Exploring strategies to improve learning outcomes in video analytics and machine learning in large classes

Ahmaderaghi, B., Martinez-del-Rincon, J., & Stewart, D. (2025). Exploring strategies to improve learning outcomes in video analytics and machine learning in large classes. In *IEEE Global Engineering Education Conference (EDUCON 2025): Proceedings* (Proceedings of the IEEE Global Engineering Education Conference (EDUCON)). Institute of Electrical and Electronics Engineers Inc..
https://doi.org/10.1109/EDUCON62633.2025.11016368

Published in:
IEEE Global Engineering Education Conference (EDUCON 2025): Proceedings

Document Version:
Peer reviewed version

Exploring Strategies to Improve Learning Outcomes in Video Analytics and Machine Learning in Large Classes

Baharak Ahmaderaghi
School of Electronics, Electrical Engineering and Computer Science (EEECS)
Queen's University Belfast
Belfast, United Kingdom
b.ahmaderaghi@qub.ac.uk

Jesus Martinez del Rincon
School of Electronics, Electrical Engineering and Computer Science (EEECS)
Queen's University Belfast
Belfast, United Kingdom
j.martinez-del-rincon@qub.ac.uk

Darryl Stewart
School of Electronics, Electrical Engineering and Computer Science (EEECS)
Queen's University Belfast
Belfast, United Kingdom
dw.stewart@qub.ac.uk

***Abstract*— The integration of Artificial Intelligence (AI) across various fields has transformed the educational landscape and demands a targeted approach to teaching AI in an academic setting. As lecturers aim to prepare students for an AI-driven future, they face various challenges arising from the complex and mathematical nature of AI. This paper explores the challenges of teaching and assessing AI modules in large classrooms by implementing a student-centred approach alongside formative assessment and feedback. It also examines issues related to the diversity of students' skill sets and learning style. This study was conducted on two different cohorts of the same module, Video Analytics and Machine Learning during 2022-2024. Two distinct cohorts were chosen to ensure unbiased conclusions in our study. By recognising and actively addressing these challenges, lecturers can more effectively equip students with the skills needed to navigate this rapidly evolving field. In conclusion, this study shows that implementing formative assessments like quizzes and student-centred approaches are highly beneficial in large classrooms and lead to a significant improvement in student performance and learning outcomes. In addition, the analysis shows that students who are more actively engaged with quizzes tend to score higher on the module. While the overall student feedback has been positive and there has been noticeable improvement in performance, it is important to recognise that there have been instances of unsatisfactory student outcomes as well.**

Keywords*— *Student performance, Artificial Intelligence, Machine learning, Technologies in education, Formative assessment, large cohorts teaching.

I. INTRODUCTION

In recent years, Artificial Intelligence (AI) stands as one of the most transformative technological advancements of the modern era. AI applications highly used across diverse sectors of society including education by creating personalising learning experiences, automating tasks, and providing data-driven insights [1]. As AI capabilities continue to advance, more tools and libraries are released that broaden the access to AI for larger audiences, at the cost of hiding the complexity of fundamental concepts required to fully understand and further developing the AI field.

Therefore, teaching AI itself, involves providing students with the knowledge and skills to understand and apply artificial intelligence concepts effectively. This includes covering foundational topics such as probability, feature engineering, machine learning (ML), and data analysis, while also addressing ethical implications and real-world applications of AI. Lecturers must balance theoretical and technical instruction with practical experience, often using hands-on projects and coding exercises to reinforce learning. Another key point to consider is the creation of formative assessments for students. It's important to ensure that these assessments provide high quality feedback on their learning, encourage motivation and self-esteem, while serve as a tool to support continuous improvement in students educational journey [2], particularly given the complexity and wide range of aspects to be mastered in AI. Given the rapid evolution of AI and ML technologies, lecturers need to continuously update the curriculum to reflect the latest advancements, ensuring that students are well-prepared for a future increasingly shaped by this technology.

This study investigates how incorporating these considerations into teaching practices can improve student outcomes. The paper integrates insights gained from a module covering video analysis, AI and machine learning in a computer science and engineering curriculum, applied to undergraduate bachelor's and integrated master's cohorts from 2022 to 2024. This module involves a large student cohort of >120 students from diverse pathways and backgrounds, including software engineering, computer science, data science, electronic engineering and mathematics.

