

Rethinking Engineering Assessment in the Age of Generative Artificial Intelligence: Challenges, Risks, and a Responsible Redesign Framework

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ABSTRACT:

The advent of generative AI (GAI) and in particular, large language models (LLMs) has presented a set of new problems for the purposes of assessment in higher education. The impact on engineering education is especially significant as many frequently used assessment methods (including coding assignments, numerical problem solving, lab reports, design documentation, literature review, and project reports) can be completed or significantly aided by the use of AI tools. The use of GenAI can be helpful as an explanatory aid, a problem-solving tool, feedback and debugging guide, and even as a writing assistant, but it does have several issues to consider related to academic integrity, authenticity of student work, overreliance, technical inaccuracies, privacy concerns, confidentiality concerns, and the loss of foundational engineering skills. In this paper, a conceptual overview of the problems of assessment in engineering education is introduced in the era of GenAI. It does not report primary experimental data, survey data or institutional implementation data. Rather, it draws on existing concerns raised in recent educational guidance and engineering education literature and offers a framework for a redesign of assessments that is responsible. It proposes to focus on Engineers' Judgement rather than only answers, transparent policies for use of AI, alignment with learning outcomes, process-based evidence, oral verification, practical demonstration, reflective disclosure, and an evaluation of the process. The paper proposes that the assessment of engineering students needs to go beyond relying on AI-powered detection systems and blanket policies that prohibit. Rather, assessments should be restructured to reveal student thinking, designing decisions, verification strategies, and practical skills. Finally, the paper offers that the introduction of GenAI could be considered a learning support tool in appropriate cases; the ethical considerations, technical validation, and engineering reasoning, however, must remain with the student and educator.

Keywords: Generative AI, engineering education, assessment redesign, academic integrity, ChatGPT, artificial intelligence, engineering pedagogy, authentic assessment.

1. Introduction

The assessment process is an integral aspect of engineering education that generates evidence of the learning achieved by students, technical skills developed, professional readiness and achievement of course and programme outcomes. Typically, engineering assessment is conducted through written exams, numerical problem-solving, assignment, lab reports, programming problem solving, design projects, presentation and viva voce. These techniques are designed to not only assess final products, but they are also used to assess conceptual understanding, mathematical reasoning, hands-on skills, design judgment, and professional communication.

These assessment practices are facing a huge challenge due to the quick development of generative artificial intelligence. UNESCO's recommendations for the use of generative AI in education and research highlight the importance of a human-centred approach, the creation of institutional capacities, and ethical governance of GenAI in educational contexts [1]. Likewise, the QAA's guidance for assessment in the age of ChatGPT calls for a re-thinking of the design of assessment and not just the traditional academic-integrity mechanisms [4]. Nikolic et al. directly investigated the answers from ChatGPT to the prompts used on engineering assessment tasks for 10 subjects and 7 Australian universities in engineering education to draw attention to the potential issues with assessment integrity and authenticity [5].

GenAI tools can create text, answer repetitive questions, write code, summarize content, write reports, and design. It presents learning support opportunities, but it also makes it unclear what is original and what isn't when it comes to student work. A take home assignment, project report or laboratory write-up will not reliably demonstrate individual learning unless there is a design that connects the learning process to the write up.

The impact of engineering education is particularly strong due to the nature of many engineering tasks that are dependent on structured problem solving, coding, simulation, report writing and design documenting. These tasks are beneficial for learning, and can be

facilitated by the use of AI tools, but may not be apparent on the surface by the final product.

Meanwhile, full ban on AI might not be feasible, as AI tools are getting more and more integral to professional engineering practice. Engineers of the future will have to navigate the ethical complexities of AI, acknowledging its capabilities and limitations. The question, then, is not one of whether or not AI can be used everywhere or not. The key question is how can the system of assessment be reimaged in an environment of AI and still be valid, fair, authentic, and educationally meaningful. This paper tackles that question by providing a review of the key challenges that GenAI presents to assessment and proposing a responsible framework for the redesign of assessment in engineering education.

2. Scope and Methodological Position

This paper is a conceptual review and a framework proposal. It does not add new empirical facts, student performance indicators, student survey data, or institutional case-study findings. Thus, there are no specific measures of the rates of use of AI, student attitudes, faculty perceptions, or measurable learning gains.

