Approved

Articles that were considered relevant (approved) upon full text reading.

A01

Paper ID:	A01
Title:	AI-supported Collaborative Projects for Enhancing Problem-solving Skills in STEM Education
Author(s):	J., Li, Junzhuo; T., Long, Taotao; X., Zhu, Xiaomeng; D., Pan, Dongchen
Year:	2025
Publication Venue:	International Conference on Computer Science and Technologies in Education
Link:	https://ieeexplore.ieee.org/abstract/document/11092200
Abstract	This study aimed to explore the role of Generative AI (GAI) in enhancing Collaborative Problem-Solving (CPS) capabilities within STEM education. To identify distinct types of learners based on CPS performance and to understand the interactions between learners and AI in the AI-supported projects, the research employed Epistemic Network Analysis (ENA) to analyze the cognitive networks of learners. Project-Based Learning (PBL) strategies was utilized to implement the AI-supported STEM collaborative projects and design teaching prompts procedurally in computer-supported collaborative learning environment (CSCL). As a result, the study identified three distinct clusters of learners with varying CPS performance. ENA results indicated varying interaction patterns and qualities among clusters, with implications for the effectiveness of AI as a collaborator in different stages of learning. In conclusion, the study concluded that GAI can significantly support CPS development in STEM projects, particularly when human collaboration is clear and directed. However, the effectiveness of AI is contingent upon the quality of directives provided by learners and the design of collaborative learning prompts. Future research should focus on in-depth study of prompt-design, and broadening the scope of factors considered in GAI-supported learning environments. © 2025 Elsevier B.V., All rights reserved.

RQ1: How is Generative AI being used in Project-Based Learning?	"Project-Based Learning (PBL) strategies was utilized to implement the Al- supported STEM collaborative projects and **design teaching prompts procedurally in computer-supported collaborative learning environment (CSCL).**" "The research mainly focused on the unit of mathematical modeling with the aid of GAI, aims to **enhance collaborative learning and deep thinking among students.**" "Ultimately, **GAI is employed to facilitate better collaboration among students.**" "During the process, **students interacted with GAI in a role-playing format to explore solutions to the steel ladle problem**, and they were required to interact with Al through Prompts Programming and Thinking Tools like Chain of Thought to deepen the dialogue..."
RQ2: What is the impact of using Generative AI in planning courses, classes, and assessments?	"It is generally accepted that the rapid rise and development of generative artificial intelligence (GAI), such as ChatGPT, **can supplement students' prior knowledge and stimulate the generation of new ideas.**" "Further to this, the conversational large language model with Retrieval-Augmented Generation (RAG) function, such as Kimi.ai can access a large amount of data through web crawling, **providing users with rich learning materials and resources, and it can make responses more accurate, efficient, educational meaningful, and logical.**" "The study concluded that **GAI can significantly support CPS development in STEM projects, particularly when human collaboration is clear and directed.**" "Our findings suggest that while Al **can compensate for deficits in human collaboration**, its effectiveness depends on the quality of instructions provided by learners." "**The structured ideas generated by AI indicate a possible pathway towards developing a procedural knowledge system for real-world problem-solving, albeit with the need for information filtering that remains a laborious task.**"
RQ3: What challenges are present in adopting Generative AI for Project-Based Learning?	"Nonetheless, **there is still a significant challenge in designing effective teaching strategies and appropriately arranging prompts** , which requires continuous exploration." "However, **the effectiveness of Al is contingent upon the quality of directives provided by learners and the design of collaborative learning prompts.**" "Nonetheless, **this process requires students to sift through information, a task that is both cumbersome and time-consuming.**"

	"Thirdly, **the current limitations of GAI, including potential inaccuracies and biases in responses, could affect the quality of collaboration and the development of CPS skills.**" "**Rigorous frameworks may stifle exploration and innovation, while the absence of prompt schemes could impede students from achieving educational objectives.**" "Additionally, **practical challenges in integrating GAI into education, such as teacher training and resource limitations**, are not fully addressed."

A02

Paper ID:	A02
Title:	Co-designing Large Language Model Tools for Project-Based Learning with K12 Educators
Author(s):	P., Ravi, Prerna; J., Masla, John; G., Kakoti, Gisella; G.C., Lin, Grace C.; E., Anderson, Emma; M., Taylor, Matthew; A.K., Ostrowski, Anastasia Katharine; C.L., Breazeal, Cynthia L.; E., Klopfer, Eric; H., Abelson, Hal
Year:	2025
Publication Venue:	CHI '25: Proceedings of the 2025 CHI Conference on Human Factors in Computing Systems
Link:	https://dl.acm.org/doi/10.1145/3706598.3713971
Abstract	The emergence of generative AI, particularly large language models (LLMs), has opened the door for student-centered and active learning methods like project-based learning (PBL). However, PBL poses practical implementation challenges for educators around project design and management, assessment, and balancing student guidance with student autonomy. The following research documents a co-design process with interdisciplinary K-12 teachers to explore and address the current PBL challenges they face. Through teacher-driven interviews, collaborative workshops, and iterative design of wireframes, we gathered evidence for ways LLMs can support teachers in implementing high-quality PBL pedagogy by automating routine tasks and enhancing personalized learning. Teachers in the study advocated for supporting their professional growth and augmenting their current roles without replacing them. They also identified affordances and challenges around classroom integration, including resource requirements and constraints, ethical concerns, and potential immediate and long-term impacts. Drawing on these, we propose design guidelines for future deployment of LLM tools in PBL.
RQ1: How is Generative AI being used in Project-Based Learning?	"AI's capacity to **personalize learning** is beneficial in PBL settings where differentiated instruction is crucial. **AI tools can support targeted instruction by tailoring lessons for diverse**

	learners, **encouraging student iteration on artifacts, and adapting materials to individual student strengths and weaknesses**. Helping students manage time and materials efficiently, tools like Trello and Cronofy, integrated with AI plug-ins, can predict resource needs. **AI-assisted design tools** like Autodesk Dreamcatcher and intelligent project management software such as Asana and Monday.com **can facilitate student project management, allowing them to focus on creative and critical thinking**. **AI-powered assessment systems**, such as Automated Essay Scoring (AES) and Automated Written Corrective Feedback (AWCF), **can offer real-time, continuous feedback, helping students to refine their work iteratively**. These systems not only reduce the teacher's workload but also enhance the accuracy and efficiency of grading, allowing teachers to focus on more meaningful interactions with students."
RQ2: What is the impact of using Generative AI in planning courses, classes, and assessments?	**Apoio ao Currículo e Avaliação** ● "Our findings suggest that LLM tools can support curriculum support (**project brainstorming and lesson planning**), assessment support (**rubric creation** with differentiation and grading), and **progress tracking**." **Apoio à Avaliação e Feedback** ● "Considering grading in PBL, AI-powered assessment systems, such as Automated Essay Scoring (AES) and Automated Written Corrective Feedback (AWCF), can offer real-time, continuous feedback, helping students to refine their work iteratively. These systems not only reduce the teacher's workload but also enhance the accuracy and efficiency of grading, allowing teachers to focus on more meaningful interactions with students." ● "Moreover, AI can support formative assessment practices by providing insights into students' progress, helping teachers guide and support them more effectively." **Redução da Carga Administrativa** ● "LLM tools can alleviate teachers' administrative burdens by organizing data, monitoring group performance, and curating 'output' responses. This allows teachers to remain at the center of the grading process while using the AI to enhance their ability to provide targeted and effective feedback." **Desafios** ● "However, teachers expressed concerns around the quality of LLM-generated feedback and the subjectivity involved in grading certain student artifacts."
RQ3: What challenges are present in adopting	**Desafios de Implementação e Recursos**

Generative AI for Project-Based Learning?	"PBL poses practical implementation challenges for educators around project design and management, assessment, and balancing student guidance with student autonomy." "The teachers noted a need for technical support and resources, and also raised concerns that this technology could exacerbate the digital divide due to varied access to reliable internet." **Questões Éticas e de Confiança** "The teachers identified concerns with ethics, personal agency, and student and teacher privacy. The need for human oversight is paramount to ensure fairness and accuracy in grading and feedback." "Another teacher voiced a concern about students' over-reliance on AI, stating, 'I want to encourage students to develop their own ideas, not just use a tool that's going to give them a generic idea...'" **Qualidade do Conteúdo e Limites da IA** "Additionally, teachers expressed concerns around the quality of LLM-generated feedback and the subjectivity involved in grading certain student artifacts." "Our teachers were skeptical about the reliability of LLMs to handle tasks that required a deep understanding of context or the subtle nuances involved in student expressions and multimodal creative artifacts."

A03

Paper ID:	A03
Title:	Construction and Application Effectiveness of a Project-Based Learning Model Based on Generative Artificial Intelligence
Author(s):	R., Guo, Rong; G., Li, Gui'an; H., Miao, Haifei; X., Huang, Xinyi; Z., Wang, Zhenzhong
Year:	2025
Publication Venue:	International Conference on Computer Science and Technologies in Education
Link:	https://ieeexplore.ieee.org/document/11092069
Abstract	Generative Artificial Intelligence (GAI), with its powerful text generation capabilities, has shown significant potential in the field of education. This study focuses on the application of GAI in programming education, aiming to explore its impact on enhancing students' computational thinking. Through literature review, we found that the application of GAI in programming education is still in its early stages, with a lack of empirical research on its

	effectiveness. To address this gap, this study proposes a project-based learning model that integrates GAI to enhance students' computational thinking. The model is constructed by analyzing the components of computational thinking, the key elements of project-based learning, and the potential roles of GAI in this context. To evaluate the effectiveness of the proposed model, a quasi-experimental study was conducted. Independent samples t-tests were used to compare pre- and post-test results. The findings revealed a significant improvement in students' computational thinking after participating in the GAI-enhanced project-based learning activities. Specifically, significant differences were observed in the sub-dimensions of creativity, algorithmic thinking, and problem-solving ability. However, no significant differences were found in the sub-dimensions of collaborative ability and critical thinking.
RQ1: How is Generative AI being used in Project-Based Learning?	**I. RESEARCH BACKGROUND AND PROBLEM STATEMENT** This study focuses on the application of GAI in programming education, aiming to explore its impact on enhancing students' computational thinking. To address this gap, this study proposes a project-based learning model that integrates GAI to enhance students' computational thinking. --- **III. MODEL CONSTRUCTION** Based on the analysis of the components of computational thinking, the elements of project-based learning, and the role of GAI in programming, we have constructed a project-based learning model supported by generative artificial intelligence (see Figure 1). **GAI Support** Q&A on professional knowledge Explain code and grammar Write and debug code **Guiding Students to Analyze Problems:** During this process, students may encounter difficulties related to specialized knowledge. At this point, they can leverage GAI's expertise to engage in interactive Q&A. **Presenting Code and Guiding Students in Learning Syntax:** However, due to differences in students' comprehension and individual learning needs, students in the experimental group interact with generative artificial intelligence (GAI) to learn the meaning of the code. Students can engage with GAI based on their cognitive levels and learning pace, enabling personalized learning. Additionally, the code contains various syntax rules, and students can ask GAI about the usage of syntax or request examples.

