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MumtahnGPT: A Preparatory Tool for Reducing Anxiety and Enhancing Students' Academic Performance with Retrieval-Augmented Generation and AI Feedback

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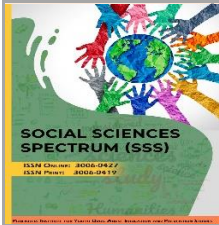
Abstract

In this study, MumtahnGPT is presented, a Generative AI powered tool, empowering students and researchers with intelligent, personalized external examination practice. The preparatory tool is developed using the Retrieval Augmented Generation (RAG) workflow. The tool is designed with the aim to boost confidence and reduce presentation anxiety. Similarly, it improves academic performance while delivering thesis defenses, synopsis and proposal defenses. To cope this AI integration helps MumtahnGPT to retrieve relevant information from student's uploaded documents. It augments with external knowledge in order to generate personalized questions to assist in preparation. The tool also offers feedback on user responses so as to help students to refine their answers. The tool is built with Python utilizing Gradio as User Interface (UI) and a gemini-2.5-flash LLM powered by Google API. The functionality of tools includes uploading documents, chunks creation, questions generation, lifeline features feedback and final performance report generation. The results validate the effectiveness of the tool in reducing anxiety and uplifting the student's confidence. Further, it also assists external examiners and high ups in asking insightful questions during the defenses and presentations. The study concludes with future enhancements and broader applications in educational scenarios.

Keywords: Artificial Intelligence, Retrieval-Augmented Generation, Academic Anxiety, Oral Assessment, Academic Confidence, Teacher Education, STEM Education, Formative Assessment, AI Feedback.



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1. Introduction

The last few years have seen great improvements in Educational Technology and Learning Analytics which have changed how academic tasks are done. Thus, several different AI applications have been helpful in students' academic performance (Lakshmi et al., 2024). These tools emerge as a valuable resource for personalized learning, content generation, adaptive learning paths, and offering real-time feedback. One such technique is the RAG workflow or pipeline that amalgamates generative capabilities and information retrieval to provide enhanced learning experiences (Han et al., 2024). **Figure 01** depicts the RAG workflow in detail for novice readers and learners.

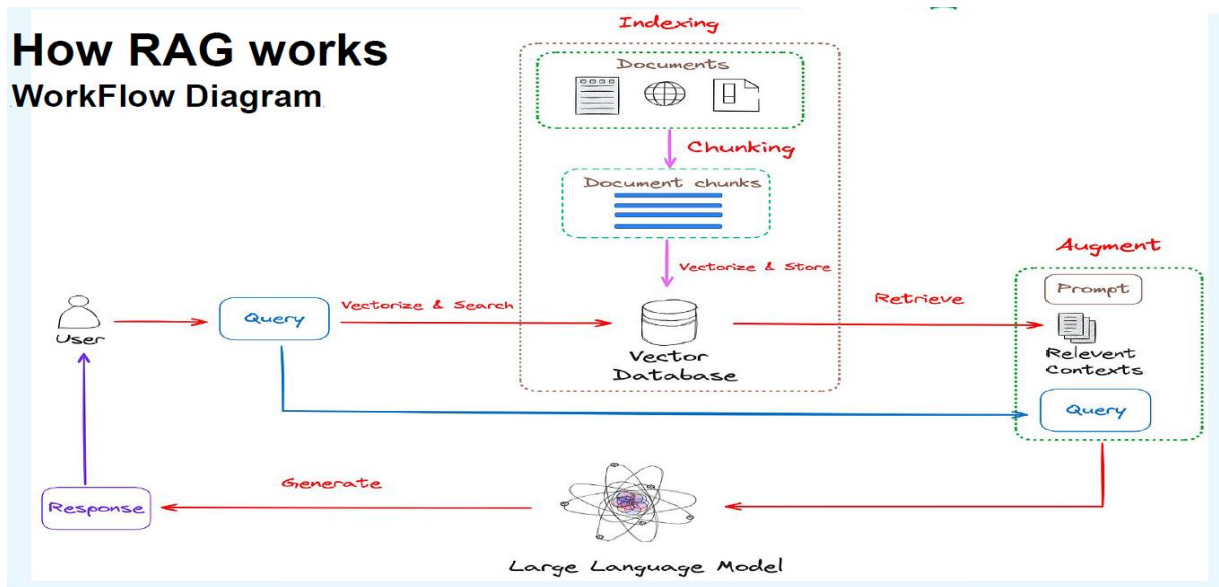


Figure 01: Fully working pipeline of RAG model that combines retrieval with generation in straight forward manners, incorporating question answering using enterprise knowledge bases, indexing, chunking, incorporating vector databases, and augmentation to retrieve contextual response of student query

The workflow shown in **Figure 01** is a digital foundation for AI-based Learning Analytics. Since learning analytics has become a prominent field, principally focusing that how much external data can be leveraged and concatenated to enhance learning outcomes. However, despite the proliferation of AI tools in education, very few are available for anxiety reduction and personalized question generation to enhance academic preparations (Hawes & Arya, 2023). Further, many AI tools depict hallucination while experiencing during the incorporation of Large Language Model (LLM). Hence, this prolific intuition motivates us to work on such a challenging idea.

