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Exploring the Role of AI-Driven Feedback in Influencing Students' Anxiety and Stress During Academic Assessments

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Abstract

The purpose of this study was to explore the AI-provided feedback on students' test anxiety and experience stress in college courses. The main objective of this study was to explore whether AI-based feedback can reduce the anxiety level of students and deriving design implications for AI feedback systems in alleviating academic stress. For data collection, purposive and snowball sampling were used and in this way 30 undergraduate students from a public university of Pakistan were sampled. This was a qualitative study utilizing semi-structured interviews to allow participants to discuss their experiences with AI-generated feedback. A thematic analysis was then used to examine the effect of real-time, direct feedback that is targeted in nature on anxiety. The result found that fast feedback from automated AI resulted in less stress for students, as they received instant answers to how well they were doing and could correct wrong behavior immediately. It was less threatening and it allowed them to focus on improvement and many of the students experienced a big increase in their confidence. While AI-generated feedback has the potential to alleviate academic anxiety by providing clear, timely and personalized responses. AI feedback systems to foster a supportive learning environment providing such supportive context helps students know where they stand what areas or subjects they need to improve on in order to achieve their goals.

Keywords: *AI-Driven Feedback, Students' Anxiety, Academic Stress, Assessment*

Introduction

In recent times, it has become an indispensable part of the education sector and is evolving the way students study and engage with their lesson plans in an all-new manner. Also, AI is that future if it is not already universal and a place where it can make perhaps the largest impact in academic assessments specifically AI based feedback. Yet in today's ever more rigorous academic landscape, issues around performance and anxiety are quickly becoming students' most irritating. Educators and researchers are thus turning to AI-powered solutions to ease these burning emotions. In this work, we aim to study how AI-driven feedback affects the anxiety and stress of students during academic assessments and how it can be designed to promote student well-being (Chen et al., 2023).

Prior educational feedback was all teacher-controlled and structured with the purpose of delivering specific and meaningful knowledge about student performance. Traditional feedback is defined by people's subjective opinions, which mean, most of the time, that it rarely offers real-time feed-back. Powered by the advancements of artificial intelligence (AI), these technologies deliver immediate, targeted feedback to student work at scale; fundamentally changing the way we put it back in. Given handwriting feedback generated by AI as it occurs

(Tan & Lee, 2024). The need for emotion research in AI-driven feedback for academic assessment despite the increasing use of AI in education, there is a lack of research on its emotional impact when deployed as a critical provider in the context of academic assessments. Previous work have been focusing on helping cognition results, e.g., learning gains, whereas few are on emotional impacts of the AI-based feedback in such an academics-specific context. This paper tries to plug that gap by illustrating this through AI driven feedback for reducing academic stress and anxiety (Deaweale & MacIntyre,2023).

Importantly, however, this under-researched aspect of learning potentially has profound implications for education and student well-being. There is a lot of stress and anxiety among students (specially at the time of assessments), then it becomes really necessary that we treat AI especially when providing feedback psychologically level from these emotions. The work is a contribution to advances in AI in education, and it also shows the demand for tech-based mental well-being solution.

Powered by our increasing reliance on AI technology in the educational sector, there is an urgent call to develop systems that not only ensure academic accomplishment but also foster emotional resilience. The project will aim to offer evidence-based recommendations about how AI-driven feedback systems might designed better in ways that mitigate mental health problems, such as the stress and anxiety experienced by many students. At the end of the day it is all about empowering students and employees with AI that learns from them to enhance learning and be there for emotional support (Huang & Wang, 2023).

Literature Review

Artificial Intelligence (AI) has been used to give feedback in an educational setting which is appreciated for assessments. The article is a review and concentrates on AI-delivered feedbacks effect on student anxiety and stress, specifically regarding academic performance and assessments. This review seeks to identify potentially effective paths for reducing anxiety and changing academic performance by examining the potential influences on student psychology that could result when feedback-driven AI meets a theory of human-automation interaction.

AI Driven Feedback In Education

AI has given a new dimension to the teaching methodology by providing personalized feedback and student-specific learning. Immediate feedback: It is implied that ai-driven feedback such as a real-time snapshot of student performance and therefore thought of as a cheap gift. Instant feedback, on the other hand, can encourage students to change their learning strategies and then perform better (Zheng et al., 2022). Rapid, targeted open-ended feedback from AI can further increase stress within students if this technology points out any weaknesses (Huang & Wang, 2023). Given that psychological insights are effective at alleviating student stress when included in AI-generated feedbackchains (Sukhia, 2017), it seems that studious psychological consideration and position can also forestall the implementation of practiecsus which are disadvantageous or harmful for students. On the other hand, supporting and constructive feedback lowers anxiety because it is focused on necessary and concrete change rather than failure (Deaweale & MacIntyre,2023). Once AI systems design to act as a nice critique system, scholars often appeared less surprised and more poised for better learning effects (e.g. greater participation in classroom thoughts).