	● **Providing Different Problem Contexts:** When writing code, students often encounter issues such as letter case sensitivity, punctuation errors (e.g., mixing Chinese and English punctuation), and repeated errors, which can significantly reduce their self-efficacy. Therefore, students can collaborate with GAI to boldly write code, focusing on the logic while leaving error detection and correction to GAI. GAI helps students quickly identify errors and explains the reasons behind them.
RQ2: What is the impact of using Generative AI in planning courses, classes, and assessments?	O artigo não responde essa pergunta.
RQ3: What challenges are present in adopting Generative AI for Project-Based Learning?	O artigo não responde essa pergunta.

A04

Paper ID:	A04
Title:	Collaborative Uses of GenAI Tools in Project-Based Learning
Author(s):	M.A., Perifanou, Maria A.; A.A., Economides, Anastasios A.
Year:	2025
Publication Venue:	MDPI - education sciences
Link:	https://www.mdpi.com/2227-7102/15/3/354
Abstract	Artificial intelligence (AI) is forcing a dramatic transformation of the methods by which we acquire knowledge and engage in collaborative learning. Although there are several studies on how AI can support collaborative learning, there are no published studies examining how students can actually collaborate among themselves while interacting with AI tools. For this study, thirty postgraduate students were organized into teams of three, and each team developed a project mainly exploiting responses from ChatGPT, Google Gemini, and MS Copilot, as well as the internet and class resources. Each team selected a specific internet of things (IoT) application area and described the technologies and real-world cases in this area. Then, each team delivered a report with the full description of their project and their interactions with these generative AI (GenAI) tools and presented their work in class. Additionally, students answered an online questionnaire with closed- and open-ended questions and participated in focus group discussions. Members of each team collaborated to design prompts using five suggested modes of collaboration. Eventually, half of the students exploited all five collaborative modes, but they mostly liked and preferred three of these collaborative modes. On average, teammates initially disagreed 24% of the time but eventually reached an agreement. Students appreciated GenAI tools for their

	quick and well-structured responses, natural communication style, broad subject coverage, as well as their ability to simplify complex topics and support personalized learning. However, they expressed concerns about GenAI tools' inaccurate and inconsistent responses and identified key risks, such as passive learning, over-dependence, outdated information, and privacy issues. Finally, students recommended that GenAI tools should provide a shared and well-organized discussion space for collaborative prompt asking, allowing all team members to simultaneously view each other's prompts and the tool's responses. They also advised source verification and proper training to ensure these tools remain supplementary rather than primary learning resources.
RQ1: How is Generative AI being used in Project-Based Learning?	"For this study, **thirty postgraduate students were organized into teams of three, and each team developed a project mainly exploiting responses from ChatGPT, Google Gemini, and MS Copilot, as well as the internet and class resources.** Each team selected a specific Internet of Things (IoT) application area and described the technologies and real-world cases in that area. Then, each team delivered a report with the full description of their project and their interactions with these generative AI (GenAI) tools and presented their work in the classroom. Furthermore, the students answered an online questionnaire with both closed- and open-ended questions and participated in focus group discussions. **The members of each team collaborated to design prompts using five suggested collaboration modes.**"
RQ2: What is the impact of using Generative AI in planning courses, classes, and assessments?	O artigo não responde essa pergunta.
RQ3: What challenges are present in adopting Generative AI for Project-Based Learning?	"The main challenges the students faced while using GenAI tools were a **lack of confidence in the provided responses**, **difficulties in designing effective prompts**, **limited prior knowledge in the topic,** and **information overload**. The lack of confidence stems from the fact that **GenAI tools are known for providing hallucinations or inaccurate information. Students had to cross-reference the output with other sources, which was time-consuming. Prompt design was also a major challenge; students often found it hard to formulate a good prompt to get a useful response from the tool. Furthermore, if a student lacked background knowledge on a topic, it was challenging for them to evaluate the quality and accuracy of the GenAI output. The large amount of information generated by the tools was also a source of frustration, as students felt overwhelmed and struggled to synthesize the information effectively.** Finally, students also raised concerns about **academic integrity**, worrying about the originality of their work when using GenAI."

A05

Paper ID:	A05

Title:	Embracing Project-Based Assessments in the Age of AI in Open Distance e-Learning
Author(s):	E.(., du Plessis, EC (Elize)
Year:	2025
Publication Venue:	International Journal of Information and Education Technolog
Link:	https://www.ijiet.org/vol15/IJIET-V15N2-2249.pdf
Abstract	Even while Artificial Intelligence (AI) has long been a part of our lives, it has recently received more attention thanks to the Chat Generative Pre-Trained Transformer (ChatGPT) introduction. Since its launch in November 2022, writers have discussed its advantages and disadvantages for society. Considering the various applications of this easily accessible instrument, a significant discussion centres on how it affects learning and the academic setting. This paper discusses using ChatGPT for project-based assessments in online teacher education. Therefore, this paper aims to guide lecturers using ChatGPT to challenge students in learning and developing critical thinking abilities through various project-based evaluation methods. The constructivist paradigm was used in this exploratory case study to assess lecturers' preparedness for project-based assessment, aligning with a qualitative approach. Twelve lecturers with at least five years of Open and Distance e-learning (ODeL) experience were purposefully selected, and data was gathered via e-mail questionnaires focused on project-based assessment. Inductive analysis, a qualitative researcher synthesising and making sense of the data, was used to evaluate the questionnaire-transcribed data. Assessment is a necessary teaching skill, one of the most important critical aspects of teacher preparation. More emphasis on project-based evaluations that emphasise knowledge application should replace traditional, memorisation-based exams. Through project-based learning, students can show that they can apply what they have learned and engage in critical and creative thinking. Findings reveal that academic institutions and individual scholars must prioritise exploring AI technology, such as ChatGPT, and its implications within educational contexts. Moreover, project-based assessments are highly effective in fostering critical and creative thinking. These assessments encourage students to solve problems, collaborate, and apply theoretical knowledge to real-world scenarios. However, many students lack proficiency in project-based skills and struggle to apply knowledge from traditional resources to develop new ideas. Academic institutions should incorporate generative AI technology alongside project-based learning methodologies to prepare students for the rapidly evolving workplace. This approach promotes creative and critical thinking, collaboration, and the practical application of knowledge. © 2025 Elsevier B.V., All rights reserved.
RQ1: How is Generative AI being used in Project-Based Learning?	1. **Para criar cenários e perguntas desafiadoras**: 　◦ "If students utilise ChatGPT to create unique situations to which their exams would reply, academic users may find it helpful for **creating scenarios for real-world, case study-based assessments**. Because the assessment is unique and

	student-generated, this helps to ensure its validity and guards against plagiarism and other violations of academic integrity" . ◦ "First, questions like 'How could you tackle this new challenge using your prior knowledge and skills?' are a good starting point, and questions like 'What tactics would you employ to overcome any obstacles?' **challenge pupils to apply critical thinking and problem-solving skills**" .2. **Para desenvolver e personalizar avaliações e lições**: ◦ "Second, instructors can periodically evaluate their students' abilities and pinpoint areas for development by using ChatGPT to **design quizzes and assessments that gauge students' comprehension of the subject matter**" . ◦ "Third, ChatGPT may **create unique lessons based on each student's needs and skill level**, giving them progressively more challenging assignments to push themselves" . ◦ "Viljoen argues that **ChatGPT can generate differentiated assignments tailored to each student's needs and abilities, offering increasingly complex tasks to challenge individual students**". 3. **Para fornecer modelos de alta qualidade**: ◦ "Furthermore, ChatGPT can **produce excellent solutions to tasks and assignments, giving students access to high-quality models** " . ◦ "Furthermore, ChatGPT can provide examples of **high-quality responses to assignments and tasks to furnish students with exemplary models**" .
RQ2: What is the impact of using Generative AI in planning courses, classes, and assessments?	**Criação de Cenários e Perguntas para Avaliações:** ◦ "If students utilise ChatGPT to create unique situations to which their exams would reply, academic users may find it helpful for **creating scenarios for real-world, case study-based assessments**. **Because the assessment is unique and student-generated**, this helps to ensure its validity and guards against plagiarism and other violations of academic integrity." ◦ "First, questions like 'How could you tackle this new challenge using your prior knowledge and skills?' are a good starting point, and questions like 'What tactics would you employ to overcome any obstacles?' **challenge pupils to apply critical thinking and problem-solving skills**." • **Design de Questionários e Avaliações Personalizadas:** ◦ "Second, instructors can periodically evaluate their students' abilities and pinpoint areas for development by using ChatGPT to **design quizzes and assessments that gauge students' comprehension of the subject matter**." • **Criação de Lições Únicas e Adaptadas:**

	◦ "Third, ChatGPT may **create unique lessons based on each student's needs and skill level**, giving them progressively more challenging assignments to push themselves." ◦ "Viljoen argues that **ChatGPT can generate differentiated assignments tailored to each student's needs and abilities, offering increasingly complex tasks to challenge individual students**."
RQ3: What challenges are present in adopting Generative AI for Project-Based Learning?	**Preocupações com a Integridade Acadêmica e Plágio:** ◦ "The implications of using ChatGPT for assessment in higher education raise concerns related to **plagiarism and ethical issues**". ◦ "Because ChatGPT may **produce essays without giving credit where credit is due, it challenges current plagiarism-detection systems and encourages essay outsourcing**". ◦ "Academic integrity is jeopardised when generative AI presents generated content as original work since it violates ideals like honesty and justice". • **Potencial de Respostas Imparciais ou Incorretas:** ◦ "Evaluations' **impartiality and fairness may be impacted by biased replies from biased training data**". ◦ "Because ChatGPT lacks contextual knowledge, it may respond to complex assessment tasks **incorrectly or improperly**". ◦ "AI moves quickly from research laboratories to real-world applications, yet machine learning models that work well in the laboratory can fail in real-world use, with essential consequences". • **Dificuldade em Avaliar Habilidades Cognitivas Superiores:** ◦ "Furthermore, **higher-order cognitive skills like creativity and critical thinking are complex for AI-driven systems to evaluate**".

