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Speaking of Upgrades: Using AI to Boost Engineering Presentation Skills

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CONTEXT AND PURPOSE

Presentation skills are critical for students to articulate complex ideas, vital for professional collaboration and innovation. Employers highly praise graduates with these skills, which may be a decisive factor in hiring, highlighting the need for improved training and feedback in undergraduate programs to prepare students for the job market. Undergraduate curricula often limit practical presentation opportunities due to curriculum constraints and the breadth of activities included, hindering skill development. To ensure the value of an assessment task is effective for skills development, there must be a strong tie to the feedback cycles, including formative and summative feedback. This study reports AI-augmented feedback to enhance the learning experience and improve presentation skills, providing timely and comprehensive critiques that boost student engagement and bridge the gap between academic training and employer needs.

APPROACH OR METHODOLOGY/METHODS

In a third-year undergraduate engineering course, an AI-facilitated method was implemented to evaluate student presentations. Students were required to present on critical entrepreneurial topics related to selected start-up companies. Both students and tutors used Google Forms to assign scalar grades and provide typed comments on four specific criteria: content quality, presentation weaknesses, delivery style, and areas for improvement. This feedback was then compiled to calculate average numerical scores. Qualitative comments were summarised and personalised using an OpenAI large language model (LLM) (ChatGPT-4-turbo). This approach quantified student performance and offered constructive insights for improvement.

ACTUAL OR ANTICIPATED OUTCOMES

The AI-augmented formative feedback process in the presentation task has significantly enhanced student engagement and skill development. Students actively engage in peer evaluation, using the same criteria applied to their work, which fosters a deeper understanding of the subject matter and critical presentation skills. This reciprocal learning environment bolsters their presentation competencies and nurtures a reflective practice among peers. As a result, students report substantial improvements in their ability to identify and correct presentation errors, benefiting from the detailed and specific feedback provided by peers and AI-enhanced tools. Future research will refine this feedback process through targeted surveys and sentiment analysis to optimise its effectiveness and precision.

CONCLUSIONS/RECOMMENDATIONS/SUMMARY

This study demonstrates the effectiveness of AI-augmented feedback presentation skills development. Engineering students are empowered to enhance their skills precisely, demonstrating the potential of integrating AI with human insights to boost student competencies and professional preparedness significantly.

KEYWORDS

AI-facilitated feedback, Presentation skills, Formative feedback, Employability Skill Development

Introduction

Presentation skills are essential for engineering students to effectively communicate ideas, collaborate with teams, and articulate complex technical information to diverse audiences (Crosthwaite, 2021; Riemer, 2007). Employers highly value these skills and consider them crucial for employability (Ajit & Deshmukh, 2013). Engineering students typically have only 6–10 presentation opportunities despite their importance during a four-year degree program (Jackson, 2016). Each assessment task is heavily weighted, and feedback is often brief and from a singular perspective, such as that of the tutor or unit convenor. Constructive feedback on presentations is time-consuming and challenging, especially in large classes with more than 100 students (Carless & Winstone, 2023). Without holistic, timely, and representative feedback, students find soft skill development tasks less engaging and meaningful (Alt et al., 2023), leading to reduced satisfaction and inadequate development of practical communication skills. Employers frequently cite presentation skills as one of the most prized attributes in graduate hiring, and a lack of these skills is a common reason for not hiring candidates.

Engineering entrepreneurship prepares modern engineers to navigate the rapidly evolving technological landscape. This discipline equips engineers with essential skills for innovation and leadership, ensuring they remain resilient against industry challenges (Amalu et al., 2023; Pradhan, 2022; Rogers-Draycott et al., 2024; Zappe, 2023). The Business Model Canvas is a fundamental tool for fostering entrepreneurial skills, but its complexity can be daunting for STEM students, who are generally not business oriented. It is crucial to incorporate engineering-specific examples when introducing the Business Model Canvas to mitigate this. By contextualising the framework within familiar engineering scenarios, students can better grasp its relevance and application, bridging the gap between technical and business knowledge (Henry, 2015).