This paper is grounded in existing educational guidance and research on GenAI, Academic Integrity, Assessment Redesign, and Engineering Pedagogy [1]–[5]. The goal is to give an organized, defensively sound resource for engineering educators. This paper highlights assessment methods that are used in the engineering programmes and recommends the redesign strategies that can be adopted by institutions, departments or individual faculty members.

Since this paper is conceptual, it would not be a statistically confirmed model. Instead, it should be viewed as an actionable synthesis which will inform empirical studies, institutional-level policy design, and classroom-level policy redesign.

3. Generative AI and the Changing Nature of Assessment

Unlike many other technologies that have been used in education, generative AI can produce synthesized responses instead of just retrieving information or performing pre-programmed

calculations. Users use search engines to find information, to perform calculations, and to run simulations of technical systems. The AI can be used to provide explanations, writing support, coding suggestions, summarization, and even conversational feedback all in one place.

For engineering assessment, students can use GenAI to write Python, MATLAB or C code, to debug code, solve numerical problems, to write laboratory report, summarize technical standards, to prepare presentation, and to brainstorm design alternatives. Use in a formative way may help learning. Asking an AI tool to explain the action of a circuit, or to find a syntax error in a program, can aid students in revising and improving their understanding.

But the same power can be harnessed for non-learning purposes as well. A student can present AI-generated material without having to comprehend the concept, calculation, code, decision, or experimental interpretation. Qadir highlights the future of GenAI in engineering education, discussing its strengths and weaknesses in supporting student learning and presenting potential challenges in terms of misuse and integrity [6]. In addition, research in the field of software related education demonstrates that in certain instances these tools, like ChatGPT, can offer valuable answers, and in others incomplete or incorrect answers [9].

This two-folded character of the education calls for a change in the pattern of assessment. The goal should not be just to catch the use of AI after the fact, but rather to design assessment tasks to be transparent regarding responsible usage, and not to lead to irresponsible usage that offers a slight advantage to the student.

4. Key Risks for Engineering Assessment

4.1 Loss of Authenticity in Student Work

The work submitted may not accurately reflect the student's proficiency if the assessment task can be done to a large extent by an AI tool without requiring much work from the students. For engineers, this is a very important issue because graduates will be faced with decisions in the future that impact public safety, infrastructure, machines, software systems, energy systems, and human users.

The assessment of engineering is a process that demands understanding of assumptions, application of principles, verification of results, interpretation of constraints, and reasoned decision making; all of these activities must be demonstrated in order to be considered authentic. A well-rehearsed computer response can mask a student's lack of understanding. Thus, not just a final written product should be expected as evidence of assessment, but also the process and evidence of reasoning and verification.

4.2 Academic Integrity Concerns

GenAI challenges the conventional definitions of plagiarism and cheating. The typical plagiarism consists of copying from a source that is easy to identify. The AI text generation may not be verbatim, and traditional plagiarism detection methods might not be as effective. Students are also allowed to use AI to rewrite or paraphrase copied content, write code, create explanations that do not exist in the original, or enhance content that is below the student's comprehension.

Sometimes it's not so easy, though. AI tools could be used for grammar editing, brainstorming, or formative feedback, among other things. Institutions and teachers need to establish clear rules and guidelines on the acceptable and unacceptable use of AI. In the absence of rules, students may have a difficult time knowing whether AI support is valid or cheating. As such, assessment strategies and assessment design in the GenAI era are recommendations in the assessment guidance provided by QAA [4].

4.3 Technical Inaccuracy and Hallucination

GenAI systems have the potential to generate confident, yet wrong answers. The term hallucination is used to describe such errors. In engineering, these inaccuracies can manifest themselves as incorrect formulas, incorrect assumptions, invalid code, false references, unsafe design recommendations, or misleading interpretation of results. Since AI-generated answers are typically well-formed and coherent, students might blindly trust them without proper scrutiny.

This is a big problem in assessment, where students might submit a well-formulated but factually inaccurate answer, as a result of using AI. Another challenge teachers encounter is being able to tell if a student is misunderstanding a concept or if it is a technical issue with the AI. Hence, learners need to be evaluated in terms of verifying and validating their outputs, particularly if the use of AI is allowed.