1.1 Motivation

Students and researchers often feel anxiety, low confidence, and fear when preparing for thesis defenses, proposal defenses, critical academic events, and important academic presentations. Therefore, such widespread issues often led to suboptimal performance in front of peers, examiners, and high-ups. It is all because of unpredictable examiner questions, limited realistic

practice, traditional prep limitations, and weak area identification. Consequently, most of the students feel increased stress, which definitely affects their academic outcomes. Similarly, the examiner who is responsible for assessing the student's work need reliable tool that helps to generate insightful and relevant questions to evaluate the student's performance effectively.

To address these challenges, A Generative AI powered tool, MumtahnGPT, is introduced that empowers students to face academic challenges with preparation, confidence, and peace of mind. MumtahnGPT creates an intelligent, safe, and realistic defense environment where students can reduce anxiety and practice confidence through examiner-style questioning and guided AI feedback. In this regard, this tool has the following main features:

- Authentic exam preparation, Anxiety test-taker's response simulation, and question tackling.
- Personalized learning pathways, Adaptive systems tailoring to targeted practice, and personalized practice sessions.
- Constructive, performance insights Intelligent Systems giving Feedback to improve response, and presentation quality.
- Improved calm and confidence. The tool has practice in a judgment-free zone to build confidence and lower anxiety.

With the above features in mind, this study's main contribution is:

1.2 Contributions

This study makes the following contributions:

- Design and implementation of MumtahnGPT using the RAG workflow for thesis vivas, synopsis, and proposal defenses.
- Gradio is integrated as UI and gemini-2.5-flash LLM powered by the Google API for AI capabilities and natural language processing.
- The tool's impact on student performance is evaluated, including anxiety reduction, overall effectiveness, and feedback mechanisms in enhancing presentation outcomes.
- Describing the future potential for scaling the tool and expanding its capabilities in diverse educational scenarios.

The rest of the paper is organized into a few sections. Section 2 highlights the related work, followed by the proposed methodology in Section 3. Results and discussions are given in Section 4 while to end this study Section 5 reflects conclusions, limitations, and future work.

2. Related Work

In the preceding section, the relevant literature is presented. As far as the study is concerned in Educational Technology and Learning Analytics, it is categorized into Educational Tools in AI, presentation anxiety, academic assessments using question generation, and feedback mechanisms using AI-powered tools. For this reason, the related work is presented in multiple sections.

2.1 Educational Tools in AI

The AI integration in education has been a prolific topic of research in recent years, particularly when intelligent tutoring and personalized learning tools are major concerns (Du Plooy et al., 2024). (Daulay et al., 2024) published AI-based writing assistants that encourage students to enhance their writing skills. The AI assistant also offered real-time suggestions and feedback for improvements. Similarly, (Akheel, 2025) developed AI powered tutor that mimics itself as a student's learning style. The concept is to provide personalized content to improve student

academic performance. Hence, the RAG-based AI tool MumtahnGPT is a novel contribution in the list of educational tools to improve students' learning capabilities effectively in a personalized environment.

2.2 Presentation Anxiety for AI

As far as the presentation anxiety is concerned, surveyed and investigated the utilization of AI tools. The authors observed the support of AI tools to student in public speaking that how AI can provide real-time feedback on speech coherence, confidence level, and voice clarity. In another work (Pavlopoulos et al., 2024), design and developed a system that uses AI to monitor speech content and delivery. The system also offered feedback to minimize anxiety and enhance presentation anxiety. Such work aligns with MumtahnGPT where the aim is to help students to prepare effectively and build confidence for academic defenses.

2.3 Academic Assessments using AI Question Generation

The foremost objective of recent research is the generation of relevant questions for academic defenses. (Taylor et al., 2025), published an article in which a machine learning based approach generates personalized questions for students. The algorithm analyzes and generates questions specifically within the boundaries of the content that the students wanted to present. In this way, the system is capable of creating targeted questions that assess the student's understanding of their topic. This is also aligned with the developed tool MumtahnGPT. Since the student experience personalized questions based on the uploaded document by simulating real-world questioning from an external examiner.