Integrating engineering entrepreneurship into the curriculum, emphasising the Business Model Canvas through engineering examples, and leveraging AI for feedback can significantly enhance the development of future-proof engineers. Engaging students in presenting entrepreneurial examples hone their communication skills and improves their ability to articulate complex technical concepts clearly and compellingly (Spinuzzi, 2014).

This study explores the use of AI-facilitated feedback to support student development in presentation skills, aiming to enhance their overall competency and readiness for professional success. Peer evaluation is pivotal in providing a platform for diverse and authentic feedback, where tutors and students act as change agents, contributing to a rich feedback ecosystem (Hovardas, 2014). Effective skill development relies on formative feedback, which provides constructive insights for continuous improvement. Unlike summative feedback summarising a student's performance with a final evaluation as a grade, formative feedback offers detailed comments on what was done well and areas needing improvement, fostering a culture of ongoing learning and development.

The emergence of AI models, particularly Large Language Models (LLMs) like ChatGPT-4, can revolutionise the feedback process (Meyer, 2024). These models can synthesise and personalise feedback comments, streamlining the process of summarising feedback from multiple sources. By enabling students to receive comprehensive and actionable insights, AI models help develop their employability skills and entrepreneurship knowledge. This study examines the potential of AI-facilitated feedback to provide holistic, timely, and representative feedback to engineering students, particularly in developing their presentation skills, to enhance their overall employability and professional readiness.

Methodology

In the unit ENGG3050—Leadership and Entrepreneurship, students were tasked with delivering a five-minute presentation on a self-selected start-up company. Each student selected one of five topics closely aligned to the Business Model Canvas, which ties directly into the entrepreneurship core concept within the unit. This task was designed to enhance students' understanding of engineering entrepreneurship and the critical considerations an engineer-entrepreneur must weigh when creating a start-up. The focus spans technological readiness, business acumen, and human-centred aspects of business operations (Table 1).

Table 1: Presentation Topics for Student Selection

Topic	Description of topic
A	**Management structure and people/company culture:** Discusses the management style of the CEO, directors, or founders, strategies from the early stages to current success, company culture development, and tools/strategies employed to establish the people and culture.
B	**Funding process and general business case**: Examines the funding process from pre-seed to various stages of additional funding, original sales pitch, key value propositions (KVPs), and business cases used to secure financing.
C	**Growth strategy and scaling journey**: Explores the growth story, initial idea conception, steps taken to create the MVP, and subsequent scaling of product/services.
D	**Market opportunity and technology edge**: Analyses the marketing opportunity, product/service edge, competitive advantage, competitors, and intellectual property (IP) protection.
E	**Customer segment and product placement**: Investigates the product/service offering, targeted demographic, archetypical customer, product evolution to cater to customer needs, and financial aspects.

Each week, through five weeks, each student participated in one of three roles: a) Presenter, b) Question Bearer, or c) Evaluator of another presenting student. The teaching staff (tutors and convenors) were also responsible for assessing the students' presentation skills, including information content and presentation skills. Feedback and grades from tutors and students were captured via Google Forms and the Learning Management System (LMS). The grading rubrics included performance metrics (numerical or scalar grades) for various categories and formative feedback (long-form typed remarks).

Evaluators were required to address four specific items in their commentary:

1. What was done well in the presented content?

2. What was lacking?

3. What was done well with presentation style and behaviour?

4. What needs improving?

Each participating grader provided feedback on these four criteria. In a typical class of 260 students, presentations lasted 1 to 1.5 hours each week over five weeks. Depending on the number of tutors (typically 2-3) and assigned student graders, each presenter could receive between 2 and 9 formative feedback entries. Students were instructed to provide genuine and authentic comments, avoiding tokenism such as "Well done" or "Good job." A manual process

based on response length was used to screen for non-genuine feedback, and marks were penalised accordingly.