4.4 Overdependence and Weakening of Fundamental Skills

It is important for engineering students to acquire independent problem-solving capability and it must be rigorous. Overreliance on AI for derivations, calculations, algorithms, simulations, technical writing can lead to a reduction in the development of foundational skills. They include mathematical reasoning, algorithmic thinking, drawing and interpretation, laboratory observation, physical intuition and technical communication.

Assessment therefore needs to safeguard basic learning. AI can assist students after they have tried solving a problem, but cannot take the place of thinking in order to achieve deep understanding. Problem solving without assistance might still be required in some basic courses. For advanced classes, AI-supported work would be suitable when students can provide explanations, checks and justifications of what they produce.

4.5 Inequality and Fairness

Students may not have equal access to the use of AI tools. Some students might be able to use professional tools, have more useful equipment, have free or better Internet access or have more effective prompting skills; some students might be able to use free or limited tools.

Assessment fairness might be impacted if the use of AI is not planned for or regulated within institutions. Equity should therefore be taken into account in the assessment policy. All students should have reasonable access and guidance to AI in assignments when necessary. Wherever possible, AI is not used, and this should be explicitly stated and enforced via assessment design. Both UNESCO and OECD recommend that the use of digital and AI in

education transformation be regulated in a manner that takes into account fairness, capacity and institutional readiness [1, 3].

4.6 Privacy, Confidentiality, and Intellectual Property

Data from projects, industry, unpublished research, design files, laboratory data and confidential institutional material are all often used by engineering students. Storing the data on public AI platforms can present privacy, confidentiality, and IP concerns.

Assessment instructions should thus explicitly define what information should not be fed into external AI systems. There should also be guidance for teachers and students about the responsible use of third-party AI systems, as this will be included in institutional policy. Wang et al. identified several frequent issues addressed in the policies and guidelines developed by universities, including ethical use, accuracy and data privacy [7].

5. Limitations of AI Detection-Based Approaches

When it comes to AI misuse, one approach is to employ AI-detection software. Assessment integrity is not, however, hinged on being detected. AI detectors can flag the wrong papers as suspicious or miss suspicious papers. Also, their reliability may be compromised when the AI-generated text is edited, paraphrased, translated, or integrated into other human-written texts. Too much dependence on detection can establish an antagonistic relationship between student and teacher.

Ardito asserts that relying exclusively on GenAI detection in higher education assessment is problematic and promotes more robust assessment methods and policy approaches that acknowledge the education value of GenAI [8]. TEQSA's Academic integrity guidance also mentions steps for ensuring the integrity of take-home written assessments and minimizing risks of AI-generated text [10].

A better way is to redesign the assessment to make the learning process visible. Teachers should not only ask if the final product is AI-generated, but also if the student can explain the work, justify decisions, show intermediate steps, demonstrate practical skill, and verify the result.

Detection tools can be used as supports to assessment integrity, but must not be used as the mainstay of assessment integrity. The basis for good assessment design is clear policy, student education, teacher judgement and good assessment design.

6. Engineering Assessment Types and AI-Related Vulnerabilities

6.1 Numerical Assignments

Numerical problems are frequently found in subjects like circuit analysis, mechanics, control systems, thermodynamics, power systems, signals and systems and engineering mathematics etc. While step-by-step solutions might be produced by AI, they could be incorrect. For repetitive or predictable work or tasks from familiar sources, AI might produce the assignment for the student without requiring a high level of active participation.

Personalized data, interpretation questions, assumption justification, error-checking and oral explanation are better designed. Students might also be asked to do comparison between the manual calculation and simulation and explain the difference.

6.2 Programming Assignments

Programming assignments are susceptible as they can be written and run by the AI and debugged in a few different programming languages. This can help in the learning process but it can also be the opportunity for students to hand in code that they don't understand. In the domain of software testing education, Jalil et al. analyzed the potential use of ChatGPT and identified opportunities and threats, such as the lack of full answers or even correct answers in some responses [9].