2.4 Feedback Mechanisms using AI-Powered Tools

Feedback is an important and effective mechanism in AI tools to improve student learning outcomes. (Liu et al., 2025), comprehensively discussed the importance of feedback mechanisms in AI tools that strongly assess oral presentations. The important point they observed is that it focuses on aspects including tone, structure, clarity, and content coherence.

Likewise, the proposed tool provides real-time feedback to learning students so that they can identify areas of improvement and refine responses to ultimately enhance their performance. Thus, MumtahnGPT aims to bridge and combine the aforementioned gaps into a tool. The tool is rich enough in providing a tailored learning experience to accommodate students so as to boost confidence and improve their presentation skills in high-stakes academic all-in-one settings. Thus, the upcoming section discusses in detail the proposed framework of the tool.

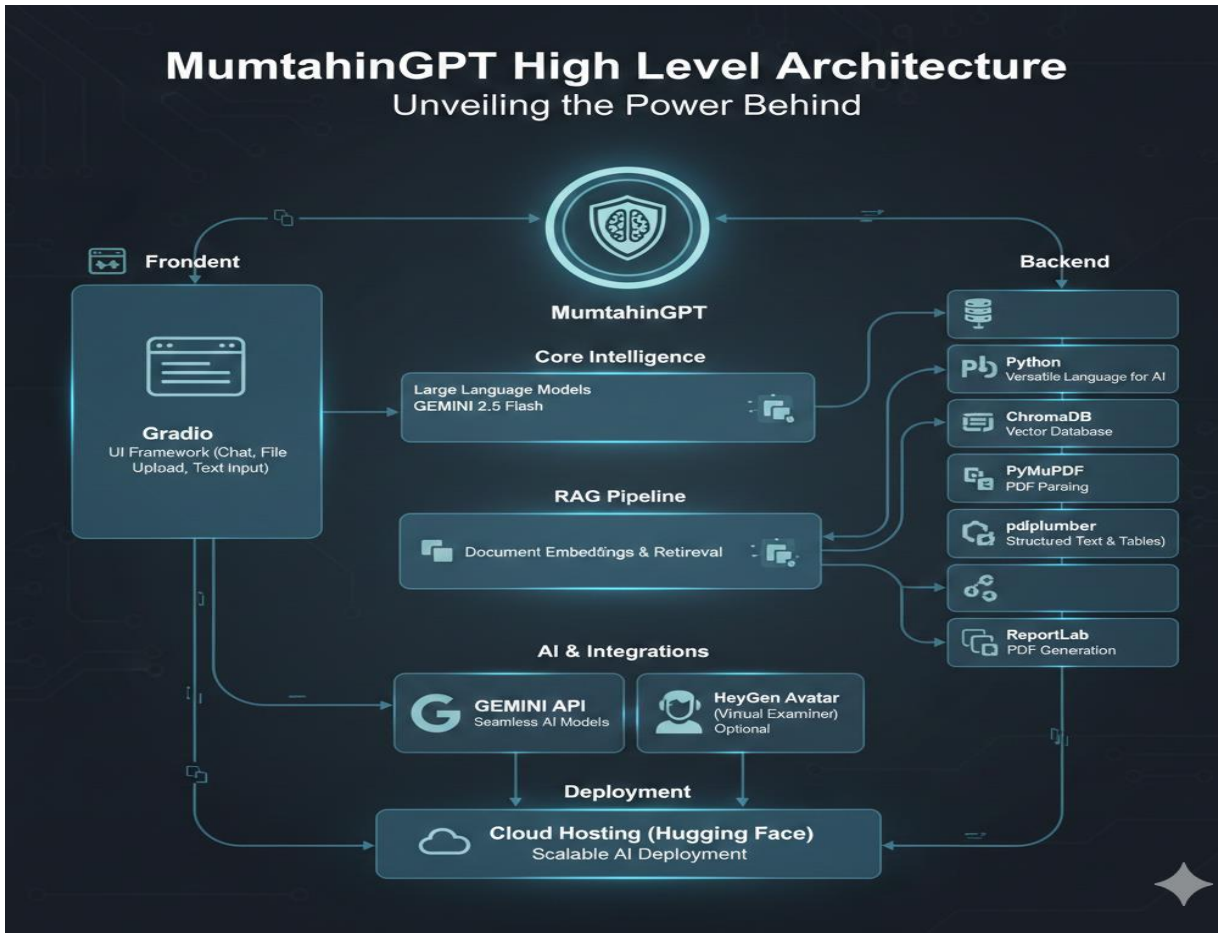


Figure 02: MumtahnGPT High-Level Framework, i.e., Unveiling the Power Behind

3. Research Methodology

This section presents deeper insight into the functionality and backend technologies used to build the proposed tool. The backbone of this tool is the RAG workflow or pipeline shown in **Figure 01**; the complete high-level architecture framework is illustrated in **Figure 02**. Hence, diving into the details of each core component of **Figure 02** step by step certainly makes the AI-powered proposed tool defense simulation possible.