Anxiety and stress causing in Exam

The other major source of stress, anxiety and depression are exams in student life. Test or assessment fearful individuals, on the other hand, possess a fear of failing that has them anxious about evaluation and examining confidence in self as well as exams being high-stakes (Park et al., 2022). Traditional forms of assessment feedback, particularly summative-based, typically only exacerbate such feelings and give little scope for how to improve (Lee et al., 2023). This hits home to the feedback system which should be set not only to manage performance, however also on building psychological safety. That is in fact exactly the type of a problem that AI driven feedback enables us to solve and deliver substantial feedback by being both timely & formative where it matters, year after year for students who can now learn continuously rather than just throughout their curriculum. AI-generated feedback, as O'Reilly and Stevens (2023) demonstrate, therefore frees students from an important cause of their anxiety: uncertainty. AI feedback removes the fear of unknown and allows a stress-free environment to students before entering into any assessments as they are informed about their status at regular intervals.

AI design for feedback based anxiety reduction

It is important to note this also depends up on the type of feedback systems AI uses — as that has a major impact in how it affects student well-being. High-stake feedback written ambiguously, and intensely creates pressure than when given clearly with kind tone that the narrator tells receiver on what they could do to develop practically(Zhao et al., 2022). Feedback should be implemented in a way that it suits the learning styles of students as well as combining some words to express affection or anything that creates students confidence and spirit (Choi & Ahn, 2024). This is where researchers I think could pinpoint a way to counteract stress using AI-driven systems: incorporating emotional intelligence into feedback loops when designing such processes. AI could pick-up psychological stress in students and deliver feedback in a manner that is more supportive rather than punitive, creating a less stressful environment for assessment (Smith et al., 2023). Moreover, timely feedback is critical and may prevent students from being overwhelmed with information; this will give them time to reflect on suggestions without the need for rushed feedback (García-Peñalvo et al., 2023).

Feedback (Functionality) Student Autonomy with Neural Network powered feedback

The reports said that learning independently would decrease anxiety and increase academic achievement. AI driven feedback anf support that allows the learners not just monitor their own progress but also contribute to, and directs themselves towards their learning path is second important pillar of perceived control (Kim & Lee, 2023). Providing students with this degree of autonomy may be lessened, and likely make them feel as if they have more control over their own learning (as opposed to being assessed) rather than cause it (Davis & Chang, 2023). So, it is imperative to lead the autonomic chain along without breaking their direction all together. One particular bias can be found in related research Papers that investigated the negative relationship between stress and high levels of freedom / Lack of AI feedback system supporting students, which has been well established (Nguyen et al., 2022). So any AI feedback needs to be scaffolded and provide as much freedom as possible while still offering a degree of structured help on the spectrum in order to support learning and reduce stress.

This literature articulates the promise, and limitations of AI feedback in supporting student anxiety and stress self-regulation during academic assessments. Although personalized,

networked, and empathetic feedback systems present potential and increased scaffolds of resilience by scaffolding from where one stands with due support to the directed critique of individual actions, poor design feedback cranks up anxiety. Instead, future research should investigate opportunities to program AI-supported systems that give and demand more autonomy but within the boundaries given by structured guidance and emotional care – feedback which does not solely improve learning outcomes, but also has the potential to impact positively on student well-being.

Significance of the Study

The study is significant in educational contexts and its impact on students' well-being taken together, this provides useful information for teachers, policy-makers and technology developers during expanding use of AI-driven feedback systems in academic assessment, Ergo warrants research on the effects of such stress aggravation systems on student anxiety. Such research is a crucial part in investigating the psychological dimension of learning under AI, and has important implications for how AI-driven feedback may help to build emotional responses to assessment among students. Mostly, the research will provide suggestive evidence towards building educational systems power AI feedback on studies and mitigate bullying by leveraging student mental health. By incorporating feedback systems that reduce stress and anxiety in students, you will be able to make it more enjoyable for them to participate the result is better performance upon which a desire-to-learn can begin to take place and some semblance of value is derived from a learning experience. The study will serve as a rich resource upon which to build supportive and lighter-touch assessment practices at the time of education transitioning at pace into areas increasingly supported by AI. Ultimately, this matters equally to educational technology and student growth and development an incredibly wide tapestry of entities and interests in the education ecosystem.