A06

Paper ID:	A06
Title:	Enhancing statistics education through Project-Based Learning (PBL) and the emergence of ChatGPT
Author(s):	L., Al-Labadi, Luai; A., Ly, Anna
Year:	2025
Publication Venue:	Wiley
Link:	https://onlinelibrary.wiley.com/doi/10.1111/test.12405
Abstract	In the 1990s, educators advocated for projects in statistical courses to enrich student learning. Prior research showcases the positive impact of Project-Based Learning (PBL), where students complete

	course-driven projects. In agreement with this perspective, we implemented PBL methodologies within two statistical courses at a North American research-intensive university: "Survey, Sampling, & Design" and "Experimental Design." Students were invited to participate in an optional survey to share their opinions regarding the course project. Consistent with existing literature, our findings indicate that students hold favorable views towards course-based projects, noticing benefits such as understanding real-life applications, collaboration, and enhancing data analysis skills. Additionally, many students have incorporated the use of generative AI for their works, such as ChatGPT, and shared the advantages of such tools in their coursework. Drawing from our experiences, we propose strategies to enhance course projects and address concerns related to the overreliance of generative AI tools.
RQ1: How is Generative AI being used in Project-Based Learning?	**Impressão Positiva:** "For me I think ChatGPT is really helpful for **assisting in code and general-and-quick check for written report**, sometimes using chatgpt is truly time-saving and more efficient in some steps of the project, such as coding. **This is because in this case you [don't] need to [search] google and hence save your time for doing other things." "for me, AI is a better version of google.** It saves me a lot of time, especially when I am trying to build an overview of something." "I have used ChatGPT in the past to act as a 24/7 TA. This has actually helped me in the unexpected way of making double check the [output] of the GPT with course materials since it can make errors and that causes me to remember better!"

◦ **Impressão Mista:** "Chatgpt is more suitable for **making final summaries and providing analytical views**, but is not suitable for calculating data, because Chatgpt's calculations are terrible."
"I think **generative AI tools are helpful when I am struggling with the outlines, it can provide a nice guide for my study.** However, AI tools like Chatgpt is kind of helpless in analysis or explanations with weak logics and weird word choosing."

◦ **Impressão Negativa:** "I don't think it would be super useful. Normally for technical questions, the responses are filled with errors, so if you don't understand the concepts you won't be able to fix them, and if you do, there's not much need for ChatGpt, fixing the errors can take just as long as writing it up yourself." |
| **RQ2: What is the impact of using Generative AI in planning courses, classes, and assessments?** | 1. **Ameaça aos métodos de avaliação tradicionais e risco para o desenvolvimento do aluno:** "An escalating number of students rely on ChatGPT to assist in completing their coursework, **threatening the traditional essay assessment method.** While recognizing students' use of ChatGPT to clarify basic misunderstandings, debug code, and refine their work, **there is a risk that excessive reliance on AI could compromise students' writing proficiency and critical thinking, thereby hindering the students' growth in writing.**"
2. **Influência na qualidade dos relatórios e necessidade de intervenção:** "We suspected (and confirmed) that students used generative AI to help write the introduction, discussion, limitations, and conclusion. During interrogations, several groups |

	could not explain their thought process and admitted to utilizing generative AI tools. We asked all students to re-write their reports and re-marked with a slight penalty to their projects." "Nonetheless, **the quality of the submitted reports falls short of the standards set before the 2023–2024 academic year.** Two potential explanations for this discrepancy could be the excessive dependence on AI tools and the disruptive impact of the COVID-19 pandemic on students' educational experiences." 3. **Ajustes significativos nos métodos de avaliação (substituição de relatórios escritos por exames orais): "To address the over-reliance on generative AI tools, significant adjustments were made to the 'Experimental Design' course**... Instead of submitting written formal reports, students were tasked with showcasing their data analysis and responding to inquiries regarding their study during an oral examination." "**With the emergence of generative AI, we believe oral examinations may increasingly become prevalent to uphold academic rigor and ensure a comprehensive understanding of students' projects.**" "As a temporary solution, the plan is to reduce the number of reports that focus on writing and replace them with oral examinations. However, conducting oral examinations for each group is time-consuming, and students personally reported to the TA that they were a source of significant stress." "The oral examination will be used in certain cases with extreme group conflicts and/or students are suspected to have not written their report, and will be used to replace the final draft mark."
RQ3: What challenges are present in adopting Generative AI for Project-Based Learning?	1. **Risco para a proficiência em escrita e pensamento crítico dos alunos:** "An escalating number of students rely on ChatGPT to assist in completing their coursework, threatening the traditional essay assessment method. While recognizing students' use of ChatGPT to clarify basic misunderstandings, debug code, and refine their work, there is a risk that **excessive reliance on AI could compromise students' writing proficiency and critical thinking**, thereby hindering the students' growth in writing." 2. **Dificuldade em detectar o uso indevido e o plágio:** "The TA explicitly warned students that generative AI tools would be considered an academic offense. Although **there are currently no reliable ways to detect generative AI usage**, we interrogated several groups about their technical reports if we were suspicious of students using generative AI to write ideas for them. There were peculiar patterns in student projects, where multiple groups presented similar yet unique approaches compared to previous years." "We suspected (and confirmed) that students used generative AI to help write the introduction, discussion, limitations, and conclusion. During interrogations, **several groups could not explain their thought process and admitted to utilizing generative AI tools**. We asked all students to re-write their reports and re-marked with a slight penalty to their projects." 3. **Dependência excessiva e abuso por parte dos alunos:** "A recent challenge to facilitating course projects is dealing with students who **overly rely on Generative AI tools**, such as ChatGPT."

"Many students admitted to using Generative AI tools in the survey, despite their prohibition in the course syllabus." "To address RQ4—the impact of generative AI tools on course projects—many students tend to use generative AI tools and **may abuse their use to write the majority of the project**."

A07

Paper ID:	A07
Title:	Evaluating the Impact of Unrestricted GenAI Usage on Experiential-Based Learning
Author(s):	J.W., Browning, Jonathan W.; J.D., Bustard, John D.; N., Anderson, Neil; L.B., Galway, Leo B.
Year:	2024
Publication Venue:	IEEE 13th International Conference on Engineering Education (ICEED)
Link:	https://ieeexplore.ieee.org/document/10923772
Abstract	This work examines the usage and experience of students using generative AI (genAl) in a engineering entrepreneurship experiential-based learning course. It utilizes a project-based learning approach, where students are in teams of five. The course takes place over a full academic year, i.e., the fall and spring semesters. One of the aims of the course is to be as realistic as possible within an academic setting, with the students trying to create a new technology-based business, in the hopes that they will continue their ventures after the course concludes. Therefore, the teams were allowed to and encouraged to use any genAI they wish throughout the course to assist them. Outside of academia, it would be expected that a start-up founder would use genAl to speed up many aspects of starting their business. Therefore, we want to examine how the students use genAI without there being any constraints. As part of the summative assessment for the course each student peer assesses the members of their team. Included within that they also 'peer assess' genAI as though it were another team member, which is a critical reflection of their genAI usage. This work addresses how students use genAI, in experiential-based learning courses when they are allowed to use it any way possible to assist them. The study uses a quantitative and qualitative approach with student data from their 'peer assessment' (i.e., critical reflection) of their genAI usage from the academic year 2023/24. Within the peer assessment of the genAI team member the students answer Likert-scale statements to be rated on a five-point semantic differential scale. The results indicate a varied adoption and value of genAI across different project phases. While some students appreciated genAI for speeding up specific tasks, its contribution to creative processes like ideation was less impactful.

RQ1: How is Generative AI being used in Project-Based Learning?	"This work examines the usage and experience of students using generative AI (genAI) in a engineering entrepreneurship experiential-based learning course. It utilizes a project-based learning approach, where students are in teams of five. The course takes place over a full academic year... **Therefore, the teams were allowed to and encouraged to use any genAI they wish throughout the course to assist them. Outside of academia, it would be expected that a start-up founder would use genAI to speed up many aspects of starting their business.** Therefore, we want to examine how the students use genAI without there being any constraints."
RQ2: What is the impact of using Generative AI in planning courses, classes, and assessments?	O artigo não responde essa pergunta.
RQ3: What challenges are present in adopting Generative AI for Project-Based Learning?	"Integrating generative Artificial Intelligence (genAI) into experiential learning methods presents an **innovative challenge and opportunity**." • "While some students appreciated genAI for speeding up specific tasks, its **contribution to creative processes like ideation was less impactful**." • "However, **from a pedagogical perspective there is still uncertainty around the best practice of the inclusion of genAI within entrepreneurship education**." • "The results indicate a varied adoption and value of genAI across different project phases. While some students appreciated genAI for speeding up specific tasks, its contribution to creative processes like ideation was less impactful."

A08

Paper ID:	A08
Title:	iReflect: Enhancing Reflective Learning with LLMs – A Study on Automated Feedback in Project Based Courses
Author(s):	B., Anand, Bhojan; Q.S., Long, Quek Sze
Year:	2025
Publication Venue:	International Conference on Computer Supported Education
Link:	https://www.scitepress.org/Link.aspx?doi=10.5220/0013435800003932
Abstract	Reflective learning in education offers various benefits, including a deeper understanding of concepts, increased self-awareness, and higher-quality project work. However, integrating reflective learning into the syllabus presents challenges, such as the difficulty of grading and the manual effort required to provide in-dividualised feedback. In this paper, we explore the use of Large Language Models (LLMs) to automate formative feedback on student reflections. Our study is conducted in the CS4350 Game Development Project course, where students work in teams to develop a game through multiple milestone assessments over the semester. As part of the reflective learning process, students write

	reflections at the end of each milestone to prepare for the next. Students are given the option to use our automated feedback tool to improve their submissions. These reflections are graded by Teaching Assistants (TAs). We analyse the impact of the tool by comparing students' initial reflection drafts with their final submissions and surveying them on their experience with automated feedback. In addition, we assess students' perceptions of the usefulness of reflective writing in the game development process. Our findings indicate that students who revised their reflections after using the tool showed an improvement in their overall reflection scores, suggesting that automated feedback improves reflection quality. Furthermore, most of the students reported that reflective writing improved their learning experience, citing benefits such as increased self-awareness, better project and time management, and enhanced technical skills.
RQ1: How is Generative AI being used in Project-Based Learning?	"In this paper, we explore the use of Large Language Models (LLMs) to **automate formative feedback on student reflections**. Our study is conducted in the CS4350 Game Development Project course, where students work in teams to develop a game through multiple milestone assessments over the semester. As part of the reflective learning process, students write reflections at the end of each milestone to prepare for the next. Students are given the option to use our automated feedback tool to improve their submissions." • "With Bhojan and Hu (2024)'s work as the primary motivation, this study aims to **develop an automated feedback feature using generative AI and Large Language Models (LLMs) that students can utilise to improve the quality of their reflections**, thereby improving the quality of their work. By developing an automated system, each reflection can be assessed consistently without personal bias and timely feedback can be given to students at their own convenience. LLMs also have the added advantage of being able to generate feedback that can be tailored to each student's unique experiences." • "The automated feedback system is implemented as a feature in iReflect, a web application tool developed in our university that can facilitate critical peer review, discussions over peer reviews and individual reflections over multiple milestones (Tan, 2022). To study the effectiveness of our automated feedback tool in enhancing reflective learning, we conducted a study in the course CS4350: Game Development Project. CS4350 is a project-based game development course with high demand on creative and technical skills, which has integrated reflective learning as part of its coursework after the study by Bhojan and Hu (2024)." • "iReflect provides an **automated reflection feedback feature that can generate timely feedback for a student's reflection** at the student's own convenience. ... In this study, a new feedback system based on LLM prompting was developed and integrated into iReflect and replaces the use of AcaWriter." • "The new feedback system utilises **OpenAI's GPT-4o model**, which is considered to be at the forefront of developed LLMs."