Hence, assessment in programming should comprise of code explanation, live modification, debugging of faulty code, designing test-cases and viva voce questioning. Don't just ask students if something runs in their code, ask them why they chose to use a certain algorithm, data structure or control logic.

6.3 Laboratory Reports

Laboratory Reports tend to be lengthy and text-centric, making them easy for AI to create. AI can be used to write objectives, theory, procedure,

results, discussion, and conclusion. If the report does not contain authentic raw data or personal interpretation, this may not be an accurate representation of the learning in the lab. Observation sheets, raw data, manual calculations, uncertainty analysis, viva voce and reflection on errors observed during the experiment should be part of the laboratory assessment. These components help to relate the report to the actual laboratory work.

6.4 Design Projects

For a design project, you need to be creative, be constrained, be able to do trade-offs, and justify. AI can be used to create Design ideas and diagrams, Literature summaries and documentation. This can be beneficial for students learning in their initial stages, but can also result in generic or substandard designs.

Staged review, design notebook, prototype demonstration, decision log, failure analysis and individual contribution assessment are all part of project assessment. Students should be able to describe their reasons for accepting, rejecting, and/or adapting the suggestions created by AI.

6.5 Literature Reviews and Technical Reports

The student will analyse literature and technical reports. The student will interpret literature and technical reports. AI can generate literature review text and summarise papers! The danger is that students might have an inaccurate summary and/or weak critical analysis and/or make up references. Therefore, literature review assignments should include the use of verified sources, annotated bibliographies, comparison tables, and direct engagement with selected literature, as well as explanation of what was included/excluded.

6.6 Online Quizzes and Take-Home Tests

If the online quizzes or take-home tests have objective or routine questions, they can be compromised. AI-driven search and GenAI can help students during the learning process. These may be suitable for formative practice, but without supervision or redesign might not be reliable for high-stakes evaluation.

Table 1. Engineering assessment types and AI-related vulnerabilities

Assessment type	Typical student task	Main AI-related vulnerability	Suggested assessment safeguard
Numerical assignment	Solve problems using formulas, derivations, and calculations	AI may generate complete solutions without student understanding	Personalized data, assumption justification, oral explanation
Programming assignment	Write, debug, and explain code	AI may generate working code that the student cannot explain	Live debugging, code tracing, test-case design
Laboratory report	Prepare theory, observations, results, and discussion	AI may generate generic text disconnected from actual experiment	Raw data, signed observation sheet, uncertainty analysis, viva
Design project	Develop and justify a design solution	AI may generate generic design documentation	Staged reviews, design logbook, prototype demonstration
Literature review	Summarize and compare sources	AI may fabricate references or produce shallow summaries	Verified sources, annotated bibliography, comparison matrix
Online quiz	Answer objective or short-answer questions	AI may assist in real time	Use mainly for formative practice or supervised evaluation
Final-year project	Submit report and presentation	AI-polished writing may hide weak technical understanding	Progress reviews, oral defense, contribution mapping

7. Principles for Responsible Assessment Redesign

7.1 Alignment with Learning Outcomes

Polices must be tailored to the learning outcome, not the technology. If it leads to unaided foundational competence, the use of AI could be banned. If the result is professional use of

modern tools, then it might be okay to use AI-assisted work. So, it's important to not blindly use AI for everything. It should be congruent with the assessment that it is designed to measure.

7.2 Transparency

Students should be able to identify if it's banned, allowed or mandatory for students to use AI.

When instructions are unclear, it can result in confusion and inequity. A statement of the use of AI must be included in every assignment. Pupils should also be provided with information on whether they are required to state who they used prompts, tools or AI-generated content.

7.3 Process Evidence

Assessment should capture the process, not only the final answer. Process evidence may include drafts, calculations, design logs, code history, laboratory observations, simulation files, prompt records, and reflection notes.

7.4 Verification and Validation

Students should be assessed on their ability to verify AI-generated outputs. In engineering, verification may involve dimensional analysis, manual calculation, simulation comparison, experimental validation, reference checking, and sensitivity analysis.

7.5 Oral and Practical Confirmation

Student understanding may be confirmed by viva voce, presentation, live coding, lab demonstration and design defence. These are particularly effective when written submissions have been generated with the help of AI.