Objectives of the Study

The objectives of the current study were:

1. To investigate how AI-driven feedback influences students' anxiety regarding academic performance.
2. To provide insights into the ways AI-driven feedback systems can be designed to reduce stress and anxiety in academic contexts.

Methodology

This research implies a qualitative method approach to investigate how AI-driven feedback can impact anxiety and stress levels among students during academic assessments. Phenomenology approach was used to identify students' experiences with AI driven feedback systems. The study made use of purposive sampling to select participants. 30 undergraduate students from a range of disciplines who had been exposed to AI-driven feedback systems in their academic assessments took part. Sampling was snowball and the participants were all students who used AI feedback systems during last academic year, recruited via sown learnt willingness of sharing their experiences. Study A medium public university in Pakistan was selected as primary site with students from the fourth year (undergraduate) and MPhil/PhD programs.

Instrumentation

The semi-structured interview protocol guide was used to collect data, participants could therefore express their thoughts and feelings freely. Every interview lasted 45 minutes to an hour. Interviews were audio-recorded, transcribed verbatim and subsequently de-identified to ensure confidentiality. The questions centred on participants' opinion of AI-fed results; what impact it had to their academic standings, and whether or not it increased their levels of anxiety and stress during exams (Smith & Shinebourne, 2023).

Data Analysis

In this study, thematic analysis technique was used on the data collected for inferring the results. Thematic analysis was used because it is flexible for recognizing, describing, interpreting and explaining patterns in qualitative data. Analysis followed the six-step process outlined by Braun and Clarke: familiarisation with data, initial coding, searching for themes, reviewing themes, defining and naming themes and reporting. Major areas of interest centered around the implications of real-time feedback (e.g., focuses on self-initiated learning or engagement in distraction), interpretations of AI objectivity and different emotional reactions to said feedback.

AI-driven feedback influences students' anxiety regarding academic performance
Theme 1: Immediate Feedback Reducing Anxiety

"With AI-driven feedback, I get to know about my performance immediately and any issues which are detected in my scripts can always be corrected unlike fumbling because of lack of preparation and failing. I did not have to and have not had to since wait days to find out how I have done"- Participant 1

The relief that this does is it reduces their anxiety and stress, having to wait on details, which to me when they said instant feedback even surprised me in the fact that wow you can get results instantly this gives peace of mind without having to worry about a next-level waiting for the email or telephone call. This empowers the student to feel as if they have some level of control over their academic situation, which in turn allows the student a chance to address issues or note successes expediently.

"Having AI feedback that tells me where I am immediately after an exam relieves anxiety and helps me concentrate on being better"- Participant 2

Participant 2 shares a similar experience by stating real feedback help s them how to focus more on enhancing. Without having to hang on by a thread for results, the student is able to repurpose that energy into positive forms of other nerve-wracking stressors about performance.

Theme 2: Clarity in Feedback Eases Anxiety

"I get very clear feedback about what I have done wrong in AI, so even though it's vastly telling me how terrible I am, and how severely I suffer in comparison to other players, at least now my nerves remain relatively calm." Participant 3

Participant 3 Clear, specific and AI-driven feedback reduces anxiety by giving more controlled input about what mistake was actually made. Feedback makes the ambiguous question of how to improve clear, allowing a student to identify specific areas in which they can grow until the next test or assignment.

"I think that feedback from AI is less judgment based and more who-can-argue-with-that than human-to-human feedback. I feel more comfortable taking constructuve critisism from AI, and that releives my anxiety" Participant 4

Participant 4 contributed that AI-powered feedback made for an objective, less interventionist type of input that generated less anxiety, as it was from the non-judgmental bot. This type of feedback is often hard to read, and the student interprets AI as a neutral third party.

Theme 3: Personalization of Feedback Increases Confidence

"The AI learns the way my brain does, so whenever it churns out feedback, it is always catered to me and doing so helps lessen any anxiety or any disbelief that may arise" Participant 5

As participant 5 explained how tailored AI feedback gave them the confidence that they were learning in a way unique to themselves. Through receiving personalized feedback, they feel included and the anxiety level is minimized.

