

A CLASSIFICATION FRAMEWORK FOR DETERMINING PERMISSIBLE LEVELS OF GENERATIVE ARTIFICIAL INTELLIGENCE USE IN ENGINEERING EDUCATION

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Abstract: The integration of generative artificial intelligence into engineering education raises the question of how to define permissible forms of its use in different learning activities without replacing the student's personal contribution. The aim of this study is to propose a methodology for classifying these activities according to the permissible degree of generative AI use. The methodology considers the learning objective, expected outcome, required independence, risk of substitution, and possibilities for verification and traceability. As a result, a five-level framework, L0-L4, is developed, linking each level to permissible forms of use and control mechanisms. Its practical application is illustrated through a matrix of main learning activities and examples from engineering disciplines. The framework shows that generative AI can support learning when its use is transparent and controlled but should be restricted when it replaces the knowledge and skills being assessed.

Key words: generative artificial intelligence, engineering education, learning activities, academic integrity, controlled use of AI.

1. INTRODUCTION

Generative artificial intelligence (AI) is becoming increasingly prevalent in the educational environment. Systems capable of generating text, program code, explanations and sample solutions are already being used by students when preparing coursework, undertaking independent study and developing projects. In many cases, they are directly involved in the performance of learning activities, which is changing established notions of independent work, personal contribution and the assessment of acquired knowledge.

In engineering education, this issue is of particular importance. The training of future engineers involves the acquisition of theoretical knowledge, the development of practical skills, analytical thinking and the ability to solve problems independently. Generative AI can support this process by explaining complex concepts, analyzing errors, suggesting alternative solutions and generating sample code. At the same time,

over-reliance on automatically generated results carries the risk that the student will merely complete the task as set, without understanding the logic behind the solution and without acquiring the expected skills.

For this reason, the use of generative AI should not be viewed solely through the prism of a choice between a total ban and unrestricted access. Assistance in explaining a particular algorithm is not equivalent to the automatic generation of a complete solution. Similarly, the use of AI for self-study cannot be assessed by the same criteria as its use during an exam, when carrying out a laboratory exercise or when defending a course project.

Existing research and institutional recommendations address issues such as academic integrity, transparency, the adaptation of assessment practices, and the development of skills for the critical use of AI tools. These findings are of great importance but often remain at the level of general principles. A more concrete approach is still needed to distinguish between permissible forms of use in specific learning activities and to select appropriate control mechanisms.

A more flexible approach is required, one that considers the nature of the specific learning activity, the expected learning outcomes, and the extent to which the student's independence should be maintained. It is important for the lecturer to be able to monitor the students' work, check their understanding and assess not only the result but also the process by which it was achieved. In this sense, the rules for using generative AI should be part of a broader culture of critical and responsible use.

This study proposes a classification framework for determining permissible levels of generative AI use in engineering education. The framework is based on an analysis of learning activities, the risk of independent work being replaced, and the potential for transparency, traceability and lecturer control. The aim is to create a practical basis for formulating clear and applicable rules that allow the use of new technologies without compromising learning objectives, the student's personal contribution and the quality of training.

2. ANALYSIS OF THE PROBLEM

2.1. Applications, opportunities and limitations

Generative AI is used in various learning activities within engineering education. It can assist with the acquisition of theoretical knowledge, the solving of practical problems, the development of program code, the analysis of laboratory results, and the preparation of project solutions. Existing research shows that its use is gradually expanding and now affects both teaching and students' independent work [1, 2].

One of the key benefits relates to self-study and receiving additional feedback. Generative systems can provide explanations, examples and guiding questions tailored to the student's specific difficulties [2, 3]. Such assistance is useful in engineering disciplines, where understanding new material often depends on correctly grasping interrelated concepts, processes and technical relationships.

Generative AI can play a more active role in the analysis of tasks, laboratory results and software implementations. It can suggest different approaches, assist in identifying errors, draw attention to overlooked dependencies and propose sample code snippets [1,

2]. These capabilities are applicable in the development of web and mobile applications, databases and software components for automation systems. However, educational value is not determined solely by the answer received, but by the student's ability to verify, adapt and justify it.

Generative systems can also play a similar role in coursework assignments, projects and laboratory reports. They can assist in clarifying the problem, structuring the stages, comparing technical solutions and refining the language of texts. In these activities, a clear distinction must be made between permissible support for the work process and the automatic generation of a result that the student does not understand and cannot defend [4].