7.6 Ethical Disclosure

If AI is allowed, students should indicate the use of AI in their writing. The presumption of disclosure is not automatically tantamount to misconduct. Instead, it should be a part of responsible academic practice.

8. Proposed Assessment Redesign Framework

This paper proposes a five-component framework for engineering assessment in the GenAI era. The framework is consistent with international guidance recommending transparency, responsible AI literacy, protection of academic integrity, and assessment redesign in response to GenAI [1], [3], [4], [10].

8.1 AI-Use Classification

Each assessment task should be assigned to one of the following categories.

Category A: AI Prohibited

This category is suitable when the goal is to assess unaided foundational competence. Examples include closed-book examinations, basic derivations, core numerical methods, and essential hand calculations.

Category B: AI Permitted with Disclosure

This category is suitable when AI can support learning but the student remains responsible for the final submission. Examples include brainstorming, grammar editing, formative feedback, and limited coding assistance.

Category C: AI Required and Evaluated

This category is suitable when the goal is to teach responsible AI use. Examples include critique of AI-generated solutions, comparison of AI outputs, prompt design, and validation exercises.

Table 2. AI-use classification for engineering assessment

Category	AI-use status	Suitable assessment purpose	Example engineering use
Category A	AI prohibited	To assess unaided foundational competence	Closed-book examination; hand derivation; basic circuit solving
Category B	AI permitted with disclosure	To allow AI as limited support while retaining student responsibility	Grammar editing; brainstorming; debugging support; formative explanation
Category C	AI required and evaluated	To assess responsible AI literacy, verification, and judgement	Critiquing AI-generated code; identifying errors in AI solutions; prompt and validation exercise

8.2 Authentic Engineering Task Design

Assessments should simulate realistic engineering judgement rather than only seek standard

answers. Examples include selecting assumptions, comparing methods, identifying errors, justifying safety factors, interpreting abnormal data, and explaining trade-offs.

8.3 Multi-Modal Evidence

Engineering competence should be assessed through a combination of written work, oral explanation, practical demonstration, simulation files, raw data, and reflection. This reduces dependence on a single AI-vulnerable submission.

8.4 Verification Requirement

Where AI use is permitted, students should submit a verification section. This section may

include manual checks, reference confirmation, simulation comparison, test cases, or experimental validation.

8.5 Reflective AI Disclosure

Students should describe whether AI was used, for what purpose, what output was accepted or rejected, and how accuracy was checked. This promotes responsibility and makes AI use part of learning.