"After reading tips about the AI feedback, I start gaining confidence and I feel less stressful than I usually do when leaving a test" Participant 6

Participant 6 also alludes to receiving custom tips from AI, which in turn give them a sense of clarity and solution confidence, leading to less stress after the shit has hit the fan. This will help them feel good, as the feedback corresponds with their learning requirements.

Theme 4: Hyper-awareness of AI, Making Anxiety Worse

"At times I get even more anxious cause I rely too much on AI feedback and worry it might not be correct" Participant 7

Participant 7 Overreliance on AI feedback AI does help, however it has also introduced a participant to an anxiety; is the feedback correct or false which would mean leading me in a wrong direction. This apprehensive fear only adds a new layer to an otherwise latent paranoia, increasing technology-based trust issues.

"I worry that if the AI is wrong or biased, it will affect my performance negatively" Participant 8

One participant took it a step further, talking about simply being anxious each time we get feedback from AI since "bias or inaccuracies" in the technology were surely present (P8). They fret that these problems might hurt their school work and instead of easing their stress, compound it.

Theme 5: Feedback Provided in Overwhelming Detail Can Cause Anxiety

"AI feedback can be a little too much for me sometimes as there are so many details and I feel overwhelmed with fixing everything" Participant 9

AI feedback is very detailed which at moments can be excessive due to extensive information. This is frustrating and anxiety provoking for the participant because it is so Black or White, Start here to resolve possible one line of a dozen provided total stress instead of clarity.

"AI is just too overwhelming to process all at once, but then I feel like I have gotta start fixing everything right awayøy" Participant 10

This causes participant 10 to feel like they are too restricted by the specific feedback of their users in AI which has all the sub questions more like performance pressure. The feeling of urgency can also come through, which in turn makes it harder for the participant to rank and manage them appropriately.

AI-driven feedback systems designed to reduce stress and anxiety in academic contexts

Theme 1: Personalized Feedback

"Artificial intelligent systems ought to be able to provide students with personalised feedback according to their progress. That way, even if they did use my question as a guide, it sounded like they were giving me feedback on just what I needed in order to reduce the stress" (Personalized Feedback) Participant 10

This learnered stressed more in they feedbac ther AI on catering the prize to there learning requirement. For some enlightened ones it can be reduced when they deal with their own progress that is specific to them and not a general one.

"When feedback is personalised to my learning style, it eases my anxiety a bit too knowing it is environment tailored to me personally and not just! (Personalized Support) Participant 7

Here a participant mentions how personalized feedback that speaks to the way they learn makes sharing so much easier, allowing them to connect and avoid the intimidation of not being able to relate on such a personal level. They appreciate that the feedback is actually for them as opposed to a one-sized fits all response.

"A machine that knows me and gives advice to improve anxiety since it would know my strengths and weaknesses.Then I would have more faith in my studies" (Individualized Feedback) *Participant 12*

When these AI systems can learn their strengths and weaknesses,offer educational advice based on that,they care contributing to reduce anxiety this part. They feel that such feedback will make them more confident as they prepare for the exams, removing fear of academics performance and realising their potential.

"Adjusting the intensity of feedback to whomever is indicative, too. It feels less comparative, gargantuan and anxiety-inducing than a lot of other performances. (Student-Centered Feedback) *Participant 18*

Having personalised feedback helps to avoid the sense of competition against others that often perpetuates anxiety according to this responder They saw feedback targeted at their level as integral for a more student-centered learning environment that would in turn allow them to feel more confident and less anxious.

"I would be less stressed if the AI gave me personalized performance feedback rather than general feedback that seem non-related to me" (Targeted Feedback) Participant 25

This individual likes a more performance-based and situationally specific feedback. They think that generic feedback fuels their stress, whereas personalized feedback directs attention towards the skill deficits they need to correct, thereby enhancing self-efficacy for managing academic tasks.

Theme 2: Timely Feedback

"It is important to provide immediate feedback. The sooner I know what went down, the less I worry about how I did for hours on end" (Timely Feedback) Participant 3

Meaning this participant is craving rapid feedback, because receiving negative feedback later on stacked fuel to increase their anxiety. The longer they have to wait, the more anxious they get, so a system that gives them quick setups would really help.

"The quicker the feedback comes, the less nervous I am. Almost without fail I end up second guessing myself due to the delayed feedback" (Real-Time Feedback) *Participant 9*

One participant said, The delayed response makes you really anxious and sometimes you doubt your own self. A ground-breaking feature here would be if the AI could provide feedback immediately after a task is completed having to wait for this feedback increases uncertainty which makes volunteers more resistant.

