PROJECT BASED ASSESSMENT IN THE ERA OF GENERATIVE AI-CHALLENGES AND OPPORTUNITIES

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ABSTRACT

In recent years, generative Artificial Intelligence (GAI) has had a huge impact on education. Students can now prepare complex content with a very low effort, which puts in question the relevance of classic assessment methods. In this paper, we focus on the evaluation of a project-based learning course in a world where the student will benefit from GAI with its various forms of outputs. We explored the challenges of GAI on the project-based learning assessment, and we collected feedback from the course's teachers. Then, we proposed additional criteria in the evaluation grid relating to the use of GAI. We are convinced that we should take advantage of GAI while maintaining the academic integrity and ensuring development of student's critical skills. We concluded that the assessment grid should include 6 types of criteria which are: integrate AI-specific skills criteria, ethical consideration criteria, providing clear rubrics criteria, collaboration criteria, align with specification criteria, and quality of documentation criteria.

KEYWORDS

Project based Learning, Assessment, Generative Artificial Intelligence, Standards: 8, 11

INTRODUCTION

In the dynamic landscape of education, Problem and Project-Based Learning (PBL) has emerged as a transformative approach, especially in the realm of Computer Science Engineering (CSE) (Von Kotze & Cooper, 2000; McManus & Costello 2019). The Project-Based Learning (PjBL) pedagogical method has a rich history rooted in experiential learning, aiming to equip students with practical skills and a deeper understanding of theoretical concepts (Pucher & Lehner, 2011). As technology continues to evolve, the integration of PjBL in CSE curricula has become increasingly crucial.

Problem-Based Learning is not a recent phenomenon; its roots can be traced back to the progressive education movement in the second half of the 20th century (Barrows & Tamblyn, 1980). However, it gained prominence in the context of CSE as the field evolved from

theoretical concepts to practical applications. The shift from traditional lecture-based instruction to problem or project-based approaches marked a turning point in the educational paradigm. PBL engages students by presenting real-world problems and challenges, fostering critical thinking, collaboration, and problem-solving skills – essential attributes for success in the ever-evolving field of computer science (Chen & Yang, 2019).

In this paper, we propose to analyse the implications of the widespread use of GAI in the project assessment process. Focusing on CDIO Standard 11, our aim is to re-evaluate traditional assessment methodologies to reflect the emerging role of GAI in student work. Indeed, GAI not only provides automated tools; it also redefines the very contours of creativity, conceptual understanding, and problem-solving skills in the context of academic projects.

GAI, by enabling learners to produce complex content with relative ease, raises crucial questions about the relevance and fairness of the assessment process in educational projects. The aim of this study is to explore in depth the impact of GAI on the traditional project-based approach, focusing specifically on first-year computer engineering students. These students, accustomed to a dynamic learning environment, are particularly sensitive to the changes brought about by the increased power and accessibility of GAI.

The experimental approach, carried out in collaboration with committed educators, aims to explore the potential benefits of GAI as a complementary tool for improving student creativity and efficiency. However, beyond the expected benefits, our study also examines the complex challenges of the widespread use of GAI, particularly through the prism of CDIO standards 8 and 11. The preservation of academic integrity and the development of critical skills remain central concerns in this rapid move towards education infused with artificial intelligence (AI). With this in mind, our paper contributes to the current debate by highlighting the need to rethink assessment methods, aligning them with the new skills demanded by the era of GAI.

A background context will be presented in the first section of this paper. The following section will focus on an in-depth analysis of the integration of GAI tools in PjBL, highlighting opportunities, challenges, and a new assessment approach in the age of these technologies. The conclusion will point up our commitment to promoting an educational culture that combines academic integrity with the ethical use of generative technologies, while offering an assessment approach adapted to these rapid developments.

BACKGROUND

GAI is a category of AI capable of creating new content and ideas, including conversations, stories, images, videos, and music as mentioned in Lim, et al. (2023). GAI demonstrates remarkable proficiency in generating unique content. This capability arises from the utilization of generative language models, which are founded on deep learning techniques. Several examples of GAI models are used for various applications, including GPT4, the language model behind ChatGPT introduced by Open AI, Google's BERT/BARD and Meta's Llama.