3.1 Core Intelligence

The core of this proposed tool is an LLM powered by advanced AI gemini-2.5-flash. This advanced LLM ensures content-relevant question generation, understanding, and feedback from the uploaded documents. The whole process is mathematically represented using the following steps:

- Let D represents the document (e.g., thesis, synopsis, proposal, and presentation)
- Let $C = Chunks(D)$ be the set of uploaded document chunks
- For each chunk $c_i \in C_i$ used to extract relevant external knowledge $E(c_i)$
- Generate questions $Q = \{q_1, q_2, \dots, q_n\}$ based on C and $E(c_i)$

- For each response R_j , provided the feedback $F(R_j)$, where F is a feedback function based on AI evaluation metrics

Consequently, the proposed tool operates in the following manners keeping the above mathematical model in process:

- Retrieve relevant content
- Augmenting it with additional knowledge
- Generating questions
- Providing feedback based on student responses

3.1.1 RAG Pipeline

The second important component of the core intelligence is the RAG pipeline, as shown in **Figure 01** (Wu et al., 2024). The key stages of this prolific pipeline are summarized as follows:

Retrieval: The proposed tool retrieves relevant sections from the uploaded document, including thesis, synopsis, proposal, or presentation. It segments the documents into smaller pieces according to different structures as well as their contents. In this way, the retrieval component concentrated on the most pertinent parts.

Augmentation: For the next step, the retrieved segments are supplemented with extra information, such as external resources and scholarly information. This form of augmentation yields a richer context for the preparation environment. It also ensures that students are well prepared for a variety of questions that may be asked during their defense or presentation.

Generation: In the last stage of this pipeline, based on the augmented data, the proposed tool generates a set of practice questions, normally 05 to a student. The number of questions may vary depending on the student's choice. These questions are designed to mimic real-world external examiner questions. Furthermore, the proposed tool provides important AI feedback on the student's response to a particular question. Finally, it offers suggestions for improvement and refinement to enhance students' academic performance and confidence by reducing anxiety when student appears before a physical examination.

3.2 User Interface (Frontend)

The UI is developed using Gradio, which is a fast-track frontend for building a web interface framework for AI-powered tools, including chat, file upload, text input, etc.

3.3 Backend Technologies

Many backend technologies are vigorously utilized and incorporated in the development of the proposed tool. Some of the following are mentioned as follows:

- **Python** is a versatile, human-friendly language. This language is ideal for AI, data analysis, and modern application development. In this study, Python is used for coding purposes to convert the idea into a simulation. The code is written and tested using the Google Colab notebook to verify and validate the functionality and proposed features of the tool.
- **ChromaDB** is utilized and acts as a vector database, which is used for storing embeddings and retrieving relevant document chunks $C = Chunks(D)$ for the RAG pipeline.
- **PyMuPDF** is incorporated for high performance library for parsing, reading, and extracting text from PDF files.

- **pdfplumber** is used to extract tables, metadata, and structured text from PDF files with high accuracy.
- Finally, **ReportLab** is employed to generate high-quality PDFs dynamically for summaries, reports, and feedback documents.

3.4 AI Integrations and Deployment

For seamless AI integration, Google's GEMINI API is incorporated specifically for leading AI models in order to support core functionality. The proposed tool is finally deployed on cloud based Hugging Face hosting space. This hosting space provides state-of-the-art tools and AI models that allow building, managing, and deploying machine learning and NLP applications for fast and scalable public access. Hence, due to these features, Hugging Face is selected for the proposed tool deployment. The deployment link (<https://huggingface.co/spaces/farhan78/MumtahnGPT>) is generated for live access to the tool.

