aligned with recent literature.

5.1 Academic Performance

The first hypothesis was that AI-driven feedback would enhance the academic performance of students. The results of the study clearly supported the hypothesis, as students and teachers found that AI feedback led to the attainment of significant improvements in academic outcomes. Students claimed that the timely and personalized feedback through AI systems meant that they were able to correct those mistakes and gain deeper insights into challenging concepts, especially when it came to very abstract subjects such as mathematics and science. Teachers also reported that students who used AI-driven feedback systems compared had stronger solving capabilities and had altogether better performance in mathematics. These results actually follow from more recent research, like those of (Holmes et al., 2019), who found that AI provides real-time, tailored feedback to students, thus greatly improving their learning experiences. Specifically, the immediate feedback given by AI helped the students discover their mistakes and rectify it right away, which contributed to better learning results (Al Hussein, 2023). The ability of AI systems in analyzing student data at an individual level and giving specific actionable feedback perfectly speaks to the experiences of the participants in the study. In line with the findings and the previous studies, H1 was accepted- the effectiveness of AI-driven feedback in improving the academic performance of students. Though the AI system was effective enough for the improvement in the students' academic performance, some students said that AI feedback was sometimes not nuanced, which a human teacher could give directly. This finds support from (Zawacki-Richter et al., 2019) which summarized that as much as AI outshines in content-specific feedback, human teachers are still required for emotional and psychological purposes during learning.

5.2 Growth Mindset

The second hypothesis H2 claimed that AI feedback promotes growth mindset by focusing on effort and learning from mistakes. Findings from this research justified the hypothesis because students constantly reported that AI feedback helped them leave the focus on getting 'just right' answers and instead engage in the learning process. In a thematic analysis of students' responses, students encouraged viewing mistakes as routes to learning, which harmonizes with the principles of the growth mindset wherein making efforts and experiencing improvement counts more than the immediate success. More backing for this study comes from (George, 2023), which demonstrated that AI could foster a growth mindset by promoting effort-based learning. The AI feedback systems thus strengthened the message that abilities can change over time with persistence and through learned adaptation from error through giving insightful suggestions to improve and focusing on progress rather than outcome. This is in line with Dweck's theory of the growth mindset because students who believe that their abilities can be grown through effort are more prone to persist over obstacles. In this study, among the key points, the AI always emphasized effort, commending students for continued effortful attempts at solving problems although their initial answer given was wrong. This was an emphasis on the process rather than the outcome, which made them have a more positive attitude to learning, leading to the formation of a growth mindset. The teachers noticed that the students, who frequently used AI systems, developed a renewed approach to learning. The hypothesis that AI feedback promotes a growth mindset (H2) was supported, as with the majority of more recent works, among others by (Ghaleb & Alshiha, 2023), which validated the role of AI in changing the mindset of the learners.

5.3 Resilience Development

The third hypothesis (H3) was that AI feedback enhances resilience through challenges facilitated to foster persistence. This assumption was supported by the analysis of this study, where students reported that AI-driven

feedback helped them be more motivated and persistent in the face of challenges. The thematic analysis showed that AI feedback systems delivered consistent, constructive criticism that serviced to cement belief in a student's potential to improve, even when experiences were marked by setbacks. Study findings support (Byers, 2024) whose paper states that, AI-based systems help build a resilience among students by continuously providing positive feedback for continued try and effort. In this study, the students explain how AI-based systems motivated them to continue trying after being faced with initial failures; results indicated that failure is not the end but an integral part of their learning process. For instance, the AI systems seemed to contribute to building resilience because they constantly provided feedback that illustrated progress and encouraged the children to try again. Nevertheless, other students felt that although the AI's give-and-take helped boost resilience, its emotional constituent somehow did not resonate as vividly as it would have been in the case of human feedback. They desired more compassion and more emotional support, especially when things got tougher, which the AI systems could not provide. This falls in line with (Teng et al., 2023), who concluded that AI systems, although excellent tools for providing technical feedback, are deficient in the emotional and motivational support required for holistic resilience development. The hypothesis that AI feedback promotes resilience (H3) was accepted but findings indicate that human support added with AI might be more effective for use in emotional resilience building.

5.4 Teacher Perspectives

Besides the above results of students, in this specific study, the views of teachers were also brought to the foreground. Teachers appreciated the role of AI systems for routine feedback tasks so that the time of teachers could be freed up. They felt that AI systems have taken away repetitive tasks of feedback which were more time-consuming for teachers so that they can be available more to higher-order teaching work such as personalized instruction and emotional upliftment of students. This is also in line with the recent studies by (Ezzaim et al., 2022), showing that AI systems could significantly lessen the burdens of paper work on teachers, helping them concentrate more on jobs requiring human expertise and emotional intelligence. On their part, the focus by teachers concerning the use of AI is not to replace them but to be an adjunct feedback system.