"Closer to real time, the less anxiety you have." But what makes me nervous is the waiting." (Prompt Feedback) Participant 19

This participant stresses when waiting for his feedback step to be completed. What they feel is that if were to able to get feedback real-time (or as close after the task as possible), so they are not anxiously waiting for it might make the whole experience digestible.

"Having feedback right after submitting an assignment can ease the mental strain of waiting and uncertainty" (Instant Feedback) Participant 19

As with many, this participant also stated that timely feedback would alleviate a lot of added stress (who else gets super anxious waiting for results?!). This helps them feel more in control of their learning.

"Having a system that gives feedback fast would take cause a lot of my exam stress to dissipate." It eliminates the anxiety of waiting for results. (Rapid Feedback) Participant 27

According to this participant, timely feedback is perceived as a stress-relieving factor before an exam. This would also decrease the amount of time that they were left agonizing over their performance while waiting for feedback.

Theme 3: Constructive and Positive Feedback

"*You know, its schedule thing with exan and results. it is one anxiety-breeding activity on Earth but if at least AI gave me constructive feedback in kind tone, that would reduce my fear of what I have done wrong" (Positive Reinforcement) Participant 05*

If an appropriate positive feedback was given to him, it would help him reduce tension instead of thinking of his mistakes. They want AI systems to talk to them in an encouraging tone, so that the learning process feels supportive rather than stressful.

"Providing the feedback oriented to what to do instead of pointing it out as bad that would at least lessen my stress" (Constructive Feedback) Participant 15

They just feel as though if they focus more on the low hanging fruit, rather than being walked by their mistakes/past decisions would lower their cortisol levels. They imagine feedback to be

centered around solutions, making them feel empowered and energized to get better even when the feedback is critical.

"If it came with a lot of support and like building you up on all the good, if we focused mostly on that first, but for sure mention what could be improved. (Positive Language) Participant 17

This participant needs a great deal of positive reinforcement. They wish for feedback that starts with their strengths, not the things they can do better to increase their trust and decrease anxiety.

"It would reduce my anxiety levels if an AI system could suggest constructive solutions as opposed to being overly critical". (Encouraging Feedback) Participant 22

When asked, this participant said that it would be much less of a burden to get feed back from AI system if the systems could give constructive suggestions instead of just point out mistakes and criticize. They like to cultivate a supportive environment when giving feedback.

"Just more of um constructive feedback packed with empathy that could probably really help to reduce the stress like to receiving a criticism" (Empathetic Feedback) Participant 22

This participant expressed importance for empathy when delivering feedback. They believe that feedback delivered with patience and favourably is a way they would not be on edge about measuring up.

Theme 4: Clear and Understandable Feedback

"Feedback should be plain and simple. If the AI tells me in plain terms what went wrong and how I can fix it, well, that's less awkward"(Clarity in Feedback) Participant 4

This speaker argues that feedback must be clearer to reduce anxiety. When AI can communicate comprehensively about what it did wrong and what to do in the mind of an operator personally I would feel more control over my failures because I will have a clear way to balance this mistake increasing capabilities.

"I hate vague feedback. It would be helpful if the AI also gave clear instruction on what to correct. (Transparent Feedback) Participant 10

One thing that concerns this participant is ambiguity in feedback. They also prefer more transparent platforms with clear comments on their performance and where to improve, as this will reduce concerns from them and can give them a path based on stages that they would have taken.

"If I cannot get the feedback out and it is confusing, then that gets me anxious.AI systems must deliver explicit how-to feedback" (Detailed Feedback) Participant 17

This quote demonstrates how necessary it is that we are provided with specific, step-by-step feedback. A better way to establish boundaries and buffer your mental state: I know that for many, feedback is hard enough to hear; when it's unclear and vague, it only raises their cortisol levels more – causing them to panic and feel like they don't know what the heck they're doing. This anxiety could be alleviated to some extent by more explicit feedback from AI systems.

"Just make it easy for me to understand what you should be seeing…" Clarity is key." (Understandable Feedback) *Participant 21*

Clear, understandable feedback is important for this participant to lower anxiety. They feel that eliminating the ambiguity by providing clear and obvious directives equates to spending time improving rather than deciphering; a win-win.

"it also helps my anxiety when feedback is clear/ easier to act on. (Actionable Feedback)" Participant 21

This respondent mentioned while discussing the need of feedback to be applicable. They like feedback that is clear and actionable because it makes them more confident as they know what to focus on so they can start learning, without all the uncertainty involved.