3.5 Data Collection

The research used an education-centered pre–post intervention design to analyze the effects of an AI-supported structured preparatory practice on students' academic anxiety, confidence, and oral assessment. The sample included 30 students (n = 30) from a public sector university of Pakistan using purposive sampling. The sample comprised pre-service teachers (n = 18) and postgraduate students (n = 12) at the MPhil/MS education and STEM-related degrees. These participants had been selected since they were engaged in academic presentations, proposal defenses, or thesis defenses. Participation was voluntary, and prior to data collection the participants provided informed consent. A variety of educational tools were used to gather data in order to reflect on the affective and performance-related outcomes. Presentation-related anxiety was captured using a self-reported questionnaire that was previously used in academic anxiety scales, which included emotional tension, evaluative apprehension, and oral exam anxiety. Then, a self-efficacy scale, which was centered on academic attainment and confidence, was used to record the readiness, understanding, and confidence to respond to questions from examiners.

Both tools were used before and after the learning activity, and the researchers documented the learning activity changes. A rubric-based approach, typical of most teacher education assessment strategies, was used to measure academic outcomes. The rubric applied to student's mock defense/presentation responses assessed conceptual understanding, explanation and depth, academic language, organization and coherence of the response, and confidence of the response. In order to maintain the same level of scoring and to assess the same level of pre and post rubric, the two rubrics were used at the pre and post levels. In addition to the quantitative data, short reflective responses were used to capture the qualitative responses of the students. These short reflective responses documented student experiences and the feelings of anxiety, preparedness, and confidence in the oral assessments. These qualitative responses served as an additional layer to the quantitative responses. The overall data collection design adhered the most to best practices in educational research, especially the practices of formative assessment, research and evaluation focused on learning, and outcomes pertinent to teacher education and higher education.

As a final consideration to the previous steps, it must be noted that MumtahnGPT operates on a strong and contemporary technology stack, which provides every student with an experience that is quick, smart, and seamless. Therefore, the effectiveness of this tool is elaborated further in the following section.

4. Results and Discussions

This section evaluates the tool's effectiveness based on the results of various performance tests. Three tests have been selected for this evaluation process: performance metrics, anxiety reduction, and feedback. These are explained in detail as follows:

4.1 Performance Metrics

The effectiveness of the tool was evaluated on a group of students where each of them was asked to answer 100 questions related to their thesis defense. After AI feedback, students were able to answer 80% of the questions. This shows the outstanding performance of the proposed tool. This also shows the tool's capacity to enhance and gauge the students' readiness for real-world questioning. In contrast, the group of students who did not use the proposed tool in the preparation process performed poorly compared to their peers.

4.2 Anxiety Reduction

This test aimed to measure self-reported anxiety levels before and after the use of the tool, by means of an anxiety scale of 1 to 10. An average anxiety reduction of 40% was recorded for the participants of this test. This shows the success of the tool in anxiety reduction and alleviation of presentation related stress.

4.2 Feedback Mechanism

Feedback is an important mechanism to improve students' responses to complex content-related questions asked by the tool during the self-preparation process. Therefore, a preliminary study was conducted where students interacted with MumtahnGPT for academic defense preparation. The results significantly indicate that 85% of students from the selected bunch felt more confident, and 75% reported a reduction in anxiety level. It was also noticeable during performing the test that the tool's question generation was aligned and relevant to the topics as per the uploaded documents.

The screenshot displays the MumtahnGPT web interface. At the top, a purple header features the logo and the text "MumtahnGPT Powered by Google Gemini with RAG - AI Document Examination System". Below the header is a navigation bar with a dropdown menu "How to Use Mumtahn GPT (Click to expand)". The main content area is divided into two columns. The left column contains an "Upload Document" section with a "Upload PDF" button and a file upload area with the text "Drop File Here - or - Click to Upload". Below this is a "Number of Questions (Auto-calculated if set to max)" section with a dropdown menu set to "5" and a slider ranging from 1 to 100. At the bottom of the left column is an orange button "Analyze & Start Examination". The right column contains an "Examination Chat" section with a chat input area.