Alongside the opportunities, there are also significant limitations. The main risk is that it may replace independent work. When a student uses a ready-made solution without following its logic, the formal completion of the task does not necessarily lead to the acquisition of knowledge and skills [5, 6]. Over-reliance on generated results may limit the need for students to formulate the problem themselves, compare different approaches and investigate the causes of errors [3, 7].

An additional challenge is the reliability of the content generated. Generative systems may provide convincingly worded but inaccurate answers, omit important conditions, or suggest a solution that is not applicable to the specific situation [3, 7]. In engineering education, this is particularly significant, as tasks often require correct calculations, compliance with technical parameters and adherence to a specific sequence during implementation.

The use of generative AI also raises questions regarding assessment. When submitting a laboratory report, program code or coursework project, it is not always easy to determine which parts have been developed independently and which have been created using an automated tool. The risks associated with data protection should not be overlooked when personal data, research results or restricted-access materials are entered into publicly accessible systems [7].

These restrictions do not impose a blanket ban on generative AI in the learning process. They highlight the need to distinguish between different situations. Assistance in explaining learning content, error analysis and critical evaluation of a generated solution cannot be placed on the same level as the automatic completion of a task designed to test a student's independent skills.

2.2. Existing approaches and underdeveloped aspects

The growing use of generative AI in education is leading to the development of ethical guidelines, institutional policies and recommendations for adapting the learning process. These emphasize the active role of the learner, academic integrity, data protection, transparency and the critical evaluation of automatically generated content [7, 8, 9, 10].

Requirements regarding transparency, traceability and the adaptation of assessment play a key role. Where the use of generative AI is permitted, students should be able to specify the tool used, the purpose of its application and how they have verified the result obtained. For more complex tasks, key prompts, intermediate versions or a brief description of the corrections made may be presented. In addition, it is recommended to

combine different forms of assessment – continuous assessment, practical assignments, oral presentations and activities in a controlled environment [11, 12].

The development of skills for the critical use of AI is also becoming increasingly important. Students must be able to formulate clear queries, assess the reliability of the results obtained, identify inaccuracies, and consider the ethical implications of using a particular tool [1, 10]. This is particularly important in engineering education, where an automatically generated solution may appear convincing but may not meet specific technical requirements.

Existing approaches outline important principles but often remain at a relatively general level. They do not always provide a sufficiently concrete answer to the question of how a lecturer should determine the permissible level of use of generative AI in a specific learning activity. Assistance in explaining a theoretical concept, identifying an error in program code, and the automatic generation of a complete project solution cannot be assessed in the same way.

This issue necessitates the development of a classification framework that considers the nature of the learning task, the expected learning outcomes, the required degree of independence, and the means of assessing understanding. In this way, the general principles can be translated into a practical approach for engineering education.

3. METHODOLOGY FOR CLASSIFYING LEARNING ACTIVITIES

3.1. Basic principles and criteria

Determining the permissible level of use of generative AI cannot be based on a single general rule applicable to all learning activities. Self-study, laboratory exercises, course projects and examinations have different objectives and require varying degrees of independence. Therefore, the proposed methodology considers each task in its specific context and is based on six principles, presented in Table 1.

Table 1. Key principles of the proposed methodology

No	Principle	Main focus
1	Alignment with learning objectives	The use of AI must not render the task and the expected learning outcome meaningless.
2	Maintaining the student's active role	The student must understand, verify and justify the proposed solution.
3	Proportionality	The extent to which this is used depends on the nature of the task and its role in the assessment.
4	Transparency and traceability	Where AI is used to a significant extent, the tools used, the key prompts and the adjustments made should be visible.
5	Assessment of understanding	Not only the final result is assessed, but also the student's ability to explain, defend and apply it.
6	Critical and responsible use	The assessment of the reliability, limitations and ethical aspects of automatically generated content is encouraged.

These principles form the general framework of the methodology. Transparency, traceability and the assessment of understanding are of particular importance, as they

enable the evaluation to focus not only on the result, but also on the way in which it was achieved [11, 12]. The methodology aims not only to limit misuse, but also to develop skills for critical and responsible work with generative systems [7, 10].

Seven criteria are used to apply these principles to a specific learning activity. They enable an assessment of the nature of the task, the required degree of independence, the risk of substitution of personal contribution, and the possibilities for verification and traceability (Table 2).