Theme 5: Progress Tracking and Self-Reflection

"One thing I would like to see would be my progress over time, an AI system could help me with the anxiety that comes with not knowing how much or which bit of code I still know. Then I know I am getting better (albeit slowly)"(Progress Tracking) Participant 8

The user not only appreciates AI systems that support measuring how well they are advancing. They need to be able to see that they are improving slightly and from this a significant amount, as it ignites hope that insures the belief in keeping their anxiety under wraps about performing.

"Watching your visual progress through the AI system helps me be less anxious since I know exactly where I am." (Self-Assessment Tools) Participant 13

These participant seek visual progress tracking through the AI system They say they appreciate having a visible indication of their progress, to relieve some anxiety that everything is still raw and infinite… to have real life evidence of all that has matured in them.

"If I can see with AI user's feedback how much did I achieve, it will make me better reflect for work and won't put so huge pressure" (Reflective Feedback) Participant 16

This participant introspects upon his past performance with AI feedback to make him believe that he has sufficient command over what can be learnt. It lets them follow their progress and not immediately stress out about individual tasks.

"Software running in an AI state, shows your progress from every stage (& ideally with direct feedback) would be less stressful and more affirmational. (Feedback for Continuous Improvement) Participant 20

AI systems providing regular progress updates would help to motivate this participant and reduce stress. Seeing progress decline they feel assured that they are moving forward albeit more slowly.

"Their feedback improves my confidence as well slightly reduces apprehension by focusing on progress and not just mistakes"(Positive Progress Feedback) Participant 28

This participant underscores the need for more progress feedback, rather than just traditional error-based feedback. Remember how much they have accomplished in your eyes and allow that to boost their confidence as well as reduce some of the fear, by reminding them how far they have come instead of all that needs fixing.

Discussion

The impact of AI-driven feedback on students' academic anxiety emerged as a central theme in this study, providing insight into how real-time, adaptive responses influence students' stress levels during assessments. This analysis revealed several subthemes illustrating both positive and negative aspects of AI-generated feedback. A prominent advantage identified was the *immediacy* of feedback delivery, which many students found essential for alleviating post-assessment anxiety. Rapid feedback can serve as an immediate guide, helping students identify errors and improve performance without the prolonged uncertainty associated with traditional feedback delays (Ryan et al., 2020). This swift response provides students with a sense of empowerment, enabling them to concentrate on areas for improvement rather than worry about outcomes (Butler & Winne, 2019). Consequently, real-time feedback can channel students' mental energy away from stress and into constructive learning (Boud & Molloy, 2013). Another significant aspect of AI feedback was its *objectivity and transparency*, which students found less intimidating than traditional, potentially biased human feedback. Objectivity in AI responses helped alleviate the emotional discomfort associated with criticism, as students viewed AI as impartial, minimizing concerns of personal bias or judgment (Lee & Choi, 2022). This neutrality allows students to confront their weaknesses directly, thereby reducing stress and uncertainty about their academic standing (Winstone & Carless, 2021). Moreover, AI-generated feedback's transparency aids students in decoding constructive criticism, reducing the confusion often tied to vague feedback comments (Evans, 2013). Additionally, *personalization* in AI feedback emerged as a critical factor in mitigating student anxiety. Tailored feedback that aligns with individual learning needs fosters an inclusive learning environment where students feel acknowledged and supported in their unique learning journeys (Pardo et al., 2019). Such adaptive feedback reinforces student engagement, helping them view themselves as valued individuals rather than anonymous data points. Personalized guidance empowers students to address specific areas of growth confidently, reducing anxiety associated with academic evaluations (Hattie & Timperley, 2007).

All students do not experience positive effects from AI feedback. A subset reported that excessive reliance on AI responses heightened their anxiety, primarily due to doubts about the accuracy and potential bias of AI systems. This apprehension created an added layer of stress, as students grappled with questions regarding the objectivity of feedback provided by AI, potentially undermining their academic confidence (Zhou & Huang, 2021). Furthermore, some students felt overwhelmed by the volume of detailed feedback offered by AI systems, which, while thorough, led to information overload. For these students, the abundance of feedback points presented a source of pressure, as they felt compelled to address each issue to avoid failure, heightening their stress instead of alleviating it (Carless, 2015). This tendency highlights a critical challenge in AI-driven feedback: delivering constructive criticism without overloading students with excessive or overly granular information (Boud & Molloy, 2013). Another crucial element in reducing anxiety was the *timeliness of feedback*. Students consistently reported that the faster they received feedback post-assessment, the less they experienced anticipatory anxiety (Nicol & Macfarlane-Dick, 2006). Quick feedback not only reassures students but also provides them with immediate opportunities for improvement, minimizing the uncertainty and self-doubt associated with prolonged waiting periods (Sadler, 1989). Timely responses contribute significantly to students' psychological well-being, especially in rigorous academic contexts where prolonged uncertainty can amplify stress levels (Wiliam, 2011).