Tutors provided categorical grades, which were averaged and mapped to a numerical value to be released as the summative grade for the student presenter. Formative comments from tutors and student peers were summarised using ChatGPT-4 (GPT-4-turbo), an LLM by OpenAI. The specific prompt used for generating the summary was: "*Summerise these feedbacks and present in a second person active voice, in a succinct and constructive paragraph (list out who contributed to the comment):[input of tutor provided feedback]* "

The final feedback was personalised and concise, addressing students' strengths and weaknesses in their presentation effort. Additionally, the LLM included strategies for improving presentation techniques based on the lecture, which was attached to the students' feedback comments. The turnaround time for this process was typically less than one day from the presentation to receiving grades and feedback. In total, feedback from 652 students and 524 tutors was combined to create 255 personalised formative evaluations for the class.

Results and Discussion

The results of the study will reveal the quality of the formative feedback generated and how the students' responses to this formative feedback regarding the assessment task. There will also be a discussion on how long-form formative feedback aids students in improving their competency in presentation ability.

Enhancing Student Engagement

The AI-facilitated formative feedback process offers several significant benefits. Firstly, it enhances student agency in assessment tasks. This enhancement is achieved through peer evaluation, where students actively engage with and apply the same grading rubric used to evaluate their work. The process leverages the Protégé Effect (Chase, 2009), suggesting that students improve their mastery of the subject matter and develop critical competencies in relevant skill areas. By assessing peers, students can identify and avoid common errors in their work. Moreover, providing feedback engages students in reflective practices, fostering a reciprocal learning environment that supports peer teaching and learning.

Secondly, the peer feedback approach promotes active engagement among students. Students become disengaged after presenting their work or when required to observe other presentations. However, engagement is maintained by giving students the active task of providing constructive feedback to pre-nominated presenters. To ensure substantive engagement, students are instructed to avoid superficial comments such as "Good job" or "Well done," which are neither constructive nor genuine. Instead, they must provide one positive and one constructive comment to the presenter. The LLM program flags superficial comments to enforce this engagement, and students may be penalised for non-participation in the evaluative task. This system is designed to cultivate a genuinely reflective and engaged cohort of student evaluators.

Furthermore, the design of the presentation task itself presents unique challenges and opportunities. Each student presents a distinct startup company and topic pair chosen from a predefined list of 100 startups and five thematic areas (Table 1). For a typical class size of 280 students, this ensures a diverse permutation of startup company/topic pairs, preventing repeated presentations and allowing students to assess various topics and presentation styles. Because of the roles assigned, the question bearer also actively engaged with the presenters via rounds of questions between the presentations. This elevated peer discussion and facilitated curiosity for learning and comparative analysis between students with the same research topic but a different startup company. This diversity enables students to compare common themes across different startups and identify shared presentation traits and behaviours, further refining their presentation skills. Ultimately, these strategies significantly boost student engagement in the task.

Learning From Exposure and Best Practices

Students must view over 35 weekly presentations and evaluate up to 16 presentations for five consecutive weeks. Due to this extensive exposure, students naturally develop mental models of what constitutes effective and ineffective presentations. Positive examples provide meaningful learning opportunities, allowing students to emulate good practices rather than merely avoiding mistakes (To & Carless, 2016). Consequently, peer review significantly enhances students' competencies (Hoo et al., 2021). This peer evaluation approach aligns with existing literature, supporting students in developing their self-judgment of quality.

Quality and types of formative feedback provided and received

There are two sources of formative feedback from the extensive formative feedback: tutors and student peers. A combination of five teaching staff members assessed a class of 255 students. Each staff member provided 60–150 summative and formative feedback throughout the course. Multiple classmates would also be tasked with giving formative feedback, ranging from 2 to 4 evaluators for each presenting student. Therefore, the presenting student would receive feedback from at least two instructors from up to four evaluators and peer evaluations from 2 to 4 classmates. Table 2 shows an example of the raw feedback used to compile the final personalised feedback for a presenting student.