	• "After writing their reflection, the students have the option to **generate feedback using the automated feed-back system**." • "By leveraging LLMs, we developed an **automated feedback system that provided students with timely, personalized insights on their reflections**. Findings from the CS4350 course study show that the system significantly improved reflection quality, with students appreciating its concrete suggestions and specific feedback."
RQ2: What is the impact of using Generative AI in planning courses, classes, and assessments?	O artigo não responde essa pergunta.
RQ3: What challenges are present in adopting Generative AI for Project-Based Learning?	"So far, only two automated feedback systems have been developed specifically for reflective writing, both of which use rule-based AI (Knight et al., 2020; Solopova et al., 2023). However, **no studies have yet explored the use of generative AI or large language models (LLMs) in this context.**" "Some concerns pointed out by Solopova et al. (2023) regarding the use of LLMs is the **lack of transparency and control over the output and hallucinations**, which was why a rule-based AI using traditional machine learning models was preferred." "Our implementation is **limited by the lack of high-quality reflection feedback data for training and fine-tuning**. Enlisting trained human graders to provide gold-standard data would help establish a stronger benchmark for LLM-generated feedback." "Another challenge is the use of OpenAI's GPT model, which, while powerful, **operates as a black-box system**. Unlike rule-based AI, its **feedback generation lacks transparency, making theoretical soundness difficult to verify**. As such, it is best suited for formative feedback, complemented by human review." "Lastly, using a third-party LLM raises **privacy concerns**. To mitigate risks, we restricted reflections to coursework-related content, excluding personal data. However, **one student still cited privacy concerns as a reason for avoiding the tool**." "However, it is noted that there is still a sizable number of students who do not find the feedback useful in encouraging deeper reflection, replying with neutral or even disagreement to the first question. Among these responses, there are various reasons pro-vided, the most common reason was that the fea-ture which used a rubric as its basis of feedback felt too "**rigid**" and "**formulaic**". They felt that the feed-back system was just "**ticking off criteria**" without en-couraging "**deeper exploration or improvement in the quality and depth of the content**", and that these sec-tions may not always be relevant to all reflections. This relates back to Bourner (2003)'s theory that stu-dent reflections involve personal, emergent learning which is hard to assess with a predetermined crite-ria. Another point of improvement that students men-tioned is that **inconsistency of the feedback**, which

	may still provide different scores and replies given the same or just slightly different input."

A09

Paper ID:	A09
Title:	Teaching project management with generative AI: A pedagogical model for responsible and sustainable practice
Author(s):	T.I., Ruark, Terri Iacobucci; C., Biazzin, Cristiane
Year:	2025
Publication Venue:	International Journal of Management Education
Link:	https://www.sciencedirect.com/science/article/pii/S1472811725001028
Abstract	This study presents an innovative pedagogical approach integrating generative AI into project management education across five MBA courses. The research examines a structured teaching model where students applied AI tools to self-selected "Dream Projects" aligned with their career aspirations. Data analysis of 863 student submissions revealed that AI-enhanced project-based learning transformed the educational experience by repositioning faculty as learning facilitators and enabling students to engage with complex project management challenges more effectively. The teaching approach was organized around five structured modules that systematically incorporated AI applications throughout the project lifecycle, from initiation and planning to execution and closure. Students demonstrated improved decision-making capabilities, particularly in scheduling, risk assessment, and stakeholder communication, with 93 % actively applying AI tools across multiple project phases. The pedagogical model contributes to sustainable development goals by enhancing quality education (SDG 4), preparing students for evolving workplace demands (SDG 8), and developing the technical fluency needed for industrial innovation (SDG 9). This approach demonstrates how higher education can simultaneously cultivate technological competence and ethical judgment while preparing students for an AI-transformed professional landscape. © 2025 Elsevier B.V., All rights reserved.
RQ1: How is Generative AI being used in Project-Based Learning?	"The teaching approach was organized around **five structured modules that systematically incorporated AI applications throughout the project lifecycle, from initiation and planning to execution and closure**." "**The course was divided into five modules, each focusing on different phases of the project lifecycle and incorporating specific AI applications**, as summarized in Table 2. **In Module 1: Project Initiation and AI-Enhanced Ideation**, students began by selecting their "Dream Projects" based on personal interests and career aspirations. **We introduced generative AI as a brainstorming and project scoping tool, asking students to use AI to generate potential project ideas aligned with their career goals, develop preliminary project charters, and compare**

AI-generated project scope statements with manually created ones. **Module 2** focused on Stakeholder Analysis and Communication Planning, **where students employed AI to enhance stakeholder management processes by creating comprehensive stakeholder registers with AI-suggested categories, generating tailored communication strategies, and drafting initial project announcements and stakeholder engagement plans**."

"For Risk Assessment and Mitigation Strategies in **Module 3**, **students explored AI's capabilities in risk management through identifying potential project risks not initially considered, generating probability-impact matrices, and developing AI-assisted risk response plans with customized mitigation strategies**. **Module 4** addressed Resource Allocation and Scheduling, **focusing on practical project planning with AI support for creating WBS structures, generating optimized project schedules based on resource constraints, and comparing AI and traditional approaches to critical path analysis**. In **Module 5**: Project Execution and Control Systems, **students implemented their projects with AI-enhanced monitoring by developing AI-assisted dashboards for project tracking, using AI to generate status reports and performance analyses, and employing AI to identify potential corrective actions for project variances. The final module on Project Closure and Knowledge Management had students conclude their projects by creating AI-enhanced lessons- learned documentation, generating comprehensive project closure reports, and reflecting on how AI transformed their project management approach**."

"In the project management course where AI integration was required, **students used tools such as ChatGPT and Claude throughout the full project lifecycle, from initial brainstorming to budget development. AI applications were embedded into core assignments to reinforce PMI-aligned processes and promote practical engagement with key knowledge areas, including scope definition, scheduling, cost estimation, stakeholder communication, and risk management**."

"**Students were expected to interact with AI tools for content generation and for decision support, scenario modeling, and task refinement**. For example, **AI was used to explore project ideas, structure work breakdowns, generate risk registers, estimate costs, and simulate budget scenarios**. This consistent use of AI across phases encouraged students to view the tools as active collaborators in the project planning and execution process."

"In addition to these core tasks, **students were expected to incorporate AI tools into their project work**. Their use of AI was evaluated based on how effectively they integrated it into their planning and decision-making processes. **For instance, students might use AI to generate work breakdown structures, assist in risk analysis, or estimate project costs**."

	"**Rather than using AI tools solely to meet assignment requirements, many engaged beyond expectations by submitting bonus insights, exploring new tools, or extending their use of AI to unassigned aspects of their work**. The most common uses of AI involved support for specific project management functions: schedule optimization (85 %), risk assessment (82 %), and stakeholder communication (78 %)."
RQ2: What is the impact of using Generative AI in planning courses, classes, and assessments?	"Data analysis of 863 student submissions revealed that AI-enhanced project-based learning **transformed the educational experience by repositioning faculty as learning facilitators and enabling students to engage with complex project management challenges more effectively**." "The integration of AI into project-based learning demonstrated positive effects on students' decision-making and efficiency. Students reported improvements in scheduling, workflow automation, data analysis, and process optimization, which contributed to enhanced analytical reasoning and technical skills. These findings **reinforce the value of combining project autonomy with AI- supported learning, aligning with existing educational theories that emphasize the benefits of individualized learning in adult education**." "The study demonstrated that when faculty design learning experiences with structured AI integration points, they create environments where theory and practice converge naturally, **enabling deeper assessment through authentic artifacts rather than traditional examinations**."
RQ3: What challenges are present in adopting Generative AI for Project-Based Learning?	"[...] and the limitations, **particularly the need for human judgment in validating outputs and aligning them with project constraints**." "Another limitation is the **variability in the AI tools used by students, which led to different experiences. Some students found the AI-generated insights useful, while others noted that sme outputs required human validation for accuracy. AI bias and accuracy also emerged as important considerations, with students reporting occasional discrepancies in the AI-generated results**."

A10

Paper ID:	A10
Title:	Bridging Academia and Industry: Leveraging Generative AI in a Software Engineering Course for Practical Industry Experiences
Author(s):	D.M., Mejia, Daniel M.; E.D.V., Holmes, Ernest D.V.; J., Marroquin, Jenn; J., Gorson Benario, Jamie
Year:	2025
Publication Venue:	ACM Conference on Innovation and Technology in Computer Science Education
Link:	https://dl.acm.org/doi/10.1145/3724363.3729036
Abstract	The rapid adoption of generative AI across the tech industry demands a corresponding evolution in educational practices. By

	proactively incorporating generative AI, educational institutions can ensure their programs remain relevant and continue to provide students with the skills necessary for career success. This work presents an intro Software Engineering course, Software Development Studio (SDS), designed and implemented by Google in collaboration with faculty, to ensure students acquire industry-relevant skills. The course focuses on integrating generative AI tools into software engineering practices, mirroring the evolving methodologies used by professionals in the field. The curriculum emphasizes practical, real-world projects, providing early undergraduate computer science students hands-on experience using generative AI tools. Data collected during the Spring 2024 semester from students and faculty reveals a positive experience and enhancement of software engineering learning through the integration of generative AI.
RQ1: How is Generative AI being used in Project-Based Learning?	"**SDS aims to enhance the educational impact of students success through the integration of generative AI tools into a software engineering focused course and effective pedagogic best practices and critical thinking provided by academic programs.** In particular, active learning strategies, namely project based learning, were used to provide students the mechanism to engage with realistic problems and solutions. […] The SDS course builds upon relevant pedagogical approaches that emphasize industry-oriented project based learning through prototyping and system design. Additionally, the course utilizes development processes and methodologies including the use of agile software development, design and integration of industry tools and services, and the responsible and practical use of Generative AI to develop prototype systems as a means for practical learning experiences. **The students in this course were instructed to use generative AI primarily as a prompting tool, as a code developing assistant, and as a service.**"
RQ2: What is the impact of using Generative AI in planning courses, classes, and assessments?	"Given the increased use of generative AI in industry, the course required an update to the course objectives and learning outcomes in Summer 2023. The course was redesigned […] with experience leveraging generative AI tools for software development. Course outcomes were developed to integrate the needs of industry software engineering practices and introduce generative AI tools into the course. **The use of Generative AI in this course expanded on established use cases in Computer Science education including gathering information, assistance in coding, and prompt engineering.** Moreover, the mechanism used for generating the content for generative AI tools was based on the IDEE framework for using ChatGPT in Education: 1. identify the desired outcomes, 2. determine the appropriate level of automation, 3. ensure ethical consideration, and 4. evaluate the effectiveness."
RQ3: What challenges are present in adopting Generative AI for Project-Based Learning?	"As part of the changing landscape, it is necessary to begin teaching students both formalized software engineering with industry-standard tools. Academic programs focus on teaching the fundamentals of software engineering, critical thinking, and responsible and ethical use of services. Open questions exist in how to effectively maintain all of the key fundamentals while

providing instruction on the latest state-of-the-art tools, specifically generative AI."