The remaining sections of this article are organised as follows: Section 2 presents the related works and current challenges; our proposed solution will be described in Section 3, The paper will conclude with a discussion on the effectiveness of our proposed approach in enhancing student performance and learning outcomes, limitations, and future work in Section 4.

II. CURRENT CHALLENGES AND RELATED WORKS

One of the primary challenges in teaching AI across disciplines is the development of a comprehensive and adaptable curriculum. AI is not confined to a single field; its applications span across computer science, mathematics, engineering, business, healthcare, social sciences, and more. Designing a curriculum that meets the diverse needs of students from various disciplines requires collaboration between experts from those fields. Furthermore, the rapid advancement of AI technologies requires a curriculum that can adapt easily, ensuring that course content is regularly updated, while still preserving the fundamentals. This approach also involves addressing the needs of the diverse skill sets of students. Different disciplines bring unique perspectives and prerequisites to the table. For instance, computer science students may possess strong programming skills but might lack domain-specific knowledge, maths student may be able to quickly grasp the theoretical concepts while struggling in the practical implementation, whereas students from other fields may have a deep understanding of their domain but limited technical expertise. To address these gaps, lecturers must develop teaching strategies that accommodate to the diverse backgrounds of students, particularly in large classes by creating an inclusive learning environment that covers both the technical and non-technical aspects of AI.

Formative assessment and feedback are key strategies in achieving this goal. Formative assessment refers to a variety of methods that lecturers can use to evaluate student learning during the instructional process. Unlike summative assessments, which are typically performed at the end of an academic year, formative assessments are ongoing and provide real-time or near-real-time feedback to both students and lecturers. This continuous feedback loop allows for adjustments to teaching strategies and helps students improve their performance before their final evaluations. This is particularly notable in large classrooms with over 100 students, where individualised attention is limited, formative assessment becomes a crucial tool for ensuring that all students are on track. As class sizes grow, it helps the lecturer identify which students are struggling and which concepts are causing difficulties. By using formative assessments and/or including formative components, they can make informed decisions about whether to cover certain topics during revision sessions, modify their instructional approach, or provide additional resources to support student learning. It also helps them to provide timely guidance that promotes deeper understanding.

However, implementing formative assessment in large classrooms poses several challenges.

First, the high number of students can make it difficult for lectures to provide personalised feedback. In a class of 100 or more students, conducting assessments and analysing the results can be time-consuming. The lecturer may even struggle to keep up with the demands of grading and responding to each student individually and in a timely fashion.

Second, the diversity of learning styles and abilities in large classrooms adds another layer of complexity. Students may require different types of assessment to accurately evaluate their understanding, and addressing these needs in a large group setting can be challenging. Some students might benefit from quizzes and written assignments, while others might respond better to discussions or hands-on activities.

Third, ensuring that all students have the opportunity to participate, and that the assessment process is fair and equitable requires careful planning and execution.

Implementing effective formative assessment for an AI module in large classrooms may not be easy, but there are several strategies [3] that can help to make sure students are engaging and learning effectively.

In this section, we will examine various strategies for effective formative assessment and feedback that have been adapted for large classroom settings, as highlighted in the literature review. These include traditional methods like quizzes and assignments, as well as more interactive and technology-driven approaches.

In-class quizzes and polls [4], often administered using technology such as mobile apps, provide immediate feedback to both students and lectures. These tools are effective in large classrooms because they allow the lecturers to offer students immediate feedback on their understanding, helping them identify areas where they need further study. Moreover, they can use aggregated quiz data to identify common misconceptions and address them in subsequent lessons. This form of assessment encourages active learning by requiring students to engage with the material during lectures rather than only receiving information. Although automated feedback in general is efficient, they are limited in their ability to provide personalised, in-depth feedback on more subjective assignments such as projects. However, combining automated feedback with lecturers or peer feedback can offer a more comprehensive formative assessment experience.