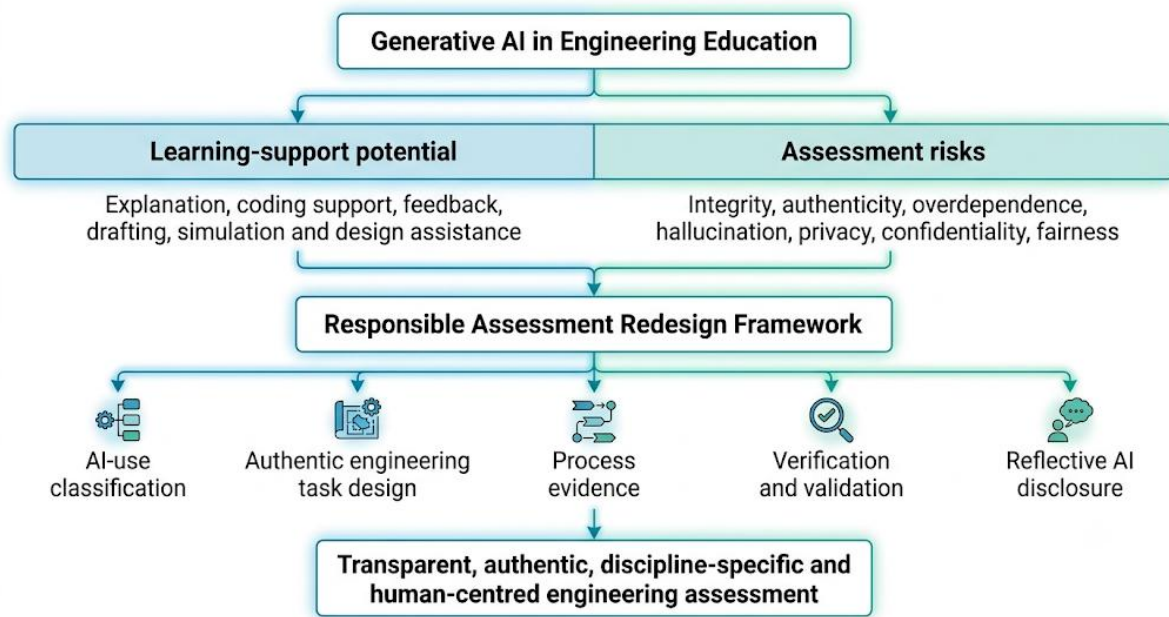


Figure 1. Responsible assessment redesign framework for engineering education in the age of generative artificial intelligence

9. Example Redesign Strategies for Common Engineering Assessments

reduce AI-related risks while preserving meaningful learning.

Table 3 provides examples of how common engineering assessments may be redesigned to

Table 3. Example redesign strategies for common engineering assessments

Assessment type	Main AI-related risk	Responsible redesign strategy
Numerical homework	AI-generated solution submitted without comprehension	Add oral explanation, personalized values, assumption justification, and error-checking questions
Programming assignment	AI-generated code copied without understanding logic	Include live debugging, code tracing, test-case design, and explanation of logic
Laboratory report	AI-written report based on generic theory	Require raw data, observation sheet, uncertainty analysis, viva, and reflection on actual errors
Design project	Generic AI-generated design documentation	Use staged reviews, design logbook, prototype demonstration, and individual defense

Literature review	AI-generated summaries or fabricated sources	Require verified references, annotated bibliography, comparison matrix, and source-based critique
Online quiz	Real-time AI assistance bypassing independent effort	Use for formative assessment only, or convert high-stakes parts to supervised or in-class formats
Final-year project	AI-polished writing hiding weak technical understanding	Add progress reviews, reference checks, oral defense, and individual contribution mapping
Presentation	AI-generated slides delivered without mastery	Include question-answer sessions and require individual explanation of technical decisions

10. Discipline-Specific Examples of AI-Aware Assessment Redesign

Redesigning assessment for engineering cannot be a one-size-fits-all approach due to the variability among the engineering learning evidence. Different learning outcomes and different risks for AI in programming assignment in computer engineering, circuit simulation in electrical engineering, structural design calculation in civil engineering and machine design report in mechanical engineering. Thus, the use of AI-aware assessment should vary with respect to the subject, the laboratory setting, and the required level of professional competence.

In electrical engineering, AI tools can be used to create MATLAB or Python scripts for simulating power systems, electrical circuits, or creating control logic. When students can grasp the algorithm, the parameters and what they mean, and the interpretation of the output, this can be educational. If students turn in AI-written code without comprehending the code they are submitting, however, the assessment may not truly reflect student competence. Redesigned assessment may then involve giving students simulation files, explaining each major code block, having to manually check one sample calculation, explaining the output waveforms or graphs, and answering viva questions on assumptions and limitations.

AI can also help civil engineers with generating reports on structural designs, summarizing codes, or creating construction management documents. The danger is that the students might create polished, generic, but uninformed reports without comprehending such variables as load assumptions, safety factors, material properties, and design constraints. Hand calculations for critical sections, explanation of design

assumptions, comparison with relevant standards, drawing interpretation and oral defence of design choices may be required with a better assessment design.

For computer engineering, AI can create entire programs, fix code bugs, and propose algorithms. This can aid learning, but can also limit development of algorithmic thinking when applied without understanding. Live coding, code tracing, debugging of faulty program, designing test cases, explaining time and space complexity and individual viva must, therefore, be a part of programming assessment. The students should be judged on whether the code runs, but also on the understanding of why it runs.

AI can assist mechanical engineering students in drafting design reports, CAD reports, manufacturing process summaries, or thermal-system explanations. However, to be able to make sound design decisions, the designer must have knowledge of constraints, materials, tolerances, manufacturability, and safety. Other forms of assessment may then be designing books, CAD model demonstration, manual checking of a selection of calculations, explanation of a prototype or a model, and discussion of failure modes.