"**With the addition of instruction on generative AI tools, instructors identified some limitations. […] there was a large breadth of topics that needed to be covered. Due to this, some topics may have lacked the necessary depth that would be most beneficial for students. From a technical point of view, there were issues with the amount of time it took to set up the tools and the ability to access them in different parts of the world. […] An instructor stated 'when generating unit tests, the functionality would return the wrong answer'.**"

A11

Paper ID:	A11
Title:	"Hi Kids, Let's Talk About How Snakes Hunt": Understanding the Process of Children's Instructional Video Creation through a Workshop Study
Author(s):	Z., Cai, Zhenyao; S., Wei, Shiyao; A., Han, Ariel; K.A., Peppler, Kylie A.
Year:	2025
Publication Venue:	Proceedings of the 24th Interaction Design and Children
Link:	https://dl.acm.org/doi/10.1145/3713043.3728859
Abstract	As children increasingly transition from media consumers to "prosumers" on user-generated content platforms, developing their media and content creation literacies becomes critical. Yet little research examines how children engage with video creation or how emerging technologies, such as generative AI, can support this creative process. This study explores children's engagement and challenges during a two-week, project-based learning workshop where they learned to create educational videos teaching school-aligned science topics. Our exploratory findings suggest that educational video creation activity, when designed properly, can serve as an intervention for the dual learning of science literacy and media literacy. In the workshop, children showed different engagement profiles: some were self-directed and motivated by both science learning and video creation, some focused primarily on learning the science content, some treated the activity as a classroom assignment, and others disengaged from the process. Building on insights from our findings, We also extend Shneiderman's Collect-Relate-Create-Donate (CRCD) model to better support children's creativity. We propose design directions including conversational, filtered, and multimodal information gathering for the Collect phase; role-based peer and family interaction for the Relate phase; low-floor, high-ceiling creation tools for the Create phase; and positioning children as meaningful sharers of content while supporting education around content sharing, privacy, and audience awareness for the Donate phase.

RQ1: How is Generative AI being used in Project-Based Learning?	"In Stage 2 of the workshop, **children were introduced to two tools for finding information:** general search engines and conversational search tools... **Additionally, we introduced Generative AI, explaining how it works and discussing the potential for misinformation. In the second part of the workshop, students used the three tools—Kiddle, PlayLab.ai, and their search techniques—to find at least three facts related to their question...** Similar to stage 2, we used Playlab.ai, an education-focused and customizable LLM tool, to support scriptwriting and storyboarding... students used the AI tool as a source of inspiration rather than a shortcut, selecting useful parts of the AI's output and rephrasing them in their own words."
RQ2: What is the impact of using Generative AI in planning courses, classes, and assessments?	"While most students, including those who initially struggled to translate their ideas into scripts and storyboards, successfully used the AI tool to produce scripts with clear introductions, main points, and conclusions, the tool's design played a crucial role. It guided students step-by-step in writing their scripts; however, when students faced challenges, the tool often provided completed outputs. **While this approach ensured task completion, it ultimately made students overly dependent on the tool's output. Most children (9 out of 13) opted to copy the AI-generated content with minimal adaptation… While students appreciated the assistance, the resulting outputs often lacked personalization, self-expression, and creativity.**"
RQ3: What challenges are present in adopting Generative AI for Project-Based Learning?	"Children generally appreciated AI-powered tools as search engines over traditional search engines… **However, children did not fully recognize the potential for AI to produce inaccurate or misleading results… many children relied heavily on AI-generated content, often copying and pasting answers directly without additional effort or synthesis…** While this approach ensured task completion, it ultimately made students overly dependent on the tool's output… the resulting outputs often lacked personalization, self-expression, and creativity."

A12

Paper ID:	A12
Title:	Towards a Retrieval-Augmented Generation Framework for Originality Evaluation in Projects-Based Learning Classrooms
Author(s):	S., Yanes-Luis, Samuel; D.G., Gutiérrez-Reina, Daniel Gutiérrez; S.T., Marín, Sergio Toral
Year:	2025
Publication Venue:	Education Sciences
Link:	https://www.mdpi.com/2227-7102/15/6/706
Abstract	Project-Based Learning is central to modern engineering education, but assessing the originality of student work poses significant challenges, particularly when previous project repositories are accessible. This paper addresses the issue by proposing a framework based on Retrieval-Augmented Generation and Large Language Models to evaluate the originality of project

	proposals in the context of a master's course in Electronic Engineering. The system processes and summarizes prior work—including reports, code, and presentations—creating a semantically indexed knowledge base. Upon receiving a new proposal, the RAG system compares it to this base, identifies the most similar previous works, and generates an originality assessment. Results show the effectiveness of the approach, with a strong correlation (coefficient of 0.87) between the originality scores assigned by the system and those given by expert instructors in a blind evaluation. The proposed RAG system demonstrates its ability to systematically detect similarities and potential lack of originality that might be overlooked by human evaluators due to the volume of prior work. This framework provides an objective and efficient tool to support originality assessment, benefiting both instructors and students by promoting genuine innovation in PBL settings. © 2025 Elsevier B.V., All rights reserved.
RQ1: How is Generative AI being used in Project-Based Learning?	"This paper addresses the issue by proposing **a framework based on Retrieval-Augmented Generation and Large Language Models to evaluate the originality of project proposals** in the context of a master's course in Electronic Engineering." "To address the problem of originality in projects, it is proposed to **use a RAG system that allows students and the instructor to interact with an LLM**." "Thus, this article presents and validates **a framework based on Retrieval-Augmented Generation (RAG) and Large Language Models (LLMs) as a viable and effective solution to address this originality assessment challenge** in the context of the Advanced Digital Systems and Applications course." "**From the student perspective, the tool functions as a formative assistant during the ideation phase. It provides feedback about the novelty of an idea, retrieves similar previous projects, and suggests refinement**."
RQ2: What is the impact of using Generative AI in planning courses, classes, and assessments?	Não responde.
RQ3: What challenges are present in adopting Generative AI for Project-Based Learning?	"A first class of failure involves **mismatches between the RAG score and the instructors' perception of novelty**. [...] This suggests that **the system tends to penalize projects that share vocabulary or components with common patterns in the corpus, even when the conceptual framing is new**." "**The system retrieved a similar prior project based on PIR sensors, interpreting the structural similarity as significant, despite the difference in sensor technology**. **This** shows the system's capacity to recall structural analogies that instructors may miss, but also **exposes its limitation in recognizing meaningful technical distinctions**."

"These cases illustrate a general pattern: **the system is conservative near the upper end of the scale and sensitive to recurring terminology or architectures, sometimes under estimating pedagogically novel work**."

"Several students reported that the tool was useful for shaping ideas but noted that **its performance strongly depended on how explicitly the idea was described. If the proposal was vague or underspecified, the system often failed to interpret it meaningfully**. Others pointed out that **when asked for highly original ideas, the system occasionally responded with suggestions that were too complex or impractical for the scope of the course**. These behaviors suggest that **the system** is effective when properly guided, but **may not be well-suited to early-stage ideation without support**."

"However, they also noted that **the system tended to be overly strict, rarely assigning top scores even to projects they considered outstanding**. These observations point to **three key limitations**: (1) **the system's reliance on surface-level similarity may obscure recognition of conceptual novelty**, (2) its suggestions and evaluations are highly sensitive to input precision, and (3) **the scoring model lacks adaptability to the pedagogical goals of each specific course**."

A13

Paper ID:	A13
Title:	Leveraging Genai Tool in Design Drawing: A Case Study of an Architecture Course in a Chinese University
Author(s):	X., Liu, Xiaokai; F., Chiang, Fengkuang; Y., Tan, Yuqiao; X., Wu, Xinyi; Y., Cha, Yingying; C.P., Lim, Cher Ping
Year:	2025
Publication Venue:	International Journal of Artificial Intelligence in Education
Link:	https://link.springer.com/article/10.1007/s40593-025-00507-4
Abstract	Generative Artificial Intelligence (GenAI) introduced new possibilities and challenges into university classrooms across various disciplines. In particular, the text-image generation technology has significantly impacted architecture and design education throughout the whole process, from initial idea brainstorming to the manufacturing of the final artifact products. Based on a mixed-method case study of a Project-based Learning (PBL) Design Drawing course for first-year students who majored in architecture in a Chinese university, this paper examines how a text-image GenAI tool, *Midjourney,* is integrated into the course to improve student learning experiences and outcomes. The key findings suggest that the integration of the GenAI tool in the course has a positive impact on both students' learning experiences and outcomes. Notably, students with limited foundational competencies benefited more significantly from using the tool; it

	may have bridged the competency gaps among peers. Additionally, a positive correlation is observed between the frequency of GenAI usage and improved learning outcomes. *Midjourney* enhanced students' artistic competencies, aesthetic sensibility, and confidence. Identified challenges from the case study encompassed equitable access to GenAI technologies, the extent of teacher intervention, and *Midjourney's* technical drawbacks. This exploration offers a practical example for advancing pedagogical approaches and fostering creativity and innovation in architecture education and relevant fields. It contributes to evolving educational paradigms and provides actionable pathways for reconstructing design pedagogy across related disciplines.
RQ1: How is Generative AI being used in Project-Based Learning?	O artigo não responde essa pergunta.
RQ2: What is the impact of using Generative AI in planning courses, classes, and assessments?	"Regarding the course design, **the instructor emphasized the significant pedagogical benefits of utilizing GenAI tools before and during class sessions.** […] During class, students engaged in hands-on practice, **receiving immediate feedback from both Midjourney and the instructor, which enhanced their engagement and minimized the need for extensive lecturing. This way, the instructor can transfer to an inspirational mentor in the classroom.**" "For the assessment of each project, the instructor meticulously reviewed the students' assignments and graded the manual drawings and the GenAI-generated process images. Subsequently, the course instructor compared and analyzed the manual drawings with the GenAI-generated ones, and **the comprehensive improvement of students' grades and in-class performance was observed to identify students' learning status and assess whether and how the progress has been made.**"
RQ3: What challenges are present in adopting Generative AI for Project-Based Learning?	"While the integration of Midjourney has significantly impacted teaching and learning, several challenges persist from the instructor's perspective […] Firstly, **accessibility remains a significant issue due to national policy restrictions, the high cost of software licenses, and technical barriers.** […] **Another key challenge for the course instructor is balancing instructional guidance with student creativity and prompts training.** […] Additionally, **the instructor also indicated that there is currently no definitive quantitative standard for measuring the specific outcomes of GenAI tools in educational settings, posing challenges in the assessment of students' learning outcomes.** […] Thirdly, **it is further highlighted challenges in ethical concerns […] copyright disputes are also a significant issue.**" "Students also reported challenges that they encountered. **Despite Midjourney's proficiency in generating initial design concepts, students realized that its effectiveness depends heavily on their language ability to provide specific and detailed prompts in English.** […] **the tool's effectiveness diminishes for abstract design tasks and vague descriptions, potentially leading to adverse outcomes such as generating unsatisfactory images and student frustration in using the tool.**"

A14

Paper ID:	A14
Title:	Collaborative project-based learning in global health: Enhancing competencies and skills for undergraduate nursing students
Author(s):	S., Lee, Sujin; J., Yoon, Juyoung; Y., Hwang, Yeji
Year:	2024
Publication Venue:	BMC Nursing
Link:	https://bmcnurs.biomedcentral.com/articles/10.1186/s12912-024-02111-8
Abstract	

Abstract

Background

Despite the importance of collaboration and communication in global health, existing educational approaches often rely on traditional one-way instruction from instructor to student. Therefore, this study aimed to evaluate the effectiveness of a newly developed undergraduate curriculum on global health in enhancing nursing students' competencies in global health and communication, problem-solving, and self-directed learning skills.