Table 2: An example of feedback provided by tutors and peers and the final AI summary

	Summative	Formative
Tutors' Grading and feedback (2 teaching staff) Teaching staff's name was retained	69	***Mackenzie's feedback:*** *good attempt to give background information.* ***Rockson's feedback:*** *Good presentation outline but too many words on the slides* ***Mackenzie's feedback:*** *definitely need more practice. Low energy during the presentation. try to wear the shoes where you are trying sell the product to overcome this. Poor ending due to lack of practice.* ***Rockson's feedback:*** *Good presentation, engage more with the content of the slide.*
Student peers' Grading and Feedback (4 students) Students' names are naturally anonymised	70	***Peer Comment:*** *The presenter makes clear references to the slides and images in the slide, as well as provided a clear and specific explanation of the company and its goals. The presenter was also engaging in that he maintained eye contact with the audience. The presenter did not have an engaging speaking style, with occasional pauses and a low voice. The slide's content help support the presentation, but seemed cluttered and disorganized.;* ***Peer Comment:*** *Positive Comment: The information in the presentation was insightful and informative, getting right to the point and relevant to the topic Constructive Feedback: You used alot of filler with ahhh and ummms when thinking/talking about your information, a bit more practice to increase your own confidence in your work would go a long way;* ***Peer Comment:*** *Positive comment Speaker had really good knowledge on the topic he was presenting, slides had plenty of information that was relevant to the presentation. Spoke comfortably in front of an audience. Constructive feedback Speaker spoke relatively confidently, however could speak with more certainty and emphasis. For a higher level presentation hand gestures and an open stance can help engagement instead of putting hands in pockets.; Peer Comment: Did not read the slides whilst rarely looking at notes. This was more engaging otherwise more information would be beneficial for the company.;* ***Peer Comment:*** *positive comment: the presentation was clear, not too much txt on screen, good amounts of images/figures. presentation was engaging. font size was adequate not too small or too big. didn't stare at notes or screen too much had eye contact at times with the audience. Constructive feedback: presenter delivery could've been clearer, at times seemed a bit lost.*
LLM summarised version		*The feedback on the presentation reveals commendations for content and structure, yet also points out significant opportunities for improvement in delivery and slide design. Mackenzie appreciated the background information provided but noted the presentation suffered from low energy and a lack of engaging delivery, suggesting more practice and better immersion in the product's context. Rockson highlighted a good presentation outline but criticized the excessive wordiness of the slides and advised more engagement with the slide content. Peers noted the presenter made clear and specific references to slides, maintaining good eye contact, and showed substantial knowledge of the topic. However, the presentation was frequently critiqued for issues like reading directly from the slides, using filler words like "ahhs" and "umms", and a speaking style that lacked confidence and engagement. Suggestions for improvement included better organization of slide content to avoid clutter, more dynamic speaking through gestures and voice modulation, and overall greater preparation to enhance confidence and clarity in delivery.*

Formative feedback required one positive aspect and one constructive criticism, resulting in a final feedback mix of positive and negative elements. Some comments from tutors and students were contradictory, offering a comprehensive perspective from a diverse set of evaluators. For example, Table 2 highlights some contradictory statements regarding confidence and speaking style:

> **Peer Comment 2: "***You used a lot of fillers like 'ahhh' and 'ummm' when thinking/talking about your information."*
> **Peer Comment 3:** *"The speaker spoke relatively confidently, but could speak with more certainty and emphasis."*
> **Peer Comment 5:** *"The presenter's delivery could have been clearer; at times, they seemed a bit lost."*

These varied reviews on speaking style, which include comments on the use of fillers and the need for more confidence, emphasise the differing perceptions of the same presentation aspects among peers.