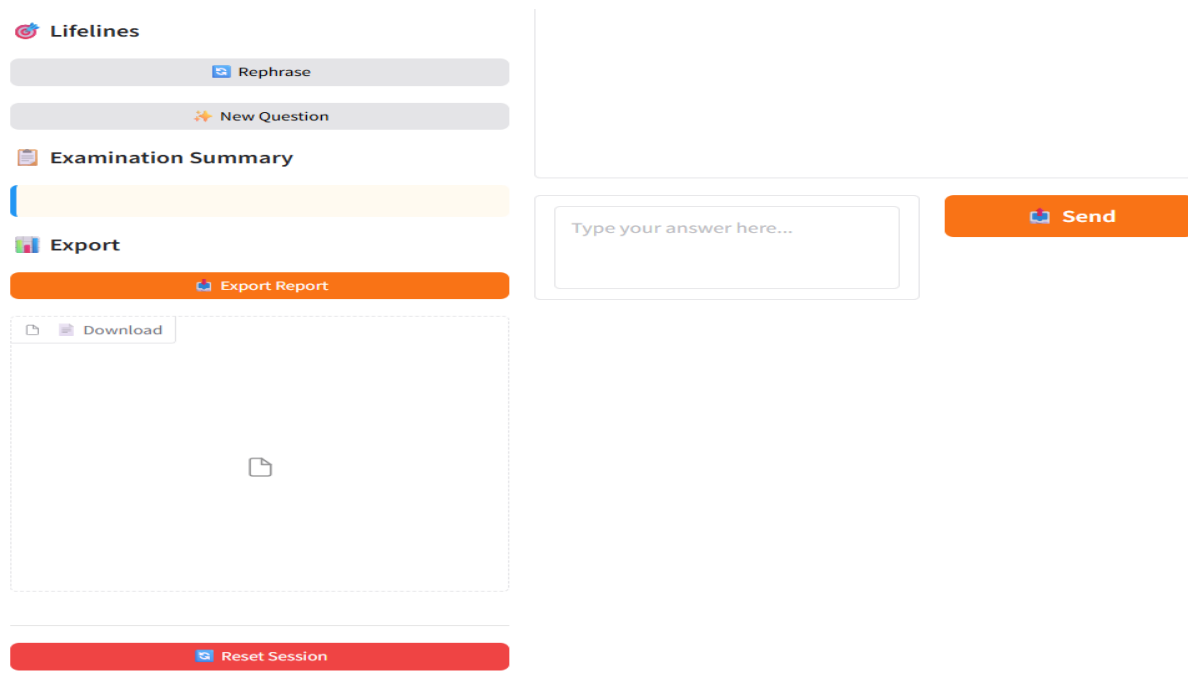


Figure 03: MumtahnGPT main frontend screen when loaded on the web browser

4.4 User Interface

The main interface screen is shown in **Figure 03**. It tools first when loaded on a web browser. This main page guides the student to navigate the functionality of MumtahnGPT, as **Section 03** highlights in detail. Further, it is important to notice that a performance report can also be downloaded for record and necessary action when and where required for a particular student.

The collected data were analyzed using the Statistical Package for the Social Sciences (SPSS). Prior to analysis, the dataset was screened for missing values, outliers, and normality assumptions. Means and standard deviations were generated to present the summary of the students' reports on the three questionnaires and the performances using the rubrics for the case of academic anxiety and for the case of the academic confidence for both the pre- and post-intervention stages. In relation to the principal questions of the study, and to establish whether pre and post intervention scores were significantly different from each other, paired sample t-tests were performed for each dependent variable. This form of statistical test appears to be the most appropriate since a single cohort for the study the participants ($n = 30$) were under observation at varied intervals. A test of significance at 0.05 alpha level was performed. The study calculated an effect size using Cohen's d to determine the level of magnitude of change and aid the pragmatic interpretation of the findings to educational practice. For the performance score rubrics, a summative score was calculated for each of the rubric items. The revision of the rubric's consistency was performed using the Cronbach's alpha test for educational research, with the assurance of consistent and enough reliability. In regard to the students' qualitative data reflections of the rubrics, these data were treated using the thematic method which involved immersion in the students' reflections, the construction of an open coding scheme, and identification of a set of themes. In the practices of thematic analysis, the reports, reflections, and rubrics were systematically analyzed for recurring themes and the construction of the three meta-

themes, confidence, anxiety and preparedness. The qualitative results were used to enhance the quantitative results and to better explain the context of the students' learning experiences.