Methods

A 15-week course "Global Health and Nursing" was designed for undergraduate nursing students, and a collaborative project-based learning method was used. Study participants were undergraduate nursing students enrolled in the course. The study was a multi-method study and included quantitative and qualitative components. It employed a one-group pretest–posttest design to quantitatively assess the impact of the curriculum. Additionally, student experiences with the learning process were qualitatively explored through a focus group interview. A total of 28 students participated in this study, and 5 of them participated in the focus group interview.

Results

The collaborative project-based learning method significantly improved global health competency ($t = -10.646$, $df = 22$, $p < 0.001$), with a large effect size. It also improved communication skills ($t = -2.649$, $df = 22$, $p = 0.015$), problem-solving skills ($t = -3.453$, $df = 22$, $p = 0.002$), and self-directed learning skills ($t = -2.375$, $df = 22$, $p = 0.027$). Three themes were found through the focus group interview: (a)

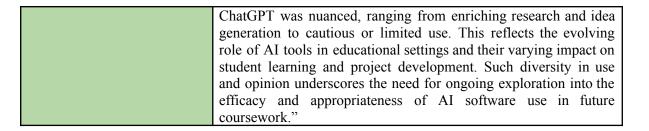|	Promoting global health competency; (b) Fostering life skills through collaborative projects; and (c) Recommendations for future classes. The focus group interview indicated that overall, the study participants were satisfied with the collaborative project-based method for global health education. **Conclusions** This study confirms that project-based learning significantly boosts the competencies and skills of students, recommending its broader adoption in nursing education. Nursing instructors should consider adopting this teaching approach for global health education at the undergraduate level. Future studies may employ a longitudinal design to assess the prolonged effects of the collaborative project-based learning approach, particularly focusing on the long-term retention of skills and the broader applicability of this model across different educational settings.
RQ1: How is Generative AI being used in Project-Based Learning?	"**The course director actively encouraged students to utilize generative artificial intelligence (AI) software, such as ChatGPT, as a pedagogical tool to augment learning outcomes. Specifically, the students were allowed to leverage this generative AI software for various educational purposes, including initiating discussions, generating ideas, and assisting with their English writing for the final paper. This innovative approach aimed to enhance student engagement and understanding by integrating cutting-edge technology into the learning process, thereby facilitating a more interactive and supportive educational environment.**"
RQ2: What is the impact of using Generative AI in planning courses, classes, and assessments?	"**Students reported diverse experiences with generative AI software. These experiences ranged from highly beneficial to eliciting skepticism, illustrating the diverse ways in which students interacted with and perceived the value of generative AI in their studies.** One student leveraged ChatGPT for initial guidance, particularly for outlining and collecting related materials for their part of the project. … Another student found ChatGPT extremely useful for exploring cases, precedents, and solutions related to their project topic and appreciated the varied answers and insights it provided. … Furthermore, a student highlighted that the use of ChatGPT was limited to English translation tasks within their group, and another student expressed their distrust of ChatGPT, citing its unreliability as a major concern… **Overall, the landscape of student interactions with ChatGPT was nuanced, ranging from enriching research and idea generation to cautious or limited use.** This reflects the evolving role of AI tools in educational settings and their varying impact on student learning and project development."
RQ3: What challenges are present in adopting Generative AI for Project-Based Learning?	"Furthermore, a student highlighted that the use of ChatGPT was limited to English translation tasks within their group, and another student expressed their distrust of ChatGPT, citing **its unreliability as a major concern, which led them to avoid using the tool altogether.** Overall, the landscape of student interactions with

	ChatGPT was nuanced, ranging from enriching research and idea generation to cautious or limited use. This reflects the evolving role of AI tools in educational settings and their varying impact on student learning and project development. Such diversity in use and opinion underscores the need for ongoing exploration into the efficacy and appropriateness of AI software use in future coursework."

A15

Paper ID:	A15
Title:	Use of Search Tools in Software Development: A Study of Microservice-Based Team Projects
Author(s):	Y.M., Lau, Yi Meng; C.M., Koh, Christian Michael; L., Jiang, Lingxiao
Year:	2025
Publication Venue:	International Conference on Computer Supported Education, CSEDU - Proceedings
Link:	https://ink.library.smu.edu.sg/sis_research/10140/
Abstract	Universities are increasingly integrating real-world projects into software engineering curricula to prepare students for careers involving complex concepts like Microservices Architecture (MSA). Students frequently struggle with such concepts within limited class time and turn to various search tools and online resources for additional help. Search tools are also widely used in the software development industry. While search engines, like Google and Yahoo!, can provide quick solutions, they pose the risk of information overload. Large Language Models (LLMs) such as ChatGPT, offer the advantage of delivering more precise answers. Studies have shown that LLMs can comprehend codes, assist in system architectural design, and suggest solutions, potentially enhancing the learning experience for students. This study aims to determine how students make use of search tools for their team projects in a software development course that teaches MSA. It will also explore if search tools can enhance learning in team projects by facilitating collaborative, peer, and self-directed learning, and propose methods to address any limitations. © 2025 Elsevier B.V., All rights reserved.
RQ1: How is Generative AI being used in Project-Based Learning?	"Survey results showed that 67 (94.4%) **students use LLMs or search engines for their team projects**." "The survey data shows that **students use search tools in their projects with a higher preference for LLMs**."
RQ2: What is the impact of using Generative AI in planning courses, classes, and assessments?	Não responde.
RQ3: What challenges are present in adopting	"Four students (5.6%) indicated they do not use either, as they prefer to get help from their peers and reason that **they do not trust LLMs' coding abilities**."

| Generative AI for Project-Based Learning? | "On some occasions, LLMs **provide a generalized perspective** (8.164) (see L2 in Figure 4) **and require well-crafted prompts to get the desired results** (8.746)(see L3 in Figure 4), but their natural language capability simplifies prompt creation (8.284) (see L4in Figure 4)." |

A16

Paper ID:	A16
Title:	The underlying potential of NLP for microcontroller programming education
Author(s):	A., Rocha, Andre; L., Sousa, Lino; M., Alves, Mário; A.J.M., Sousa, Armando Jorge M.
Year:	2024
Publication Venue:	Wiley
Link:	https://onlinelibrary.wiley.com/doi/10.1002/cae.22778
Abstract	The trend for an increasingly ubiquitous and cyber-physical world has been leveraging the use and importance of microcontrollers (µC) to unprecedented levels. Therefore, microcontroller programming (µCP) becomes a paramount skill for electrical and computer engineering students. However, µCP poses significant challenges for undergraduate students, given the need to master low-level programming languages and several algorithmic strategies that are not usual in "generic" programming. Moreover, µCP can be time-consuming and complex even when using high-level languages. This article samples the current state of µCP education in Portugal and unveils the potential support of natural language processing (NLP) tools (such as chatGPT). Our analysis of µCP curricular units from seven representative Portuguese engineering schools highlights a predominant use of AVR 8-bit µC and project-based learning. While NLP tools emerge as strong candidates as students' µC companion, their application and impact on the learning process and outcomes deserve to be understood. This study compares the most prominent NLP tools, analyzing their benefits and drawbacks for µCP education, building on both hands-on tests and literature reviews. By providing automatic code generation and explanation of concepts, NLP tools can assist students in their learning process, allowing them to focus on software design and real-world tasks that the µC is designed to handle, rather than on low-level coding. We also analyzed the specific impact of chatGTP in the context of a µCP course at ISEP, confirming most of our expectations, but with a few curiosities. Overall, this work establishes the foundations for future research on the effective integration of NLP tools in µCP courses.
RQ1: How is Generative AI being used in Project-Based Learning?	"Our analysis of µCP curricular units from seven representative Portuguese engineering schools highlights a predominant use of AVR 8‑bit µC and project‑based learning. While NLP tools emerge as strong candidates as students' µC companion, their

	application and impact on the learning process and outcomes deserve to be understood. This study compares the most prominent NLP tools, analyzing their benefits and drawbacks for μCP education, building on both hands‑on tests and literature reviews. **By providing automatic code generation and explanation of concepts, NLP tools can assist students in their learning process, allowing them to focus on software design and real‑world tasks that the μC is designed to handle, rather than on low‑level coding.** We also analyzed the specific impact of chatGTP in the context of a μCP course at ISEP, confirming most of our expectations, but with a few curiosities. Overall, this work establishes the foundations for future research on the effective integration of NLP tools in μCP courses."
RQ2: What is the impact of using Generative AI in planning courses, classes, and assessments?	O artigo não responde essa pergunta.
RQ3: What challenges are present in adopting Generative AI for Project-Based Learning?	"Nonetheless, **the adoption of LLMs and other cutting‑edge technologies in education present challenges and controversies**. Given the novelty of these technologies, **research on the topic is scarce, resulting in knowledge gaps such as student usage, effective implementation, and the repercussions on the educational system.** It is imperative to investigate the impact and optimal integration of these tools, specifically in the context of higher education" . • "The potential uses of these technologies in an educational setting, along with their **ethical and privacy implications** , and the short, medium, and long‑term effects on μCP education, are still open" • AI "also **raises concerns about academic integrity and cheating**" • "Although the aforementioned related studies explore the usage of NLP tools in programming education, we observe that given the novelty of this subject, there is **limited research available, and more focused on the capabilities of these tools rather than their impact on students' behavior, learning outcomes, and the adaptation of current pedagogical methods**" • The article also highlights that adopting Generative AI in the specific domain of microcontroller programming (often taught using PBL) needs to address its "unique challenges: **low‑level programming, limited memory, and processing resources, real‑time constraints, interfacing with various hardware components, sensing and actuating over physical objects, power management, embedded systems debugging, and electronics knowledge**".