In electronics and communication engineering, students can use AI to describe the behaviour of circuits, provide the simulation steps, and even understand the model of a communication system. The actual re-designed assessment can involve a breadboard demonstration, interpretation of waveforms, comparison of theory and simulation, an explanation of the choice of components and a viva based on actual circuit behaviour. As these examples demonstrate, the question of the use of AI should not be restricted to a yes/no response. The

question should include checking, explaining, justifying, and applying the work in an engineering context.

11. Role of Teachers

Teachers remain central in AI-aware assessment. Their role is not only to detect misconduct but also to design meaningful learning tasks. Teachers should explain acceptable AI use, provide examples of responsible and irresponsible use, and train students to verify AI outputs. Faculty members also need institutional support and training because assessment redesign requires time, clarity, and coordination.

Teachers should be cautious when using AI-generated assessment questions, rubrics, or feedback. AI may help generate question variations, rubrics, or formative comments, but final academic responsibility remains with the teacher. This aligns with the broader human-centred approach to educational AI governance recommended by UNESCO [1], [2].

12. Role of Students

Students are expected to be aware that they are still responsible for the use of AI. In a technical context, an answerer agrees to be responsible for the correctness of the answer when the answer is submitted. The students should be taught how to use AI as a tool, not as a teacher. They should validate formulas, code, reference, and be aware of all results submitted.

Responsible use of AI includes: Using AI to explain after having tried to solve the problem; Using AI to check work against a textbook, standards, or simulation; Disclosing AI use when required; Not submitting confidential data as AI content when prohibited; Explaining all submitted content; The ability to explain AI work when it is submitted as their own.

13. Faculty Development for AI-Aware Assessment

Faculty needs to be prepared to make the transition to responsible assessment redesign. Individual efforts from teachers are not enough to deal with challenges related to AI. Institutions should facilitate faculty's development through structured development activities, sharing resources and on going discussion. A model for practical faculty development can address brief

training sessions on GenAI skills, examples of uses of AI that are inappropriate to a discipline, approaches for creating an AI-resilient assessment, and how to assess AI-assisted work. Faculty should also be trained to provide clear directions for faculty use of AI with each assignment. An explicit statement should be made about bans or allowances on AI usage, as well as its mandatory incorporation into learning tasks.

Departments can create collectively available rubric banks for similar assessments like programming projects, lab reports, design projects, literature reviews, and presentations. The following are rubrics that should be included: conceptual understanding, process evidence, verification, originality, ethical disclosure, and oral explanation. Redesigned assignments can be shared among peers to learn from one another and minimize duplication of effort.

This should be followed by practice in conducting short yet effective viva voce examinations as part of faculty development. Even a brief, focused discussion would suffice for some students, so there is no need to devote much time to Viva. Likewise, teachers can also be trained to ask open-ended questions: why did they assume this, how did they verify their results, what sources of errors did they take into account, etc., what part of the AI output did they reject or correct.

There should also be institutional support for policy clarity. The responsibility of creating new AI rules for each course should not fall on the teacher's shoulders. A single institutional structure can offer uniformity, but with flexibility in the rules as well, based upon the needs of the subjects. Furthermore, Wang et al. highlight the importance of institutional support, resources, workshops, syllabus templates, and discipline-specific policies related to GenAI use in higher education [7].

14. Institutional Policy Recommendations

Institutions should establish well-defined and practical GenAI assessment policies. Such policies must not be confined to punishment. They should consist of guidance and examples, student training, faculty development, and assessment redesign support.

The following are key components of a good institutional policy: Definition of acceptable and unacceptable use of AI, requirement for students to indicate AI use in course-level assignments, guidance on disclosure of AI-generated material, instructions regarding privacy and data protection, suggestions for ways to alter assessment methods, procedures to follow if suspected, training and sharing of faculty resources, considerations for equity of AI accessibility, and review as AI tools evolve.

Formative and summative assessment also need to be clearly differentiated in institutional policies. AI might be more widely accepted in low-stakes formative tasks that focus on learning support. In summative assessment, higher order process evidence, oral evidence, supervised components or practical demonstration may be required in high stakes assessment. As part of the academic integrity toolkit, TEQSA also emphasises the need for the use of take home written assessments and barriers to misconduct [10].