Various studies such as Lim, et al. (2023) and Mello, et al. (2023) have discussed the integration of GAI in education, highlighting its key role in shaping the future of learning. GAI in its various forms is impacting enormously on different aspects of education. In particular, it affected teaching and learning (Abunaseer, 2023; Farrelly & Baker, 2023). GAI models can be used to automatically create educational content with ongoing assistance for students by

providing additional explanations and personalized support. The personalization of learning enables providing each student with pedagogical content suited to his needs, skill level and learning style. GAI can also be used to automatically evaluate assignments, homework, and exams. This can speed up the assessment process and can provide rapid feedback. In fields such as medicine or engineering, GAI can be used to create simulations and Virtual Reality. This provides students with experiences that mimic realistic hands-on activities.

The increasing integration of GAI into educational environments is profoundly redefining the way students approach PjBL. The project-based approach, long considered a pillar of education, now finds itself at the intersection of innovation and the challenges posed by the emergence of GAI. In this changing context, where students navigate with ease through tools offering automated coding capabilities and the creation of sophisticated multimedia supports, the assessment of skills and knowledge acquired through educational projects is undergoing substantial transformations. While the benefits of GAI in education are many, it is crucial to adapt to this use of AI and to properly assess the new skills acquired by the student. Also, it is necessary to ensure that ethical challenges are considered and that these technologies are used fairly.

The success of PjBL lies not just on the final solution, but also in the entire process of inquiry, teamwork, and critical thinking it fosters. However, the rise of GAI poses a challenge to this dynamic approach, requiring us to address the obstacles that come with accurately and fairly evaluating student work. Let us examine some of the major difficulties in this ever-evolving landscape.

While AI tools are undoubtedly beneficial in streamlining tasks such as coding and media production, they can also hinder the development of crucial skills. Overdependence on automated outputs can weaken students' proficiency in coding and their ability to think critically and creatively when producing multimedia. This ultimately limits their capacity to grasp fundamental concepts and foster their own unique voices.

It is crucial to recognize the delicate balance between applying AI-generated outputs and fully comprehending the underlying principles. According to a study conducted by (Iskender, 2023), the accessibility of pre-written code and AI-generated visuals can hinder the development of critical problem-solving abilities, resulting in superficial understanding. Therefore, it is important for students to have a solid grasp of fundamental concepts to successfully adapt and troubleshoot, especially when the convenience of AI is not an option.

As we delve into the era of AI, maintaining academic integrity poses an exciting new challenge. The incorporation of AI outcomes in projects inevitably sparks debates surrounding originality and plagiarism. As noted in Gallent, et al. (2023), the distinction between student-produced work and AI-generated material can become blurred, hindering our ability to evaluate genuine learning and pinpoint instances of inadequate credits. To safeguard academic integrity, it is imperative that we establish unambiguous guidelines and encourage open dialogue on the responsible utilization of AI.

Further significant challenge we face is the potential impact on students' critical thinking and autonomy. In (Iskender, 2023), the author draws attention to the potential danger of students becoming overly dependent on AI-generated answers, consequently neglecting essential skills such as analysis, evaluation, and independent judgment. Therefore, it is imperative that we

prioritize educational strategies that promote critical thinking and encourage students to question, analyse, and draw their own conclusions, despite the availability of AI solutions.

Meeting these challenges demands thoughtful deliberation and proactive problem-solving. By embracing the potential pitfalls and embracing inventive strategies, we can guarantee that GAI will enhance, rather than impede, the growth of well-rounded, analytical-minded students in hands-on learning settings.

USE CASE

In this section, we will dive deeper into the details of the course based on PjBL that was reviewed. We will examine the actual assessment schema and discuss the feedback of the tutors. This study will result in a new set of assessment criteria that embrace the wide use of GAI by our students.