Peer assessment [5] is another formative assessment strategy that has gained popularity in large classrooms. It involves students reviewing and providing feedback on each other’s work. This method not only reduces the grading burden on lectures but also encourages students to critically evaluate their peers' submissions, enhancing their understanding of the subject matter. Furthermore, it fosters a collaborative learning environment and promotes a deeper understanding of the material. However, peer assessment in large classes must be carefully managed to ensure fairness and consistency, and training students in effective feedback delivery is essential for its success.

Group projects [6] allow students to work collaboratively, pooling their knowledge and skills to complete complex tasks. In large classrooms, where individual attention from the lecturer is limited, collaborative learning can help students take ownership of their learning while benefiting from peer support. Formative assessment in group projects often takes the form of continuous feedback during the project lifecycle. By working in groups, students learn to negotiate ideas, share responsibilities, and critique each other’s work. Feedback from both peers and lectures during the project process can guide improvements before the final submission, making group projects an effective form of formative assessment in large classes [7].

Lecturers in large classrooms can also use rubrics to standardise feedback and ensure consistency across a large number of students. Rubrics provide clear criteria for grading and offer students a transparent understanding of what is expected in their work. By using detailed rubrics, they can provide feedback that is both specific and scalable, as they can quickly identify areas where students meet or fall short of expectations [8]. In large classrooms, rubrics allow for quicker grading and more structured feedback, which can enhance the learning process without overwhelming the lectures.

With the rise of digital learning platforms, technology has become an essential tool for delivering formative assessments and feedback specially in large classrooms. Learning management systems such as Canvas and Blackboard allow lecturers to provide detailed feedback on assignments, quizzes, and projects [9]. These platforms often include features such as inline comments, grade annotations, and automated feedback options, making it easier for lecturers and teaching staffs to manage feedback for large numbers of students. Students also can access feedback at their convenience, allowing for a more flexible and responsive learning experience. Additionally, digital tools enable lecturers to track student progress over time and tailor feedback to individual needs.

In the next section we will explore some of the suggested strategies for effective formative assessment adapted for AI modules in large classroom settings.

III. THE PROPOSED SOLUTION AND DISCUSSION

The module under study in this paper, Video analytics and machine learning (VAML) introduces some of the most interesting and key machine learning algorithms and concepts and how to apply them in computer vision, cybersecurity, industry, public institutions and research. Students enrolled in this module coming from different pathways, including full time Undergraduates and MEng students from computer science, software development, electrical and electronic engineering and mathematics cohorts. The module class sizes were 132 and 118 students for the 2022/2023 and 2023/2024 academic year respectively. Fig.1 and Fig.2 illustrate the number of students registered in the VAML module based on their UG or MEng pathways. This module topic is popular among stage 3 students; however, due to its complex concepts, large cohort and different student's subject backgrounds, it often presented some difficulties.

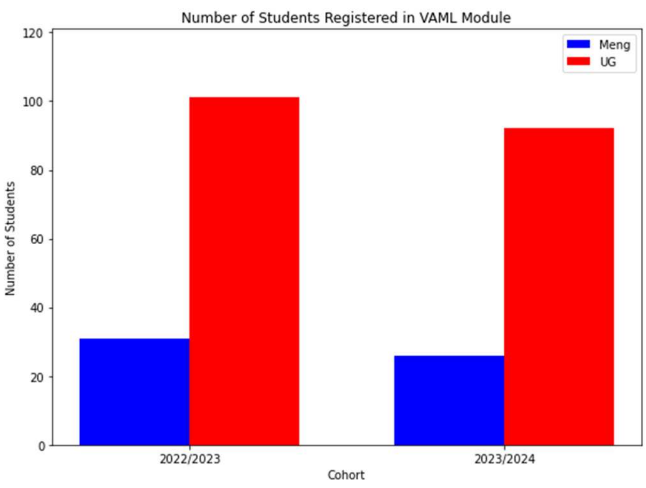

Fig.1: Number of students registered in the VAML module for UG and Meng pathways during the 2022-2024 cohorts.

This module, delivered during 12-weeks in the Fall semester of each year. It includes three hours of in-person lectures. Additionally, recorded versions of all lecture sessions were made available online through the module page in Canvas. In-person practical sessions are held in the lab over 12- weeks, each session spanning 2 hours per week. Students were provided the flexibility to do their lab work remotely or do it at their own convenient time while seeking clarification by posing questions online. Upon student request, face-to-face support sessions were scheduled within the lecturer's office hours.