A17

Paper ID:	A17

Title:	Reshaping Engineering Technology Education: Fostering Critical Thinking through Open-Ended Problems in the Era of Generative AI
Author(s):	M., Narayan, Meenakshi; L.K., Saharan, Lokesh Kumar
Year:	2024
Publication Venue:	ASEE Annual Conference and Exposition, Conference Proceedings
Link:	https://peer.asee.org/47944.pdf
Abstract	Academic integrity breaches and plagiarism existed long before the rise of Generative Artificial intelligence (G-AI), where students used paid online tutoring platforms like Chegg to obtain help with homework assignments, take-home exams, and course projects. Additionally, G-AI platforms such as ChatGPT provide students with immediate support in understanding concepts and improving problem-solving abilities. However, it also opens up possibilities for students to improperly use the technology for homework and exams. This necessitates a revision in how educators design curricula and create assignments and projects. This paper discusses four teaching strategies integrated with G-AI; a) AI-assisted learning, b) Students evaluating AI generated solutions, c) Research-based learning with AI, and d) Open-ended project-based learning. Implementation of these strategies in electrical and robotics engineering technology courses such as circuits analysis, signal processing, and robotics systems is explored. These courses often require assignments that involve theoretical analysis and coding, solutions for which can easily be generated with AI. Therefore, employing these strategies in these courses is more important to effectively address plagiarism and enhance learning. An analysis comparing grade point average scores showed that student performance improved by 11.1% in the year 2023 when the proposed strategies were applied, compared to 2022 when the strategies were not implemented. This improvement was attributed to the in-class final exams conducted without access to textbooks or the internet, indicating that students had developed a solid understanding of the material and tackle final exam questions successfully. Integrating AI into teaching strategies and revamping the engineering curriculum marks a crucial advancement in preserving academic integrity and aligning with the dynamic demands of the engineering and technology fields. © 2024 Elsevier B.V., All rights reserved.
RQ1: How is Generative AI being used in Project-Based Learning?	"Through project-based learning, **students might engage with AI to gather and analyze information on telerobotics and haptics technology, drawing upon AI-generated codes and system designs to conceptualize a telerobotic haptic robot tailored for the maintenance of transmission lines**, as demonstrated in Fig. 4." "In general, **students could refer to G-AI databases that generate conceptual ideas and instructions for systems design, embedded programming, coding, and circuits design and**

	simulation to name a few, and adapt these techniques for their specific projects."
RQ2: What is the impact of using Generative AI in planning courses, classes, and assessments?	Não responde.
RQ3: What challenges are present in adopting Generative AI for Project-Based Learning?	Não responde.

A18

Paper ID:	A18
Title:	Charting the Future of AI in Project-Based Learning: A Co-Design Exploration with Students
Author(s):	C., Zheng, Chengbo; K., Yuan, Kangyu; B., Guo, Bingcan; R., Hadi Mogavi, Reza; Z., Peng, Zhenhui; S., Ma, Shuai; X., Ma, Xiaojuan
Year:	2024
Publication Venue:	Conference on Human Factors in Computing Systems - Proceedings
Link:	https://dl.acm.org/doi/abs/10.1145/3613904.3642807
Abstract	Students' increasing use of Artificial Intelligence (AI) presents new challenges for assessing their mastery of knowledge and skills in project-based learning (PBL). This paper introduces a co-design study to explore the potential of students' AI usage data as a novel material for PBL assessment. We conducted workshops with 18 college students, encouraging them to speculate an alternative world where they could freely employ AI in PBL while needing to report this process to assess their skills and contributions. Our workshops yielded various scenarios of students' use of AI in PBL and ways of analyzing such usage grounded by students' vision of how educational goals may transform. We also found that students with different attitudes toward AI exhibited distinct preferences in how to analyze and understand their use of AI. Based on these findings, we discuss future research opportunities on student-AI interactions and understanding AI-enhanced learning. © 2024 Elsevier B.V., All rights reserved.
RQ1: How is Generative AI being used in Project-Based Learning?	Não responde. O artigo pediu para estudantes especularem usos de GenAI em PBL no futuro, então ele não responde como GenAI está sendo usada atualmente.
RQ2: What is the impact of using Generative AI in planning courses, classes, and assessments?	"In PBL, students tackle authentic problems and generate artifacts such as reports or models as solutions [9, 70]. Use of technology in PBL is usually encouraged in PBL [9, 33]. Thus, it is conceivable that AI tools will be increasingly adopted by students in PBL with instructors' permission, if not already. Artifacts produced in PBL usually serve as key indicators of students' learning outcomes [78]. However, the increasing use of AI tools in producing these artifacts

	raises questions about their reliability as accurate measures of student learning [28, 68, 73].” “One alternative strategy is to **base the assessment on detailed documentation and reports of the PBL process data, possibly in the form of presentations or learning journals** [9, 78].” “**The task delegation to AI can bypass these critical active learning steps. To this end, the goal of effective use of AI could harm students' active learning.**”
RQ3: What challenges are present in adopting Generative AI for Project-Based Learning?	“PBL engages students in solving real-world problems. But **there is a risk that students may fall into a situation where the "doing" of a project takes precedence over "doing with understanding"** [6]. **In previous PBL, these two goals have had the potential to complement each other, as succeeding in practical tasks generally requires students to develop specific skill sets. However, the advent of AI technologies adds a layer of complexity.** Many participants considered practicing and demonstrating skills in effectively utilizing AI important for future PBL (Sec. 4.2). They considered tasks that AI can do better should be delegated to AI. [...] In this way, the growing capability of AI suggests **students would be in an oversight position for many tasks in PBL, including some that require creativity and critical thinking**, which will help students understand knowledge better. [...] **The task delegation to AI can bypass these critical active learning steps. To this end, the goal of effective use of AI could harm students' active learning.**”

A19

Paper ID:	A19
Title:	Generative-AI Assisted Feedback Provisioning for Project-Based Learning in CS Courses
Author(s):	V.A., Kusam, Venkata Alekhya; L., Moore, Larnell; S., Shrestha, Summit; Z., Song, Zheng; J., Lu, Jin; Q., Zhu, Qiang
Year:	2024
Publication Venue:	ASEE Annual Conference and Exposition, Conference Proceedings
Link:	https://peer.asee.org/generative-ai-assisted-feedback-provisioning-for-project-based-learning-in-cs-courses
Abstract	Project-Based Learning (PBL) is a pedagogical method that combines theory and practice by involving students in real-world challenges. Continuous feedback is crucial in PBL, guiding students to improve their methods and foster progressive thinking. However, PBL faces challenges in widespread adoption due to the time and expertise needed for effective feedback, especially with increasing student numbers. This paper presents a novel approach using Generative AI, specifically an enhanced ChatGPT, to provide effective PBL feedback. For an undergraduate Web Technology course, we integrated three methods: 1) fine-tuning ChatGPT with feedback from various sources; 2) using additional course-specific information for context; 3) incorporating external services for

	specialized feedback. We developed a tool that implements these methods both independently and in a combined fashion. We assessed the effectiveness of the tool we developed by conducting user studies, which confirmed that this tool improves the quality of feedback as compared with general-purpose ChatGPT. By acquiring and retaining knowledge from different sources, our approach offers a powerful component for implementing PBL on a large scale.
RQ1: How is Generative AI being used in Project-Based Learning?	**"ChatGPT Feedback: For some of the checkpoints, we provided students with the pre-designed prompts. They were encouraged to use these prompts, to seek feedback from ChatGPT on their projects. These prompts were tailored to the specific requirements of each checkpoint, which enabled ChatGPT to offer both comprehensive and detailed feedback."**
RQ2: What is the impact of using Generative AI in planning courses, classes, and assessments?	**"Designing this course as a PBL with the integration of continuous feedback,effectively connects theoretical concepts with practical implementation, thereby enhancing the course learning objectives."**
RQ3: What challenges are present in adopting Generative AI for Project-Based Learning?	"Although providing relevant information related to the course and students' past checkpoint submissions helps the general-purpose generative AI model to offer high-level feedback that falls within the specific requirements and limitations of the course, **it still lacks the necessary context for providing specific task-level feedback**. For instance, the rubrics for Checkpoint 2 in our Web Technology PBL course include a requirement for code validation, which, although is considered by the previous method, but it still lacks sufficient capability to perform code analysis on its own, thus providing a generic response for code validation. **This shortfall arises because these generative AI models do not possess a comprehensive understanding of current coding standards and practices that are essential for quality coding.** "By integrating external services to handle such specific task-level functionality and using their results as context, we further enhance the ability of the general-purpose generative AI model to deliver more accurate and specific detailed feedback."

A20

Paper ID:	A20
Title:	PROJECT BASED ASSESSMENT IN THE ERA OF GENERATIVE AI-CHALLENGES AND OPPORTUNITIES
Author(s):	N., Boughattas, Naouel; W., Neji, Wissal; F., Ziadi, Faten
Year:	2024
Publication Venue:	Proceedings of the International CDIO Conference
Link:	https://cdio.org/sites/default/files/documents/360_CDIO%202024%20Proceedings.pdf
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.
RQ1: How is Generative AI being used in Project-Based Learning?	"**Students integrate AI tools at various stages of the project, including integration, design, project analysis and mainly the coding phase.**" "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."
RQ2: What is the impact of using Generative AI in planning courses, classes, and assessments?	"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.**" "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.**"
RQ3: What challenges are present in adopting Generative AI for Project-Based Learning?	"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.**" "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.**"