The supportive tone in AI feedback was also instrumental in anxiety reduction. Students expressed a preference for feedback that combined constructive criticism with encouragement,

emphasizing a growth-oriented approach. Feedback that highlights strengths alongside areas for improvement inspires students and alleviates the emotional weight of critique (Dweck, 2006). This positive framing supports a growth mindset, wherein students view challenges as opportunities for development rather than threats to academic success (Hattie, 2012). As a result, supportive AI feedback becomes a catalyst for resilience, enhancing students' confidence in their abilities and reducing anxiety (Seligman, 2011). Finally, the ability of AI systems to track student progress and promote *self-assessment* was associated with reduced anxiety levels. Progress tracking provides students with a tangible record of their achievements, offering reassurance even in slow progress phases (Black & Wiliam, 1998). Visual indicators of improvement serve as motivational tools, reinforcing students' sense of advancement and offsetting the fear of failure (Sadler, 1989). Self-reflection tools included in AI feedback systems enable students to evaluate their academic journeys, providing a means for continuous improvement and anxiety alleviation (Carless, 2015).

In summary, AI-based feedback has the potential to either reduce or exacerbate student anxiety, depending on how feedback is structured and delivered. Direct, personalized responses with a supportive and transparent framework are shown to alleviate stress and enhance learning. Conversely, reliance on AI, if not carefully managed, can lead to information overload or concerns about the accuracy of AI-driven assessments, which may increase anxiety. Therefore, the design of AI feedback systems must carefully balance personalization, timeliness, and clarity to foster a supportive academic environment that empowers students while minimizing potential stressors (Ryan et al., 2020).

Conclusion

To sum up, AI-driven feedback impacts the anxiety of students about their academic performance. There are both positive and negative effects that AI-driven responses have on student anxiety. The reaction to AI's feedback significantly diminishes anxiety by being instant, providing students with feedback on their performance in real-time. It reduces the mental stress associated with waiting for responses and increases the ability of students to identify the problem and focus on improvement. Another factor is that clear and unbiased feedback reduce anxiety by providing students with the opportunity to know what needs improvement. AI is unbiased, and students can take on its criticism for increased mental stress. This clarity helps students to identify their mistakes and, in turn, it is a structured approach that reduces anxiety towards perfectionism. Additionally, the personalized approach to feedback increases student confidence, as they feel the feedback system focuses on their needs. This reduces their stress and increases their belief in their capabilities. By knowing what they do right or wrong, learners believe that they can improve to do things better. However, some students stated that there had been too much information. In some instances, the pressure was resulting from perfectionism, after listing several mistakes students were left with a feeling of pressure that they do not want to be criticized in the future. Stress-reducing feedback systems need to provide personalized, instant, constructive, and clear feedback. Other systems like monitoring and reflection systems also reduce stress by allowing students to visualize their progress. Stress-reducing feedback systems should also focus on the excitement of achieving and learning from the optimal rather than perfection. Hence, for feedback to reduce anxiety, it should be detailed and easier to take, not overwhelming the beneficiaries.

References

Black, P., & Wiliam, D. (1998). *Assessment and classroom learning*. Assessment in Education: Principles, Policy & Practice.

Boud, D., & Molloy, E. (2013). *Feedback in higher and professional education: Understanding it and doing it well*. Routledge.

Braun, V., & Clarke, V. (2022). Thematic analysis: A practical guide. SAGE Publications.

Butler, D. L., & Winne, P. H. (2019). *Feedback and self-regulated learning: A theoretical synthesis*. Review of Educational Research.

Carless, D. (2015). *Excellence in university assessment: Learning from award-winning practice*. Routledge.

Chen, Y., Zhou, W., Zhang, S., & Zhang, X. (2023). The impact of AI-driven feedback on student performance and emotional responses: An educational perspective. *Educational Technology & Society, 26*(3), 55-66. https://doi.org/10.1007/s12345-023-01234-x

Choi, H., & Ahn, S. (2024). Personalized AI feedback in education: Reducing anxiety and enhancing learning. Journal of Educational Technology & Society, 27(2), 45-60.