15. Discussion

However, because of the arrival of GenAI, all the previous assessment methods are not redundant. Examinations (supervised), viva voce, laboratories, design reviews and practical demonstrations are still useful. Take home assignments, however, without supervision that are based solely on a final written submission should be carefully reconsidered, however.

Engineering assessment should shift from production of answers to demonstration of reasoning. With AI being able to generate comprehensible responses, the assessment should increasingly emphasize the framing of a problem, the choice of assumptions, their validation, interpretation, ethics, and judgement. These are key engineering skills that should continue to be core in engineering education. Balanced integration is the best way.

AI must be limited when it comes at the cost of learning the basics. It should be allowed where it is beneficial to learning and practice. It must be required when learning outcome is on the use of AI responsibly. This measured stance is more realistic than full prohibition, and more educationally appropriate than unchecked use.

The proposed framework also acknowledges that engineering is a discipline with a variety of offerings. No assessment model for programming could be the same as one for structural design, circuit testing, or machine design, unless it is based on an AI. Hence there should be a common policy framework of the institution, with the departments having the freedom to develop their own assessment strategies.

16. Limitations of This Paper

This paper is conceptual and does not present empirical data. It does not measure student performance, faculty perception, AI usage frequency, or learning outcomes. Therefore, the proposed framework should be understood as a practical and theoretical contribution rather than a validated model. Future research may test the framework through classroom implementation, student surveys, faculty interviews, controlled assessment redesign studies, or comparative analysis across engineering disciplines.

The paper also does not claim that the proposed strategies will eliminate academic misconduct. Instead, it argues that better assessment design can reduce overdependence on detection and make student reasoning more visible. The effectiveness of these strategies will depend on institutional context, class size, faculty workload, available resources, and student awareness.

17. Future Research Directions

A more in-depth empirical investigation into the effectiveness of the AI-aware assessment models for engineering education is warranted in the future. Research within the classroom can involve a comparison of traditional assessments and a reworked assessment which incorporates process evidence, viva voce, reflective disclosure and the verification requirements. This study can provide insights into the effectiveness of instruction to redesign assessment in terms of conceptual understanding, misuse reduction, and supporting responsible AI-literacy.

Also, discipline-specific research is required. AI-aided assessment could have different impacts in programming, circuit design, structural design, lab practices, simulation learning and final-year projects. Future studies can then be made to create branch-wise assessment models and to

examine their usefulness in the real classrooms of engineering students.

Faculty readiness is another key avenue for research. Researchers could look into teachers' conceptions of generative AI, challenges they experience when redesigning assessment, and the most helpful institutional support. Faculty development models can be created and tested, rubric banks can be developed, and departmental policy templates can be created.

More research is needed to determine the long-term impact of AI on the independent problem solving, creativity, design judgement, professional communication and ethical responsibility of engineering students. It is essential to perform such studies because improvement in assignment quality in the short-term is not necessarily a measure of the depth of learning.

18. Conclusion

Generative AI is an epic shift in engineering evaluation. It can be used for learning, feedback, code writing, exploration of designs, but it also undermines standards of academic honesty and authenticity of student work. Standard practice assessment procedures that depend on self-paced final products are become more and more susceptible.

This paper recommends that engineering education should "reflect" this change by redesigning assessment processes, not just using AI detection or outright bans. A responsible framework should categorize the use of AI, link with learning targets and outcomes, ask for evidence of the processes used, ask to hear and see it done and ask for disclosure in an ethical way.

Engineering students should not only be made familiar with the use of AI but also its verification, question, and responsibility. Engineering assessment in the future will be transparent, authentic, discipline-specific, and human-centred. AI can help students explain, code, draft and explore design, but the engineering reasoning, ethical decision making, and technical validation must be done by students and teachers. Assessment should therefore be more than just a check of the final answer and should focus on the thinking process, checking, verifying, justifying, and communication that students do in their approach to their work. Engineering institutions can maintain academic integrity by implementing clear policies, ensuring process-based evidence, providing oral confirmation, practicing the use of AI, offering faculty development, and rethinking the design of the AI-based discipline approach.

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