Parsing formative feedback into LLM

While the list of feedback may be meaningful as a sample of the audience's opinions and preferences, it will be daunting to students, if not outright confusing. Hence, it needs to be appropriately phrased into supportive, constructive, and actional comments for students to internalise. Therefore, the use of LLM is especially appropriate for such functions.

The benefit of parsing the 'raw' comments via an LLM is that it will align the statements to remove any contradictory statements and group the positive, well-done comments together. It will also coordinate the constructive comments from all the reviewers into a concise list of consideration points. (Table 2) Furthermore, organising feedback through an LLM ensures that students receive clear and cohesive insights that are easier to understand and implement, enhancing their learning experience.

Students' perception of formative feedback

As a part of quality assurance and student satisfaction for continuous unit improvement, students are invited to complete a Learning Evaluation Unit (LEU) by the end of the unit. This allowed students to express significant appreciation for the comprehensive formative feedback process utilised in the presentation task category. Some highlighted testimonials highlight the immense value derived from this detailed feedback system, underscoring its positive impact on their learning experience.

> ***Student 1:*** *"Honestly, getting so much feedback was super helpful. I noticed a lot of small mistakes I kept making that I wouldn't have caught on my own. Seeing what others struggle with helped me avoid the same pitfalls in my own presentations!"*
>
> ***Student 2:*** *"At first, I thought it would be just another boring task but it turned out really useful. Reading through detailed comments made me think more about how I present and what I can do better. It's great to learn from the feedback and actually apply it next time."*
>
> ***Student 3:*** *"The feedback process was eye-opening for me. I always got 'good job' before, but this detailed critique helped me understand specific areas I need to work on. It's one thing to think you did well, but another to see it through others' eyes and really improve."*

These testimonials indicate that the feedback process enhances awareness of common errors and facilitates self-improvement in presentation skills. The students highly value the feedback, as evidenced by direct comments to tutors and teaching staff and unsolicited feedback within the LEU. Students appreciate the targeted nature and specificity of the feedback provided, which addresses distinct aspects of their presentation skills.

Future work

Future research will focus on enhancing the precision of the formative feedback process. A targeted survey will be conducted to identify the most effective elements of feedback for student improvement and those requiring refinement. This effort will be complemented by sentiment analysis to evaluate the emotional tone of the input and explore graphical feedback methods as alternatives to traditional scalar indicators. Scalar feedback often falls within a narrow range, typically between 4 and 5 out of 5, which may only partially capture the nuances of student performance. Natural language and graphical feedback could provide a more accurate and meaningful evaluation of student skills and tasks.

Further work will also involve applying the existing framework around feedback literacy to assess how responsive the feedback is to students (Dawson, 2023). Effective feedback literacy requires students to acknowledge, appreciate, internalise, and act on feedback (Carless & Boud, 2018). Future research will aim to close this loop, ensuring that students not only receive feedback but also effectively incorporate it into their learning process.

This study underscores the significant potential of AI-facilitated feedback in enhancing student presentation skills and supporting their development for employability. The integrated approach leverages the strengths of both human evaluators and AI technologies, providing students with detailed, specific, and actionable feedback. Utilising Large Language Models (LLMs) to analyse and generate feedback ensures that students receive insightful and precise critiques, which is essential for their ongoing development. The repetitive nature of formative feedback, combined with the innovative use of AI, plays a crucial role in students' continuous improvement and skill enhancement, aligning with the goals of modern educational methodologies.

Conclusion

This study highlights the significant role of AI-facilitated feedback in improving the efficiency of generating personalised and concise formative feedback for engineering students' oral presentation assessments. Large Language Models provide detailed and specific feedback beyond conventional numerical evaluations, offering students clear, actionable insights that they find extremely helpful. This tailored feedback helps students better understand their strengths and areas for improvement, enhancing their presentation skills, which are critical for their employability. Combining human insights with advanced AI technology delivers efficient and highly relevant feedback, supporting continuous and targeted development. This method not only aligns with modern educational practices but also meets the evolving expectations of employers, effectively preparing students for professional success.

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