They emphasized that although AI systems support learning, important aspects of emotional and motivational support were the responsibility of human-to-human interaction. In this regard, it shares a similar view with (Sain, 2024), which emphasized that, despite its ability to offer timely and personalized feedback, students' emotional lives as well as the social problems of classroom management are best supported by human teachers. The teachers also noted that it was the students who received the AI feedback with support from their teachers who benefited most from the program. There was a conjunction of academic guidance from the AI system with the emotional empathetic support offered by the teachers, thus reinforcing the point that AI systems and human teachers should be used together to help achieve the best results from their students.

The findings of this study revealed that AI feedback systems are critical for the development of students' academic performance, growth mindset, and resilience. All three hypotheses-H1, H2, and H3-were accepted due to the very strong data obtained based on evidence that AI feedback fosters positive academic and psychological outcomes among students. These findings appear in more recent studies with educational technology as well, which highlight not only the potential capacities of AI to positively influence student behaviors and beliefs but also how these should be interwoven with human interaction in addressing emotional needs or motivational support. Thus, as concluded from the findings, the hybrid approach of combining AI and human teachers is found to offer an enhanced learning environment that ensures students receive not only technical guidance but also emotional encouragement they need to succeed. This contribution has thus expanded the knowledge base in AI research and education, pointing to new avenues through which AI feedback systems may be used to enhance not only academic success but also psychological resilience and growth mindset towards lifelong learning.

6. Conclusion

Such a study evaluates the extent to which AI-driven feedback systems enhance the academic performances and these critical psychological qualities, such as growth mindset and resilience. The study findings indicated that AI feedback helped significantly improve the student outcomes in academics because the students who received real-time and individualized feedback performed better in problem-solving and attained greater grades. The AI-driven feedback provided immediate actionable hints, thus allowing students to correct mistakes early and to have a deep understanding of complex ideas. This finding addressed the study's first hypothesis (H1): that AI-driven feedback does indeed boost students' academic performance. Beyond the academic benefits, AI feedback opened doors for

the growth mindset by stripping the mediacy of getting the right answers and instead encouraging students to be engaged in learning. AI systems enforced the notion that effort and persistence are important for improvement, thus encouraging students to venture into problems and mistakes as learning opportunities. In other words, this is in line with the second hypothesis (H2), that AI feedback fosters a growth mindset in that it emphasizes effort and learns from mistakes. It has been confirmed that feedback from AI stimulates students to keep trying even after failure, which is one of the pivotal aspects of developing a growth mindset.

This paper underlined the significance of maintaining the capability of AI in balance with human interaction in learning settings. While AI-driven feedback has proved to be very effective in enhancing academic performance as well as fostering key psychological traits, this emotional and motivational support should however come from human educators. Therefore, while coming up with an artificial integration of AI into education, it should focus on collaboration between AI systems and teachers to bring about a more holistic supportive learning environment. Another way of perceiving the research results was wider relevance of AI-based feedback in education. Since the development of AI is in rapid progression, it spells more strongly that its impact is not only on academic performance but also on personality building.

6.1 Implications

- AI enabled feedback relieve from routine jobs like grading and general correcting feedback. Thus, the teachers can take their time for emotional support and personal guidance to the students. However, AI cannot deliver those services. Therefore, it is essential to really combine AI with teacher support where both learning outcomes as well as student well-being are improved.
- AI systems enable so much more personalization about the learning process than the rest; it favors self-improvement and resilience. The AI feedback given would be immediate, effort-focused, where students have chances of developing critical psychological traits such as growth mindset and resilience. Under these conditions, though, students would still seek human feedback in circumstances requiring emotional support or more profound guidance.

6.2 Recommendations

- Integration of human guidance and AI feedback is provided to combine these means of giving a holistic learning approach. Though the AI can do well while providing prompt, timely, or personalized feedback, there still needs to be teacher involvement for emotional support and motivational encouragement so that the student is psychologically supported both academically and in terms of their psychological makeup.
- Future research would focus more on the long-term effects of AI feedback on students, making it better for them in terms of student resilience and career success. How AI systems influence student outcomes over time gives insight into how to better optimize AI for educational settings.
- Researchers in AI should design the systems to be sensitive to differences in students' learning styles and emotional needs. Customizable feedback mechanisms allow AI systems to respond to students in ways that can balance their intellectual and emotional needs.

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