Table 2. Criteria for assessing learning activities

Code	Criterion	Key question	Possible values
K1	Aim of the learning activity	What should the student learn, apply or demonstrate?	Acquisition of knowledge; practicing skills; developing a solution; testing knowledge; specialized work with AI
K2	Nature of the expected outcome	Is a theoretical explanation, computational solution, laboratory result, program code, project development or analytical assessment required?	Theoretical explanation; computational solution; laboratory result; program code; project development; analytical assessment
K3	Required level of independence	To what extent must the student carry out the activity personally?	Low; medium; high
K4	Risk of substitution of personal contribution	Can generative AI perform a significant part of the task instead of the student?	Low; medium; high
K5	Opportunity to assess understanding	Can the student explain, defend and modify the proposed solution?	Limited; partial; high
K6	Traceability of use	Can it be determined how the generative AI has been used?	Limited; partial; high
K7	Role of the activity in assessment	Is the task used for self-study, practice, continuous assessment or final assessment?	Self-study; exercise; formative assessment; summative assessment

The criteria are not applied in isolation. The permissible level is determined by considering them together. For example, the use of AI in a programming task may be permissible for identifying errors and discussing possible solutions but may be restricted when the same task is intended to assess the student's independent skills.

3.2. Procedure for determining the permissible level

The appropriate level of use of generative AI is determined through a systematic analysis of the specific learning activity. The approach does not involve the mechanical application of a single rule but considers the specific features of the task, its role in the learning process, the required degree of independence, and the possibilities for assessing the student's personal contribution.

The proposed sequence comprises seven main steps. To make the methodology easier to apply in practice, Table 3 presents each step as a key question that the lecturer should answer, along with the expected outcome of its implementation.

Table 3. Procedure for determining the permissible level

Step	Key question	Result
1. Identifying the activity	What type of learning activity is being analyzed?	Specific context of use
2. Defining the expected outcome	What should the student learn or demonstrate?	Formulated learning objective
3. Assessment of independence	Which part of the work must be completed independently?	Degree of independence required
4. Risk analysis	Can AI replace a significant part of the personal contribution?	Assessed risk of replacement
5. Verification and traceability	Can it be established how the AI was used and whether the student understands the solution?	Appropriate forms of verification
6. Determining the level	What level of use is permissible?	Levels L0-L4
7. Choice of control mechanism	How will the student's personal contribution be protected?	Control mechanisms

Figure 1 illustrates the general logical relationship between the steps presented in Table 3 and the transition to determining a permissible level of use and an appropriate control mechanism.

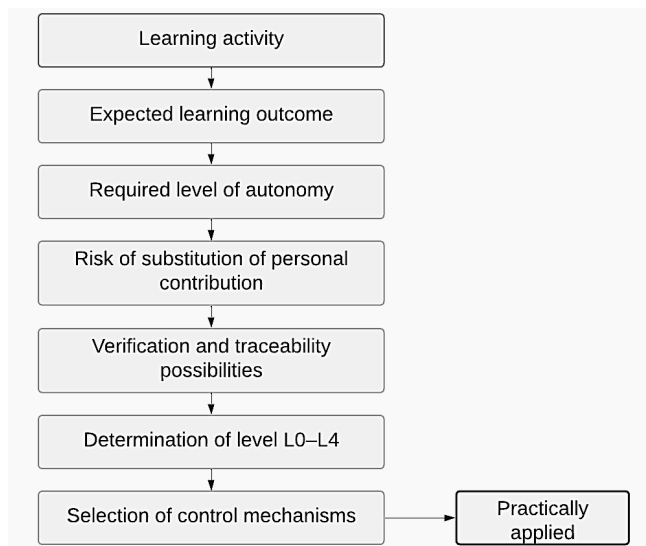


Figure 1. Sequence for determining the permissible level of generative AI use.

The proposed sequence does not imply that the level should be determined automatically based solely on the type of learning activity. For example, a laboratory

exercise may allow limited assistance during preparation but require a higher degree of independence when conducting the experiment and analyzing the results. Similarly, the use of AI in developing program code may be permissible if the student demonstrates understanding, carries out the necessary checks and is able to adapt the solution to changed conditions.

4. CLASSIFICATION FRAMEWORK FOR THE USE OF GENERATIVE AI

Based on the proposed principles and criteria, a classification framework has been developed comprising five levels of generative AI use. The levels are designated L0 to L4 and reflect the varying role of AI in the performance of learning activities (Table 4). The aim is not to assess usage solely as permitted or prohibited, but to determine the conditions under which it is pedagogically justified and compatible with the expected learning outcomes.