Course Description

The C Project is a course designed for the first-year engineering students at Esprit. At the end of this project, students will be able to contribute, as a team, to the programming of a serious video game using the appropriate resources. The C project is an integrated project in which several courses contribute to its progress. (i) C programming for the implementation of the source code. (ii) The multimedia course for the preparation of the project's graphic resources. (iii) The English course where students develop the game's story.

This project follows a clear structure aligned with the different phases of the project life cycle, corresponding to conception, design, implementation and operation. The CDIO framework is an engineering education initiative that focuses on training students in fundamental engineering skills and real-world problem solving.

This course is evaluated based on formative and summative assessments. Formative assessment is an evaluation method applied during the learning process. This type of assessment ensures student motivation (Carney et al., 2022; Thangaraj, Ward, & O'Riordan, 2023), and enhances the quality of learning (Karaman, 2021; van der Steen, van Schilt-Mol, Van der Vleuten, & Joosten-ten Brinke, 2021). In this context, we apply the feedback process that aims to readjust behaviours and attitudes encouraging student learning.

The second type of evaluation used in the C Project is summative assessment, used twice during the programming session. The other evaluations are planned at the end of each integrated module session. Finally, a final assessment will be conducted on GD3 (Game Design Day), in line with the operational phase of the CDIO approach.

To assess students during programming sessions, a criteria-based grid is adopted to accurately assess the degree of skills achieved. This grid is based on specific assessment criteria, measurable indicators, a grading scale, and performance descriptors. The current project assessment grid incorporates various criteria for assessing skills, which are closely linked to the current training objectives. These criteria are carefully aligned with the current overall learning outcomes of the project.

Results and analysis

The effectiveness of the old assessment grid when students are using GAI tools in their project was evaluated using a survey shared with 30 of the C Project instructors. We present in this section the results of the feedback survey designed to evaluate their opinion on the assessment method.

This study revealed the following findings:

- 100% of tutors confirm that all students use AI generative tools in their projects.
- ChatGPT is the most widely used tool.
- Students integrate AI tools at various stages of the project, including integration, design, project analysis and mainly the coding phase.
- The current evaluation grid disregards the use of GAI tools.
- The current evaluation grid needs to be revised.

As stated in the form submitted to collect feedback from the C Project teachers, the traditional assessment grid does not allow to assess all the skills acquired by the student. It may fall short in evaluating the skills and competencies acquired through using GAI in hands-on projects. The current grid needs substantial transformations and must include criteria that evaluate creativity, conceptual understanding, problem-solving skills in the context of academic projects, and ethical use of generative technologies. Based on these results, we decided to propose a new assessment approach integrating the use of GAI tools. We will describe our proposed solution in the next section.

Proposed update

When reviewing the current project criteria, we realized that the current criteria are of three types (i) collaboration criteria, (ii) align with specification criteria and (iii) quality of documentation criteria. We present in the table 1 the detailed criteria of the old grid.

Table1: Old criteria of the assessment grid

Criteria	Details
Propose the game story	- The students should be able to define all elements of a short story, and appropriately write the story and plot of their game.
Design the required multimedia resources	- Students should be able to construct a creative setting for their video game. - Students should be able to develop a description of their characters' physical appearance and actions in the story.
Design a game controller	- The student must simulate the electronic components and make the serial communication.
Group game modules	- The student must integrate all his tasks while respecting the game's design.
Act / organize as a team in a cooperative and productive way	- Student must be collaborative with all their peers, help their peers, be independent and always take the initiative.

Defend the project in front of a jury	- The student must present the game in English. He must be presentable, wear his badge, and be able to convince a jury.

Since these criteria (table 1) do not consider the use of GAI tools, we recommend therefore to add criteria relating to this context. We propose these criteria mentioned in table 2.