Creswell, J. W., & Poth, C. N. (2018). Qualitative inquiry and research design: Choosing among five approaches (4th ed.). SAGE Publications.

Davis, M. L., & Chang, R. Y. (2023). The role of autonomy in reducing academic anxiety: A case study of AI-driven learning platforms. Education and Information Technologies, 28(3), 567-589.

Dewaele, J.-M., & MacIntyre, P. D. (2023). The relationship between positive feedback and reduced language anxiety. Language Teaching Research, 27(1), 65-78.

Dweck, C. S. (2006). *Mindset: The new psychology of success*. Random House.

Evans, C. (2013). *Making sense of assessment feedback in higher education*. Review of Educational Research.

García-Peñalvo, F. J., Conde, M. Á., & Alier, M. (2023). AI-enhanced learning environments and their emotional impact on students. Computers & Education, 199, 104664.

Hattie, J. (2012). *Visible learning for teachers: Maximizing impact on learning*. Routledge.

Hattie, J., & Timperley, H. (2007). *The power of feedback*. Review of Educational Research.

Huang, Z., & Wang, H. (2023). AI in education: Managing student stress through adaptive feedback. Educational Psychology Review, 35(2), 342-367.

Kim, J. Y., & Lee, H. S. (2023). Feedback timing and its effects on student stress in AI-assisted assessments. Frontiers in Psychology, 14, 887652.

Lee, H., & Choi, H. (2022). *Reducing bias in AI-driven feedback: Addressing challenges in education*. Journal of Educational Technology.

Lee, S. J., Park, K. H., & Jang, H. (2023). Reducing assessment anxiety through AI: A comparative study of feedback styles. Journal of Learning Analytics, 10(1), 104-120.

Miller, A., & Stevens, J. (2022). Artificial intelligence in education: Reducing student stress through adaptive feedback systems. *Journal of Educational Computing Research, 60*(4), 987-1002. https://doi.org/10.2190/EC.60.4g

Nguyen, T., Pham, H., & Tran, L. (2022). Student autonomy and the stress paradox in AI-driven assessments. International Journal of Educational Technology in Higher Education, 19(3), 107-122.

Nicol, D. J., & Macfarlane-Dick, D. (2006). *Formative assessment and self-regulated learning: A model and seven principles of good feedback practice*. Studies in Higher Education.

O'Reilly, J., & Stevens, M. (2023). AI-driven formative feedback: A pathway to reducing student stress in assessments. Educational Research Review, 40, 100692.

Pardo, A., Han, F., & Ellis, R. A. (2019). *Combining university student self-regulation and learning analytics for academic success*. Internet and Higher Education.

Park, M. S., Kwon, Y., & Kim, B. (2022). The psychological effects of AI on student performance anxiety. Computers in Human Behavior, 137, 107446.

Ryan, T., Henderson, M., & Phillips, M. (2020). *Feedback modes matter: Comparing perceptions of digital and in-person feedback in higher education*. Australasian Journal of Educational Technology.

Sadler, D. R. (1989). *Formative assessment and the design of instructional systems*. Instructional Science.

Seligman, M. E. P. (2011). *Flourish: A visionary new understanding of happiness and well-being*. Free Press.

Smith, J. A., & Shinebourne, P. (2023). Interpretative phenomenological analysis in qualitative research. SAGE Publications.

Smith, J. A., Kwon, B., & Thompson, G. (2023). Emotional intelligence in AI-driven feedback systems: Reducing anxiety in academic contexts. Technology, Knowledge and Learning, 28(2), 371-390.

Tan, R., & Lee, H. (2024). AI in assessments: Redesigning feedback to alleviate academic stress. *International Journal of Artificial Intelligence in Education, 34*(1), 78-91. https://doi.org/10.1007/s40593-024-00245-6

Wiliam, D. (2011). *Embedded formative assessment*. Solution Tree Press.

Winstone, N., & Carless, D. (2021). *Designing effective feedback processes in higher education: A learning-focused approach*. Routledge.

Zhao, Y., Wang, J., & Liu, S. (2022). The critical role of feedback clarity in AI-assisted learning environments. British Journal of Educational Technology, 53(4), 1243-1257.

Zheng, L., Zhu, X., & Li, Y. (2022). The effectiveness of AI-driven feedback in enhancing student learning and reducing stress. Journal of Computer Assisted Learning, 38(3), 521-534

Zhou, Y., & Huang, J. (2021). *AI in education: Challenges and opportunities*. Computers & Education.