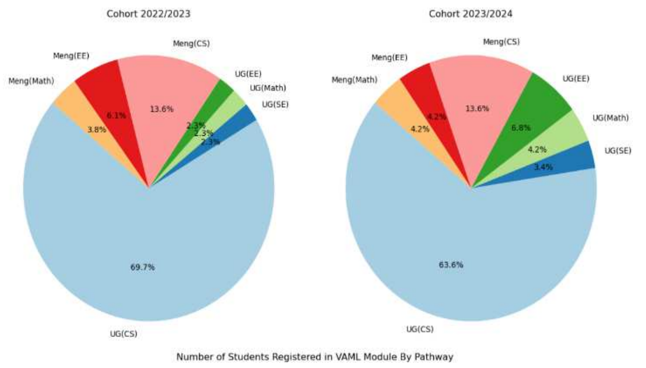

Fig.2: Percentage of students registered in the VAML module according to their pathways, Computer science (CS), Electrical & Electronic (EE), Mathematics, Software Engineering (SE) for both Undergraduate (UG) and Master (Meng) cohorts during the 2022-2024.

Additionally, online drop-in sessions were offered, allowing students to pose questions either by sending the direct MS Teams message to lab demonstrators or the module's Teams channel. This module will be assessed based on 60% coursework, which includes 20% for class test quizzes, 10% for interim project demonstration, and 30% for the final project submission. The remaining 40% will be based on the final written exam at the end of the semester.

To enhance the effectiveness of module delivery and improve student outcomes, we focused on Learning Style Theory and student-centred classroom approaches [10] as two key principles for fostering active learning. Learning style theory posits that individuals have different ways of processing information. Visual learners prefer to see information through images or text, auditory learners benefit from listening to explanations or discussions, and kinesthetics' learners engage best through hands-on activities [11]. The student-centred classroom approach on the other hand, complements learning style theory by shifting the focus from the lecturer to the students. In this approach, students take an active role in their learning process, engaging with the material in ways that align with their preferred learning styles. Lecturers guide students to explore, ask questions, and collaborate with peers. In-class collaborative exercises are used in all lectures. This method encourages deeper understanding, critical thinking, and greater engagement, as students are more invested in their learning when it is relevant to their individual preferences and interests. In our case study, we implemented these strategies as follows:

For visual learners, we use detailed flowcharts and diagrams, images, videos and pseudocode to illustrate data flow and algorithms explanations. Use of computer vision as an application to teach ML and AI concepts also benefits visual learners. Auditory learners benefit from lectures that explain the process, while kinesthetics' learners engage in hands-on activities like polling tools, coding simple AI algorithms, or using interactive tools to visualise how AI models learn during tutorial and practical sessions. We also proposed creating a separate support channel for each practical as well. This was intended to encourage students to raise issues and receive quicker support, as both lectures and lab demonstrators would have access to these channels. Additionally, we observed that some students hesitated to ask questions or raise concerns, possibly due to language barriers or other reasons. To address this, two actions were implemented. First, an online pooling tool Vevox [12] is used during the lectures and integrated in PowerPoint to get the maximum number of participants as possible in the in-class exercises and questions while keeping anonymity. Second, an anonymous form was implemented where students could suggest or indicate topics, they found difficult. In response additional time was dedicated in our subsequent tutorials to explain and focus on these challenging materials.

In this module we use MATLAB programming [13]. MATLAB, is well -known for its powerful capabilities in data analysis, image & video processing, and visualisation. Taking into account the students' varying levels of programming experience in this module, we implemented the following steps to help them work efficiently with MATLAB:

In the first practical session, we introduced MATLAB through a step-by-step approach to help students build confidence. We demonstrated how to set up the environment and begin working with MATLAB by engaging in live coding sessions. We guided students at each step, starting with basic operations and gradually moved on to more advanced components like creating functions. This approach helps students build a solid foundation, allowing them to progress from simple tasks to more complex challenges. We offered additional support for students by providing practical examples and exercises, and incorporated online resources like video tutorials, forums, and MATLAB's extensive documentation. These resources allow students to learn at their own pace and revisit challenging concepts as needed. We also create Interactive tutorial sessions, where students can ask questions and receive immediate feedback. Encouraging collaborative learning through group projects or peer tutoring can further enhance understanding, as students often learn better when they can discuss and solve problems together. We encouraged students to collaborate with their peers during practical sessions. Rather than providing step-by-step coding solutions, we offered visual aids and expected results for each practical exercise, along with detailed tutorial sessions to guide them through the tasks.