Table2: Proposed additional criteria to be integrated into the current grid

Criteria	Details
Integrate AI-specific skills	- The student integrated AI into his project. - The student integrated various AI tools. - Student's ability to overcome technical challenges related to AI. - Innovation Degree in the use of AI. -The student adapted AI-generated code to fit the project context. - Coherence with project and course objectives. - Quality of results obtained through AI integration.
Ethical consideration	- Transparency: the student presents an AI with a clear making decision process: algorithm, architecture, parameters, etc. - Explainability: the student understands and can explain how the AI works: algorithm, architecture, parameters, etc. - Informed Consent: Emphasizing the importance of obtaining consent when using AI tools.
Providing clear code	The student presents a commented and well-structured code with clear rubrics according to the specifications.

DISCUSSION AND EXPLORATION

Before proposing an evaluation grid, teachers first need to understand the role of AI in the project. Basically, they need to answer three questions: (i) Which parts of the project can be achieved with an AI? (ii) How can we update project inputs and outputs? (iii) What AI tools can be used to achieve the tasks?

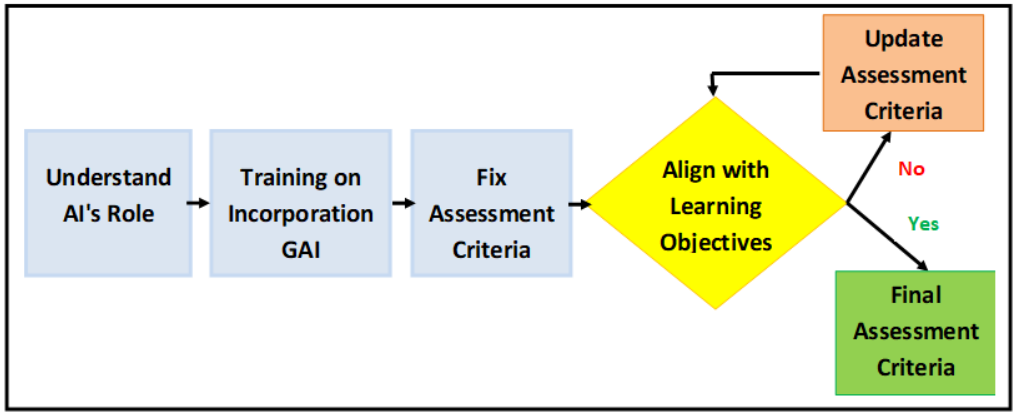

Figure 1. Producing the evaluation grid steps

The next step is to quantify the effort required to integrate AI outputs into the project. Once this is complete, initial assessment criteria will be proposed. The alignment of these criteria with the learning objectives previously defined must be confirmed. As long as this alignment is not confirmed, an adjustment must be made. The figure 1 demonstrates the steps we propose in our approach to prepare the final assessment criteria.

To foster deeper learning, we recommend incorporating the following criteria into the PjBL assessment grid, as illustrated in figure 2:

- Integrate AI-specific skills criteria: These are the most relevant criteria in the assessment grid. They aim to assess how students apply AI techniques to solve complex problems and consider their ability to choose appropriate algorithms and models for specific tasks. They may also include criteria to assess how students evaluate the performance of their AI models and consider their ability to interpret and communicate results effectively. These criteria may include algorithm design, data pre-processing and model evaluation.

- Ethical consideration criteria: These are crucial to ensure responsible and respectful use of technology. Students should make sure their projects comply with the regulations and ethical standards in force in their field. We should define Ethical Principles which may include transparency, accountability, non-discrimination, privacy, and security, and assess Potential Ethical Risks which may include algorithmic biases, privacy issues, or unintended social consequences. We must also develop measurable indicators to assess compliance with ethical principles. For example, how will you measure the transparency of your model or the way it avoids discrimination?

- Providing clear rubrics criteria: These criteria need the definition of clear expectations for the different levels of achievement and the development of clear and transparent sections for each requirement.

- Collaboration criteria: These include criteria that assess teamwork and communication skills and consider the role of each team member in the development process.

- Align with specification criteria: The deliverable in question must meet the requirements specified in the initial specifications. That means no additional or missing functionality.

- Quality of documentation criteria: These criteria assess students' ability to effectively communicate their solutions, including code comments and project reports.