Table 4. Classification framework for the use of generative AI

Level	Role of generative AI	Permissible forms of use	Basic condition	Appropriate control mechanism
L0 - Prohibited use	AI does not participate in the execution of the task.	The use of generative systems is not permitted.	The task is designed to directly assess independent knowledge or skills.	Work in a controlled environment; restricted access to external resources; practical assessment.
L1 - Consultative use	AI assists with orientation and understanding.	Clarification of concepts; additional examples; guiding questions; support for self-study.	The system does not generate a significant part of the final result.	Brief clarifying questions; checking of key concepts; comparison with learning materials.
L2 - Limited support	AI assists in the analysis of a specific task.	Identifying errors; comparing approaches; structuring ideas; discussing possible solutions.	The main work remains the responsibility of the student, who checks and corrects the suggestions received.	Error analysis; presentation of interim versions; brief defense; demonstration of the changes made.
L3 - Supervised collaborative development	The AI participates in the creation of individual	Generation of fragments of program code, project structure, a working version	The use is transparent and traceable. The student declares the application	Presentation of key prompts and interim versions; oral defense; practical

	parts of the result.	of text or an element of a technical solution.	of AI, verifies the result and can defend it.	demonstration; modification of the solution under new conditions.
L4 – Advanced use for specialized tasks	Working with AI is part of the learning task itself.	Formulation of prompts; comparison of generated variants; identification of inaccuracies; analysis of limitations; reasoned revision.	Not only the result is assessed, but also the ability to interact critically and responsibly with the generative system.	Presentation of the working process; comparative analysis; justification of corrections; defense of the chosen approach.

The difference between the individual levels is determined by the extent to which generative AI participates in the work process and in the creation of the result. At L1, it has a predominantly advisory function, whilst at L2 it assists in the analysis of a specific task, for example by identifying errors or comparing possible solutions. At L3, participation in the development of individual parts of the result is already permitted, which requires transparency, traceability and the ability for the student to defend the choices made.

Level L4 has a different pedagogical function. It does not simply involve a broader use of AI, but rather a task in which critical engagement with a generative system forms part of the learning objective. In this case, the student must analyze the generated results, identify limitations and justify their corrections.

The proposed levels are not mechanically linked to a specific type of learning activity. For example, a programming task may be classified as L1 when AI is used to explain a construct, as L2 when it assists in error detection, or as L3 when it participates in the creation of a separate fragment of code. If the task aims to assess independent skills in a controlled environment, level L0 applies.

Regardless of the formally defined level, the use of generative AI becomes unacceptable when it replaces the competence that needs to be developed or assessed. If the student cannot explain the logic behind the solution, identify an error, or adapt the result to changed conditions, the final product cannot be accepted as sufficient evidence of acquired knowledge and skills.

5. APPLICATION OF THE FRAMEWORK IN ENGINEERING DISCIPLINES

5.1. Classification of core learning activities

The proposed framework can be applied to various forms of engineering education. For each activity, a recommended range of levels, permissible forms of use and appropriate control mechanisms are specified (Table 5). This approach considers the fact that the same learning activity may serve a different function depending on the stage of learning and the method of assessment.

Table 5. Application of the framework to key learning activities

Learning activity	Level	Permissible forms of use	Key restrictions and control
Self-study	L1–L2	Explanation of concepts, additional examples, guiding questions and discussion of approaches	Do not accept unverified answers at face value; verify through clarifying questions and comparison with the teaching materials
Laboratory work	L0–L3	Preparation for the exercise, identifying errors, structuring a report and analyzing results	Do not substitute for practical implementation; monitoring through observation, demonstration and defense
Computational task	L1–L2	Explanation of the method, checking of individual steps and analysis of errors made	Generating a complete solution is not permitted when assessing skills; a step-by-step presentation of the solution is required
Programming task	L1–L3	Explaining constructs, identifying syntactic and logical errors, generating individual code fragments	The student must understand, adapt and test the code; assessment through demonstration and modification of part of the functionality
Course assignment or project	L1–L3	Structuring of stages, comparison of solutions, analysis of constraints, selection of technologies and development of components	Fully generated work without personal contribution is not permitted; interim versions and a defense are required
Diploma thesis	L1–L3	Structuring, linguistic refinement, discussion of alternatives and analysis of specific problems	The author's contribution must be clearly distinguished; supervision through consultations, interim stages and defense
Ongoing assessment or examination	L0	The use of generative AI is not permitted, except in a specially designed form of assessment	Independent completion is required; controlled environment, practical assessment and oral questions
Specialized task involving the use of AI	L4	Formulating queries, comparing responses, identifying inaccuracies, critical analysis and reasoned revision	The quality of interaction with AI is assessed; a presentation of the process and a defense of the corrections made are required