Furthermore, we incorporated formative assessments through online self-test quizzes within the Canvas virtual learning environment (VLE), which enhances the delivery of teaching and learning activities. These online quizzes, covering topics over an 8-week period and featuring various question types, were available for unlimited attempts. They were used by students for self-directed learning and provided immediate automated feedback on their knowledge and skills. This automatic feedback states if the student's answer is correct or incorrect but without ever revealing the true solution. This allow the student to keep trying as many times as possible until the solution is found, reinforcing the student own responsibility. Given the large class cohorts, the questions were designed in multiple formats to promote student reflection, self-assessment, and active engagement with the material before taking part in quizzes. Each quiz corresponds to a weekly topic and includes up to 14 questions of the following types:

- Multiple-choice: Questions with one or more than one answers may be correct requiring students to select all applicable options.
- Scenario-based analysis: Students respond to hypothetical scenarios, assessing their problem-solving and critical thinking skills.
- Calculation-based: Students need to performing specific mathematical operations, such as addition, multiplication, or more complex calculations.
- True/False: Students determine whether statements are true or false.
- Interactive analysis: Utilise multimedia elements, such as videos or images, to assess understanding in an interactive manner.

Each submission and the associated individual feedback were visible to each student in Canvas, giving them the opportunity to review their answers at any time and for an unlimited number of times. The example of some of these quizzes are shown in Fig.3.

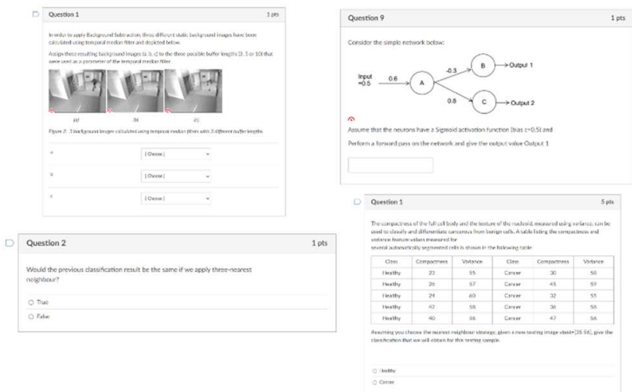

Fig.3: Formative quiz design and automated feedback: multiple-choice, calculation-based, true/false and scenario-based questions.

Although these quizzes do not contribute to the module's final grade, they were designed based on the criteria used for the final written exam and provide students with automated feedback, which is crucial for their preparation.

On the other hand, one of the summative assessment components, which accounts for 20% of the final grade, is an in-class quiz that also provides immediate feedback and results. This quiz consists of 25 questions, including multiple-choice, phrase-to-phrase matching, interactive, and complex calculation questions. Each question type is weighted differently, with multiple-choice at 10%, matching at 20%, interactive at 60%, and calculation questions at 10%.

Exam mark statistics from Canvas VLE indicate a relationship between frequent attempts and high scores on formative quizzes and higher exam scores. Figure 4 and 5 illustrates the results of 2022 and 2023 students' cohort who engaged with the formative quizzes, where the x-axis indicates the quiz scored percentages, and the y-axis indicates the number of students who received each percentage.

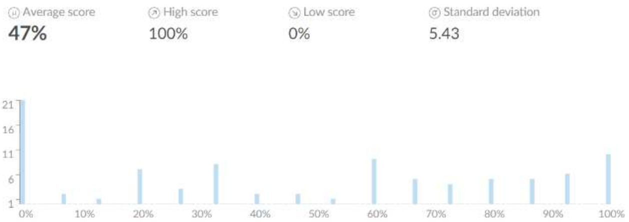

Fig. 4. Online quiz statistics for the 2022/2023 cohort.