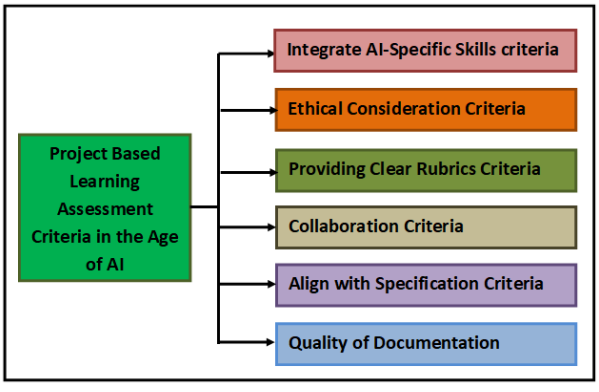

Figure 2. Proposed criteria for the project-based learning assessment in the era of GAI

FUTURE DEVELOPMENTS

GAI is transforming PjBL assessment, going beyond just rating final projects to uncovering the hidden layers of student learning. Consider AI evaluating, student interactions with code snippets, design recommendations, or multimedia elements to show their problem-solving tactics, decision-making processes, and areas of difficulties. This data enables formative assessments, individualized feedback, and the discovery of learning gaps, all while relieving instructors from the chore of grading through plagiarism detection, basic code checks, and automated reporting. This saved time allows educators to facilitate in-depth conferences, provide targeted feedback, and guide group collaborations, resulting in deeper student involvement.

GAI takes evaluation a step further by creating personalized feedback reports, recommending relevant learning resources, and even tailoring the program to individual needs. Students who have gained such insights can use AI-powered self-assessment tools to track their progress, set goals, and celebrate their growth journeys.

GAI overcomes geographical and cultural gaps by facilitating global collaboration among students through translation tools, virtual reality environments, and collaborative brainstorming platforms. Within PjBL experiences, this promotes intercultural awareness, communication skill development, and a global perspective.

In addition, GAI assessment shifts its focus from evaluating just the end result to valuing the complete learning path. Along with the final project outcomes, process-oriented rubrics, portfolio building, and self-reflection prompts recognize effort, growth, and individual learning journeys.

Finally, GAI reconsiders PjBL assessment, resulting in a dynamic, efficient, and customized system that fosters student growth, supports learning, and honors the genuine spirit of PjBL.

CONCLUSION

Nowadays, the great challenge faced by education is to meet the needs of learners in an ever-changing world where digital transformation and AI increasingly dominate society and the job market. In order to preserve the ethical principles and integrity of learning, while taking advantage of the opportunities offered by technological advances, it is imperative to thoughtfully review educational practices. In this light, teaching should consider a revision of conventional teaching and assessment methods, adopting proactive approaches that incorporate technological innovations. In this context, we have discussed in our research work (Neji, Boughattas, & Ziadi, 2023), the importance of GAI tools in education. In fact, we integrated ChatGPT as a teaching support tool for learning, while highlighting the advantages and challenges encountered.

Based on the adoption of these new technologies, and following expertise feedback from the project's tutors' team, we recognized the necessity to review the actual assessment method. To this end, we have proposed a new assessment approach which considers the integration of GAI tools in PjBL. To achieve this, an update of the criteria-based grid is deemed necessary by introducing additional criteria to evaluate the following points: the integration of AI-specific skills, the ethical consideration and the quality of provided code.

In conclusion, the use of GAI is incontestable. Careful exploitation and adaptive adjustment offer significant advantages. AI, when properly applied, not only promotes positive results and teaching motivation, but also has the potential to raise students' level of competence and knowledge to the synthesis stage in Bloom's Taxonomy. Acquiring this level will enable the student to understand in depth, apply the knowledge acquired in a variety of contexts and create innovative solutions in response to changing needs.

As perspectives, we propose to focus on current pedagogical approaches that need to be adjusted to accommodate the rapid advances in AI. This will better prepare students for the realities of AI. We are also looking at integrating AI tools into the assessment process to offer specific guidance to students based on individual performance.

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