Comparison of Pre- and Post-Intervention Anxiety and Confidence Scores

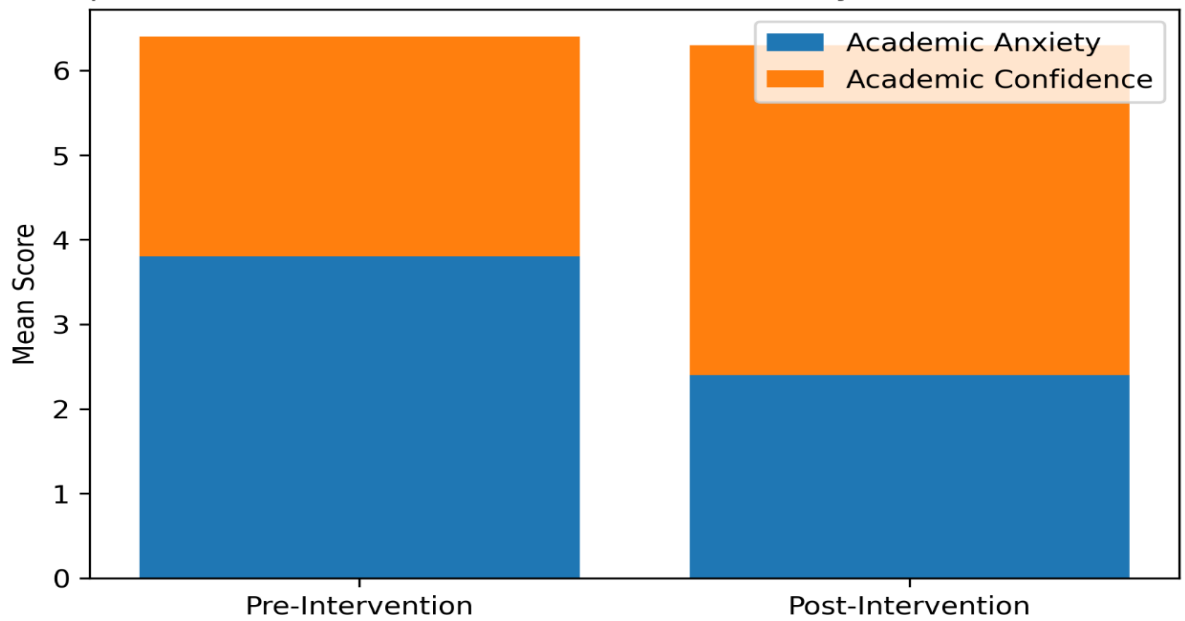


Figure 4: Comparison of Pre- and Post-Intervention Anxiety and Confidence Scores

A bar graph depicting the average data of the students' academic anxiety and academic confidence before and after the intervention. The figure reflects a reduction in anxiety and an increase in academic confidence after engaging in structured preparatory practice.

Pre- and Post-Intervention Performance Scores (Rubric-Based)

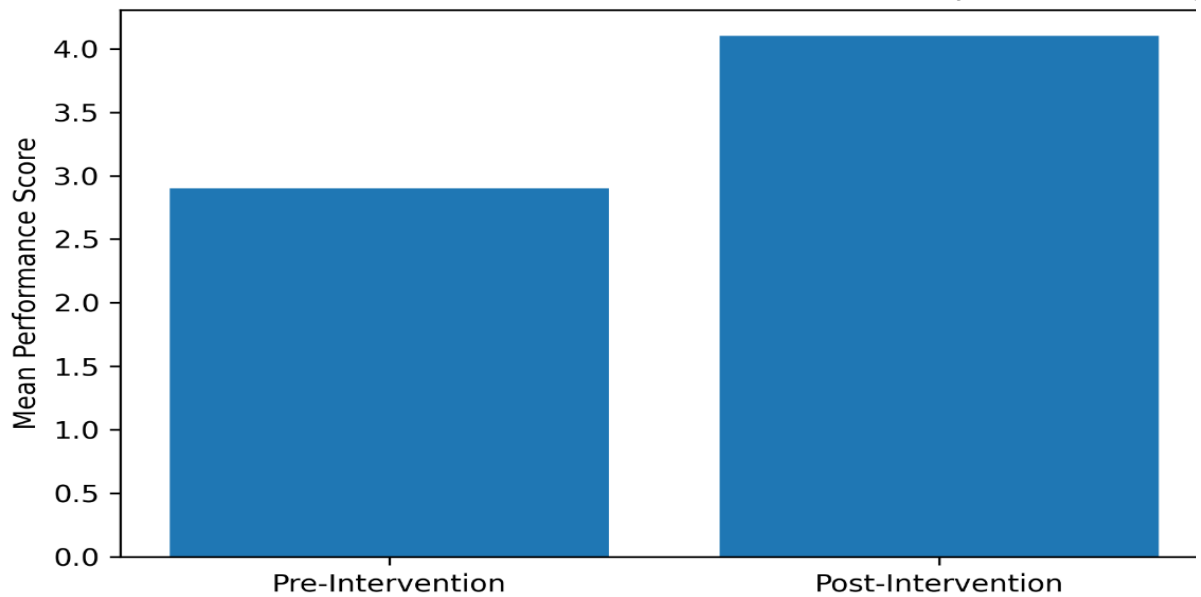


Figure 5: Pre- and Post-Intervention Performance Scores Based on Rubric Assessment

A bar chart comparing students' mean performance scores obtained through rubric-based evaluation during mock oral assessments at pre-intervention and post-intervention stages. The results indicate improvement in conceptual clarity, organization, and confidence of responses after the intervention.