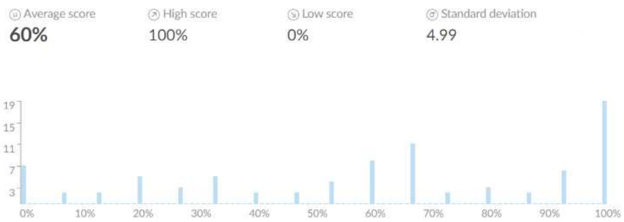

Fig. 5. Online quiz statistics for the 2023/2024 cohort.

A comparison of online quiz statistics across both cohorts shows a 13% increase in quiz scores in 2023, while the average exam score remained unchanged. Figure 6 corresponds to the written exam grades for both cohorts, where the x-axis represents student performance, and the y-axis indicates the number of students who achieved a score out of 40.

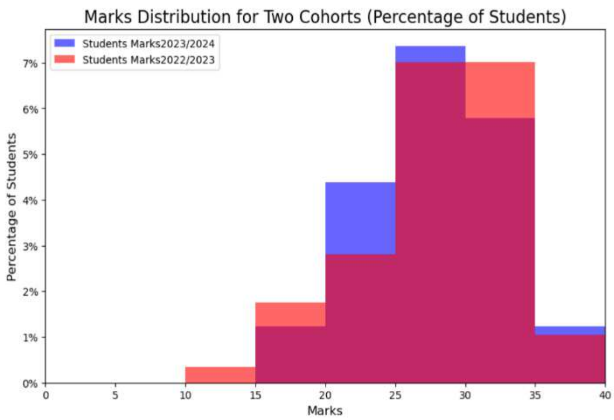

Fig.6. Written final exam grade statistics (out of 40 points) for both cohorts.

This suggests that practicing with quizzes had a significant effect on improving student performance on the quizzes and improved final written exam results by 4%. We hypothesise that this unintuitive result may be due to the particular conditions of the final exam, taken under closed-book and more stressful conditions. To verify this hypothesis, we now analyse the effect on the overall mark, where the remaining elements are open book.

An interesting aspect of these formative quizzes is that they enable the lecturer to monitor in real-time the number of quizzes attempted, completed, or ignored in Canvas especially before a class test (ranging from 1 to 37 attempts in our cases). This provided valuable insights into how many students might be struggling with certain topics or may require additional support. Additionally, quiz statistics on Canvas, along with a breakdown of question performance, were used to make necessary adjustments to specific topics or to schedule revision lectures before the final exam at the end of the semester as shown in Fig.7.

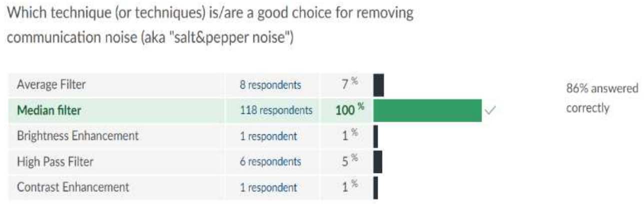

Fig.7. Question breakdown: attempts and success rate.

The outcome of our proposed method is shown in Figure 8. It represents the overall module marking distributions across the different marking groups, where the x-axis represents the marking groups, and the y-axis represents the frequency of values within those groups. The data reveals that most students in the 2022/23 cohort performed within the range of below 70, while in 2023/24, the marks have shifted towards a higher range, with more students scoring above 70.

Fig. 8: Comparison of the number of students achieving specific marking groups as final overall mark in UG cohorts during 2022/23 and 2023/24.

A more detailed comparison is shown in Figures 9 and 10, illustrating the distribution of module marks across different marking groups for both cohorts, based on the Meng and UG pathways. When comparing the performance of Meng students, it is evident that most students in the 2023/24 cohort performed significantly better, with a higher concentration in the more than 50-point range compared to the 2022/23 cohort. While there was a decrease in the number of students scoring between 70-80, there was a notable increase in those scoring between 80-100.

On the other hand, the performance of students in the UG pathways closely aligns with the overall performance across both pathways in both cohorts.