The table should not be viewed as a universal set of fixed rules, but rather as a guide for lecturers when determining the appropriate level in line with the learning objective and the specific context. For example, the use of generative AI in a programming task may be restricted to L1 if the task aims at the initial acquisition of a given construct but may reach L3 in a course project where the student declares the use of AI, demonstrates the developed component and can adapt it to changing conditions. Thus, the proposed matrix focuses attention on the specific learning objective and on the need for the student's personal contribution to be preserved and verifiable.

5.2. Examples of application in selected disciplines

The practical applicability of the proposed framework can be illustrated by examples from two engineering disciplines. These demonstrate that the permissible level of generative AI usage depends not on the discipline itself, but on the objective of the specific task, the required degree of independence, and the method of verification.

In the course 'Databases in Industrial Systems, students may be set a task to convert a denormalized relational schema into a specific normal form. When studying independently, it is permissible to use AI at Level 1 to explain functional dependencies and the principles of normalization. When completing an exercise, L2 may be applied if the system assists in checking individual steps or identifying missing dependencies. When the task is intended for continuous assessment, the automatic generation of a complete solution should not be permitted. In a specialized task, L4 is applicable if the student analyses a solution proposed by the AI, identifies errors and justifies their corrections.

In the course 'Mobile Device Programming', generative AI can assist in the development of individual components of a mobile application. At Level L1, it can be used to explain Java construct, an XML attribute or the relationship between the interface and the program logic. Level L2 is applicable when detecting syntactic and logical errors, and L3 – when AI generates a separate fragment of code. In this case, the student must understand the purpose of the code, integrate it into the application, test it and demonstrate how it works. A suitable verification mechanism is to modify part of the functionality or adjust the application's behavior under a given condition.

6. ANALYSIS OF THE PROPOSED FRAMEWORK

The proposed classification framework allows the use of generative AI to be viewed more flexibly than the usual dichotomy between permission and prohibition. Levels L0-L4 consider the different roles that AI can play in the performance of a specific learning activity – ranging from advisory support and task analysis to controlled co-development and specialized tasks in which critical engagement with generative systems is part of the learning objective.

The practical value of the framework lies in the fact that it can assist the lecturer in formulating the conditions for carrying out and assessing a specific task. The examples provided show that the permissible level is not determined mechanically according to the type of subject, but according to the expected learning outcome, the required degree

of independence and the risk of substituting personal contribution. Thus, the same technology may be useful for self-study, but unsuitable for assessing practical skills.

The framework also has certain limitations. It should not be applied as a universal set of fixed rules, as the appropriate level depends on the nature of the task, the stage of learning, the method of assessment and the students' preparation. Its effective use requires not only a formal declaration of AI, but also the development of a culture of critical and responsible interaction with generative systems [7, 10]. The next stage of the research is the pilot implementation of the framework in selected engineering disciplines to assess its practical applicability and the need to refine the individual levels and control mechanisms.

7. CONCLUSION

The use of generative AI in engineering education cannot be regulated by a single rule applicable to all teaching activities. The appropriate level of use depends on the objective of the specific task, the expected learning outcome, and the need to preserve the student's independent work.

This study proposes a five-level classification framework – ranging from L0, where the use of generative AI is not permitted, to L4, where critical engagement with such systems forms part of the learning task itself. The framework is based on a set of principles and criteria that can be used to assess the risk of personal contribution being replaced, the possibilities for verifying understanding, and the necessary control mechanisms. Its practical applicability is illustrated through various forms of teaching and examples from engineering disciplines.

The proposed approach should not be viewed as a definitive set of immutable rules. Its purpose is to provide a framework for the clearer, more controlled and responsible use of generative AI in the learning process. The next stage of the research involves the pilot implementation of the framework in selected disciplines and the assessment of the need for further refinement of the individual levels and control mechanisms.

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