4.5 Discussion

The results of the selected tests were aligned and confirmed that prior research on content-related AI-powered tools meaningfully reduces anxiety, fear and improves students' performance. However, the integration of RAG workflow in MumtahnGPT proved more accurate and effective in providing and generating tailored questions when compared with prior research on AI tools used in Educational Technology and Learning Analytics. In addition, it is noteworthy that the role of a constructive feedback mechanism is significant in the improvement of students' academic responsiveness.

From a pedagogical perspective, the decrease in anxiety and enhancement of academic performance can be verified through self-efficacy theory. Based on Albert Bandura's self-efficacy theory, the belief of learners to succeed in the performance of academic tasks affect the level of anxiety, motivation, and performance. The development of practice reinforced by Mumtahn GPT seems to have influenced students in increasing self-efficacy by creating a relaxed environment for self-practice and self-reflection, which for the students, was prior to the formal oral assessments. This is consistent with previous studies in education which suggest that guided practice and timely feedback within a mastery learning framework reduce performance anxiety and improve confidence during high-stakes assessments. For pre-service and graduate students, such practice is even more critical, since oral assessments are usually about content mastery and the development of a professional identity. The studies also emphasize the importance of formative assessment and feedback in achieving genuine learning in higher education and teacher education. With Mumtahn GPT, feedback was used as a continuous Formative assessment, which allowed students to identify content gaps, improve academic language, and enhance the alignment of their ideas. Previous research has shown that formative feedback is most effective when it is given immediately, is specific, and is related to the learning goals and objectives. Such conditions were clearly satisfied in the students' interactions with the tool. Furthermore, the more AI in generating questions that targeted the students own academic texts, the more constructive cognitive processing was triggered, supporting the higher order cognitive skills rather than just the recall of facts. This is in line with the principles of constructivist learning. Constructivist learning principles suggest that learners actively build knowledge through engagement, reflection and through interrelated contextual problem solving, thereby better preparing them for genuine academic activities, such as defending a thesis or research presentations.

5. Conclusion and Future Work

This study introduced the first of its kind AI powered external examiner preparatory tool integrated with the RAG workflow, namely, MumtahnGPT. The tool works on the principle of reducing student fear and presentation anxiety by inducing confidence during the preparation phase. This is because the tool is intended to assist students by generating AI powered feedback aimed at improving student responses to examiner questions. The tool is pilot tested and evaluated on a number of the study's student participants in the preparatory process, and with the aid of the tool, students were able to improve their confidence and performance. The only

limitation is that at present, the tool is only able to assess students by way of text-based conversations, document-aligned questioning, and structured assessments. The automated feedback and assessment tool also provided the study participants with the opportunity to practice their presentation skills prior to the oral assessments. In addition, the study participants received feedback on their presentations from their peers. In practice, the study participants were able to improve their presentations to a large extent by incorporating the feedback of their peers and the automated feedback, along with the assessment tool of the study participants. In summary, the study findings confirm that the AI-based preparatory tool is a viable means of improving students' confidence, performance, and learning at the higher education level. Moreover, the study participants were able to practice their presentation skills, and they received feedback on their presentations from their peers. The AI-based preparatory tool is a viable means of improving students' confidence, performance, and learning at the higher education level. It also demonstrates the need for further research on the potential of similar tools within the other levels of education.

The advancements of MumtahnGPT will focus on:

- An Increased data collection will allow the application to cover more disciplines in academics due to the use of broader question and answer sets.
- The next level of silent to speech capabilities means that the tool will become even more conversational and supportive in a way that will promote better engagement.
- Improvements in the tool's ability to analyze answers will provide more meaningful feedback to students as it will be able to explain the criteria used to score the answers to complicated questions.
- During the practicum, students enrolled in teacher education programs will use AI-powered prep tools to assist them in practicing their oral advocacy, presentation, defense, and viva examination techniques in low-stress environments.
- Faculty and students' supervisors are encouraged to utilize feedback-based, structured approaches in addition to their mentoring and other traditional approaches so that students can build their self-confidence, clarity of thought, and ability to communicate in a professional manner.

Additionally, it is anticipated that future studies will analyze the ways in which MumtahnGPT can be customized to meet the needs of specific organizations. Customization is expected to allow educational organizations of all levels, as well as business enterprises, to implement and use the tool in ways that are aligned with their teaching, business processes, and assessment needs, which will surely increase the value of the tool beyond educational use.

Finally, the tool is deployed on Hugging Face, and it is live. To open MumtahnGPT, use the following link <https://huggingface.co/spaces/farhan78/MumtahnGPT>.

Conflict of Interest

The authors showed no conflict of interest.

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