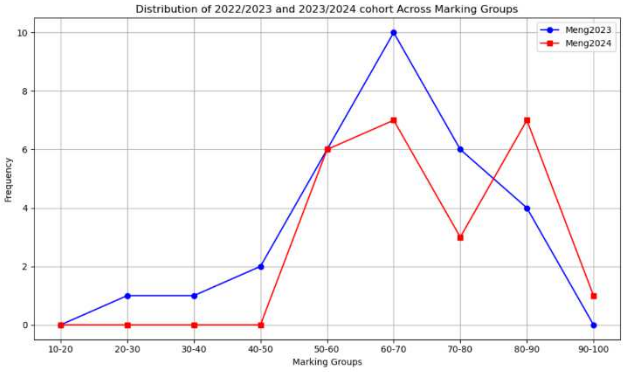

Fig. 9: Comparison of the number of students achieving specific marking groups as final overall mark in Meng cohorts during 2022/23 and 2023/24.

By analysing these overall results, we can see how a more engaged cohort with the formative elements, like 2023/24, obtained a significant larger grade than in the previous year. While this effect was not visible in analysing the final exam in isolation due to its characteristics, its effect can be better understood in the overall module performance.

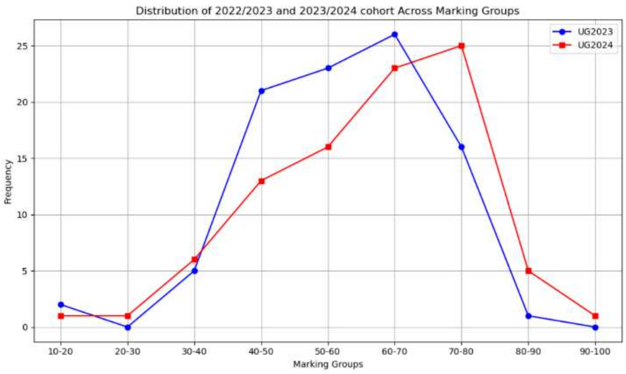

Fig. 10: Comparison of the number of students achieving specific marking groups as final overall mark in UG cohorts during 2022/23 and 2023/24.

A. *Student Feedback and Qualitative Assessment*

The pedagogical techniques introduced to the students were very well received by both cohorts as per formal end-term student feedback. Having implemented all the methods outlined above, we noted positive enhancements in student satisfaction and performance as shown in Fig 11. The majority of the class (92% for both UG & MEng) responded very positively and felt extremely enthusiastic about the employed strategies, mentioning useful examples, the variety of polls, quizzes tasks and available support from their lectures.

Some individual student comments at the end of both cohorts have included as follows:

- "Although I may have not enjoyed it at the time, I like the fact that the practical final code wasn't released. It made me work harder to complete the practicals which in turn helped me understand the module more and also helped me understand what I was doing with the assignment."
- "Gives out clear instructions when tackling practicals, offering support at each session and offered extra time to aid multiple students."
- "Reached out in lab sessions and was always willing to help with issues."
- "Gives good advice during the practicals and ensured that everyone was on track."
- "I found this module very interesting and really enjoyed the content."
- "Like quizzes, in-depth information that was very much appreciated. I liked that we looked at multiple types of quizzes. It was extremely helpful before the exam."

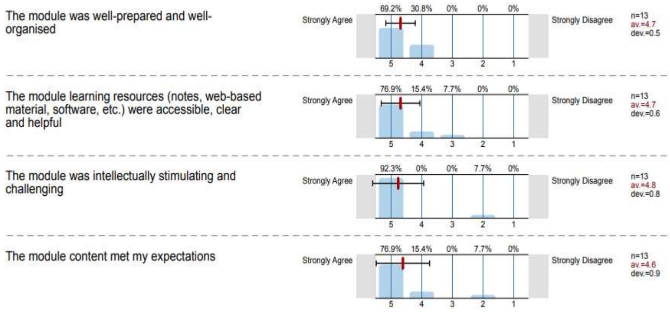

Fig.11. Student feedback results for the "Module Structure and Learning Resources" when using the framework.

Several student responses were used for the lecturer's personal reflection, including requests for more information during tutorials, increased live coding sessions, better explanation about demo expectation, and for a large classroom, the use of a more powerful microphone. We will consider that feedback in our future delivery. These comments and scores, reflect positively on the impact of the proposed strategies on student experience.

IV. Conclusion and Future Work

In this paper, we have proposed strategies to enhance student performance by integrating learning style theory and a student-centred approach, alongside the implementation of formative assessments in a large classroom setting. These methods not only help in tracking students' progress but also encourage active engagement and personalised learning, even within a sizable cohort. Formative assessments, particularly quizzes encourage regular participation, ensuring that students remain attentive and involved throughout the course. This is important in large classrooms, where students might feel lost or overlooked. Regular quizzes prompt students to review and consolidate their knowledge consistently, rather than memorising information before the main exam. This continuous engagement helps in better retention and understanding of the material. Moreover, quizzes provide immediate feedback to both students and lecturers. For students, this feedback is important as it helps them identify their strengths and areas for improvement in real-time. This timely awareness allows them to adjust their study habits and seek additional help if needed. For lecturers, quizzes offer insights into the collective understanding of the class, allowing them to identify topics that may need further clarification. In a large classroom, where direct interaction with each student is limited, this feedback mechanism is essential to meet the needs of the majority. In addition, by incorporating active learning strategies, such as group discussions, problem-solving activities, and peer collaboration, students become active participants in their education. This not only enhances their understanding of the material but also develops critical thinking and collaborative skills. Student-centred activities, like project-based learning or peer assessments, allow students to learn at their own pace, while accommodating diverse learning styles by allowing students to engage with the material in various ways. Lecturers can better cater to the needs of a diverse student body by offering multiple ways for learning, ensuring that no student is left behind.

In summary, formative assessments like quizzes and student-centred approaches are highly beneficial in large classrooms. They enhance student engagement, promote active learning, and facilitate personalised learning experiences. By incorporating these strategies, lecturers can create a more effective and inclusive learning environment, ensuring that all students have the opportunity to succeed, regardless of class size or pathway background.

In future work, we plan to develop a wider variety of online formative quizzes as part of the AI-based learning modules, aiming to enhance the learning environment and provide valuable online support to all students.

REFERENCES

[1] S. K. Vishnumolakala, S. C. C, N. P. Subheesh, P. Kumar and R. Kumar, "AI-Based Research Companion (ARC): An Innovative Tool for Fostering Research Activities in Undergraduate Engineering Education," IEEE Global Engineering Education Conference (EDUCON), Kos Island, Greece, 2024, pp. 1-5.

[2] Artificial Intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy, International Journal of Information Management, Volume 57,2021.

[3] G. Gibbs, using assessment to support student learning. Leeds, Leeds Met Press, 2010.

[4] O. Pishchukhina and A. Allen, "Supporting learning in large classes: online formative assessment and automated feedback," 30th Annual Conference of the European Association for Education in Electrical and Information Engineering (EAEEIE), Prague, Czech Republic, 2021, pp. 1-4.

[5] Topping, K. J. Peer Assessment. Theory Into Practice, 48(1), 20–27, 2009.

[6] Gokhale, A. A.Collaborative Learning Enhances Critical Thinking. Journal of Technology Education, 7, 22-30,1995.

[7] Jorion, Natalie, David Taeyaerts, and Wendy Jeanes. "Promoting collaboration using team-based classroom design." Creative Education 7.5 (2016): 724-729.

[8] Reddy, Y. Malini, and Heidi Andrade. "A review of rubric use in higher education." Assessment & evaluation in higher education 35.4 (2010): 435-448.

[9] Carless, David. "Feedback as dialogue." Encyclopedia of educational philosophy and theory (2016): 1-6.

[10] B. Ahmaderaghi, E. Barlaskar, O. Pishchukhina, D. Cutting and D. Stewart, "Enhancing Students' Performance in Computer Science Through Tailored Instruction Based on their Programming Background," 2024 IEEE Global Engineering Education Conference (EDUCON), Kos Island, Greece, 2024, pp

[11] Edways Team, https://blog.edways.com/learning-hub/3-types-of-learning-auditory-visual-and-kinesthetic.

[12] Vevox (2021). Vevox: Interactive audience engagement tool. https://www.vevox.com/

[13] The MathWorks, Inc. (2022). MATLAB version: 9.13.0 (R2022b). Accessed: January 01, 2023. Available: https://www.mathworks.com