A21

Paper ID:	A21
Title:	Application to Enhance the Programming Knowledge of Children
Author(s):	A., Dissanayake, Anuga; V., Lakpriya, Vishwa; M.C.M.A., Sanjeevan, Mahendran C.M.A.; A.F.A., Fahmi, Ahamed F.A.; S.E.R., Siriwardana, Samanthi E.R.; M., Samaraweera, Mihiri
Year:	2024
Publication Venue:	-
Link:	https://ieeexplore.ieee.org/document/10851171
Abstract	This proposal outlines the development of a comprehensive educational platform aimed at bridging the Information Technology knowledge gap among Tamil-speaking students in Sri Lanka. The platform is designed to enhance programming skills through personalized quizzes, hands-on projects, and adaptive learning models. The application focuses on two primary components: the first component emphasizes project-based learning and assessments, leveraging advanced Artificial Intelligence models for generating educational content. This model is combined with Retrieval-Augmented Generation, which retrieves relevant external information to refine and tailor the educational content to each student's needs. This component keeps students engaged and challenged at appropriate levels, promoting deeper understanding and practical Information Technology skills. The second component involves a Level-based IT Fundamental Knowledge Evaluation system, which incorporates machine learning algorithms to predict student performance, recommend customized learning paths, and assess overall technical knowledge. The platform also integrates the OpenAI Application Programming Interface, which provides real-time Tamil translation, making the content more accessible to the target demographic. The platform empowers educators to better address individual student needs with real-time feedback and tailored experiences. Its innovative approach enhances Information Technology education, equipping Sri Lankan students with essential programming skills to succeed globally. © 2025 Elsevier B.V., All rights reserved.
RQ1: How is Generative AI being used in Project-Based Learning?	"The "Teaching Kids Programming Through Quizzes and Projects" concentrates on developing the individualized learning that meets the needs of every individual learner. In this regard, **the system applied LLAMA2 to create quizzes and projects whilst RAG was used in terms evolution to tailor the developing content through refinement so that it was suitable for the children by their ages and abilities.** In order to meet the language requirements of the participants, the OpenAI API was included in to enable instantaneous translation of the quiz and project requirements to Tamil."
RQ2: What is the impact of using Generative AI in planning courses, classes, and assessments?	Permite conteúdo personalizado para os estudantes: "For instance, when compared with other language models such as GPT-3, BERT, and others, LLAMA2 with RAG made sure the needs of generation, retrieving and searching relevant content were

	met by **producing content that was not only contextualized, but catered for the particular needs of every learner.**" "This approach also proved effective for the project generation component of the system. **Generating project prompts which could be adequately demanding as well as fitting within the students' skill sets** was a task that involves comprehension, creativity, and flexibility attributes which LLAMA2 performed quite well in. **This improved adaptability meant that in addition to generating project prompts, there would be lower efforts required in managing the projects since the outputs could be enhanced interactively as LLAMA2's capabilities were harnessed through RAG framework.**"
RQ3: What challenges are present in adopting Generative AI for Project-Based Learning?	Não responde.

A22

Paper ID:	A22
Title:	ChatGPT in Data Visualization Education: A Student Perspective
Author(s):	N., Kim, Namwook; H., Ko, Hyung-kwon; G., Myers, Grace; B., Bach, Benjamin
Year:	2024
Publication Venue:	Proceedings of IEEE Symposium on Visual Languages and Human-Centric Computing, VL/HCC
Link:	https://ieeexplore.ieee.org/document/10714575
Abstract	Unlike traditional educational chatbots that rely on pre-programmed responses, large-language model-driven chatbots, such as ChatGPT, demonstrate remarkable versatility to serve as a dynamic resource for addressing student needs from understanding advanced concepts to solving complex problems. This work explores the impact of such technology on student learning in an interdisciplinary, project-oriented data visualization course. Throughout the semester, students engaged with ChatGPT across four distinct projects, designing and implementing data visualizations using a variety of tools such as Tableau, D3, and Vega-lite. We collected conversation logs and reflection surveys after each assignment and conducted interviews with selected students to gain deeper insights into their experiences with ChatGPT. Our analysis examined the advantages and barriers of using ChatGPT, students' querying behavior, the types of assistance sought, and its impact on assignment outcomes and engagement. We discuss design considerations for an educational solution tailored for data visualization education, extending beyond ChatGPT's basic interface. © 2024 Elsevier B.V., All rights reserved.

RQ1: How is Generative AI being used in Project-Based Learning?	Estudantes usaram ChatGPT para auxiliar no desenvolvimento de seus projetos: "**Throughout the semester, students engaged with ChatGPT across four distinct projects, designing and implementing data visualizations using a variety of tools such as Tableau, D3, and Vega-lite.**" "The positive experiences with ChatGPT in the course primarily revolved around its usefulness in **coding sections of the assignments, as noted by all participants. It helped fill the knowledge gap for those new or unfamiliar with web development.**" "Others described various benefits including **debugging & error resolution** (P1, P5, P6, P11, P12, P14), **understanding advanced programming concepts** (P1, P5, P7, P8, P14), **generating starter code like templates & outlines** (P4, P5, P6, P8, P12), and boosting confidence in programming (P1, P5, P7, P9, P12)." "Some participants appreciated unexpected opportunities through their interaction with ChatGPT including **unanticipated insights, problem-solving methods, and understanding of new concepts** (P1, P3, P5, P7, P8, P14)."
RQ2: What is the impact of using Generative AI in planning courses, classes, and assessments?	Não responde.
RQ3: What challenges are present in adopting Generative AI for Project-Based Learning?	Respostas erradas demandam esforço para serem verificadas: "**Inaccurate responses necessitated extra verification efforts**, which ironically pushed some participants towards traditional learning resources (P3, P14), or affected the overall quality of work (P11, P14)." Dificuldades para obter respostas desejadas: "**Participants found that they had to be extremely specific to avoid vague answers (P4, P5, P13) or often they could not fathom what went wrong in their questions** [...]" Limitação de memória do ChatGPT: "Participants also expressed frustration with **ChatGPT's memory limitations and its impact on the effective understanding of user questions** [...]" Preocupação de possível dependência: "**Worries About Developing Dependence and Hindering Learning: Several participants expressed worries about becoming overly dependent on ChatGPT** [...]"

A23

Paper ID:	A23
Title:	A PBL-Based Mini Course Module for Teaching Computer Science Students to Utilize Generative AI for Enhanced Learning
Author(s):	V.A., Kusam, Venkata Alekhya; S., Shrestha, Summit; K.A., Kattan, Khalid A.; B.R., Maxim, Bruce R.; Z., Song, Zheng
Year:	2024
Publication Venue:	Proceedings - Frontiers in Education Conference, FIE
Link:	https://ieeexplore.ieee.org/document/10893118
Abstract	This research-to-practice paper introduces a mini-course module designed to teach computer science students how to interact more efficiently with Generative AI(GAI). The rapid rise of GAI is transforming education by providing students with easy access to knowledge and answers to their questions, acting as a personal tutor. Particularly in the field of computer science, where GAI can easily generate code based on specific requirements, many instructors struggle to prevent students from using tools like ChatGPT for completing assigned programming assignments and homeworks. However, we argue that 1) the use of GAI is inevitable, necessitating a redesign of courses so that students cannot merely rely on GAI without actual learning; and 2) students' learning can be enhanced if they learn to use GAI more effectively. In this paper, we demonstrate how we integrate Project-Based Learning to design the course module in a concise yet effective manner, which not only facilitates students' learning of GAI but also enriches their learning in relation to the host course where this mini-course module is embedded. In particular, the goal of this module is to teach CS students: 1) the basic principles and workflow of GAI; 2) Prompt Engineering: how to craft questions to interact more effectively with GAI; and 3) Extending GAI: how to create interactive tools by training customized GAI models. Designed to be completed within two weeks, the mini-course module can easily be incorporated into host courses. This mini-course module was integrated into a graduate-level Artificial Intelligence course with 42 students in Winter 2024. To assess the module's impact on student learning and engagement, we conducted pre- and post-course surveys as well as student interviews. The results from the surveys and interviews highlighted key areas for improving the design of educational modules to better teach essential GAI skills. These insights focused on enhancing student engagement and learning efficiency within a concise time frame. © 2025 Elsevier B.V., All rights reserved.
RQ1: How is Generative AI being used in Project-Based Learning?	Estudantes aplicando conhecimento de GenAI para o projeto: "Mini-Project: The mini-project involves **students fine tuning a GAI model using data relevant to specific concepts from the host course.** This project helps them deepen their understanding and integrate their learning with the broader curriculum of the host course."

	"After the lectures and hands-on labs, we require students to initiate a mini-project that they propose themselves. Following project-based learning guidelines, **students are asked to identify a problem related to the topics taught in the host course and apply their knowledge of Generative AI (GAI) to design and develop a solution.**"
RQ2: What is the impact of using Generative AI in planning courses, classes, and assessments?	Não responde.
RQ3: What challenges are present in adopting Generative AI for Project-Based Learning?	Dificuldade dos estudantes para entender usar os conceitos e ferramentas por conta própria para desenvolver o projeto: "**Initial challenges with understanding complex AI concepts suggest a need for additional instructional support or resources.**" "However, challenges with datasets and setups indicate **a need for better introductory resources.**"

A24

Paper ID:	A24
Title:	Empowering Secondary School Teachers: Creating, Executing, and Evaluating a Transformative Professional Development Course on ChatGPT
Author(s):	H., Reichert, Heidi; B.T., Tabarsi, Benyamin T.; Z., Zang, Zifan; C., Fennell, Cheri; I., Bhandari, Indira; D., Robinson, David; M., Drayton, Madeline; C., Crofton, Catherine; M., Lococo, Matthew; D., Xu, Dongkuan
Year:	2024
Publication Venue:	Proceedings - Frontiers in Education Conference, FIE
Link:	https://ieeexplore.ieee.org/abstract/document/10893106
Abstract	Background and Context. This innovative practice full paper describes the development and implementation of a professional development (PD) opportunity for secondary teachers to learn about ChatGPT. Incorporating generative AI techniques from Large Language Models (LLMs) such as ChatGPT into educational environments offers unprecedented opportunities and challenges. Prior research has highlighted their potential to personalize feedback, assist in lesson planning, generate educational content, and reduce teachers' workload, alongside concerns such as academic integrity and student privacy. However, the rapid adoption of LLMs since ChatGPT's public release in late 2022 has left educators, particularly at the secondary level, with a lack of clear guidance on how LLMs work and can be effectively adopted. Objective. This study aims to introduce a comprehensive, free, and vetted ChatGPT course tailored for secondary teachers, with the objective of enhancing their technological competencies in LLMs and fostering innovative teaching practices. Method. We

	developed a five-session interactive course on ChatGPT capabilities, limitations, prompt-engineering techniques, ethical considerations, and strategies for incorporating ChatGPT into teaching. We introduced the course to six middle and high school teachers. Our curriculum emphasized active learning through peer discussions, hands-on activities, and project-based learning. We conducted pre- and post-course focus groups to determine the effectiveness of the course and the extent to which teachers' attitudes toward the use of LLMs in schools had changed. To identify trends in knowledge and attitudes, we asked teachers to complete feedback forms at the end of each of the five sessions. We performed a thematic analysis to classify teacher quotes from focus groups' transcripts as positive, negative, and neutral and calculated the ratio of positive to negative comments in the pre- and post-focus groups. We also analyzed their feedback on each individual session. Finally, we interviewed all participants five months after course completion to understand the longer-term impacts of the course. Findings. Our participants unanimously shared that all five of the sessions provided a deeper understanding of ChatGPT, featured enough opportunities for hands-on practice, and achieved their learning objectives. Our thematic analysis underlined that teachers gained a more positive and nuanced understanding of ChatGPT after the course. This change is evidenced quantitatively by the fact that quotes with positive connotations rose from 45% to 68% of the total number of positive and negative quotes. Participants shared that in the longer term, the course improved their professional development, understanding of ChatGPT, and teaching practices. Implications. This research underscores the effectiveness of active learning in professional development settings, particularly for technological innovations in computing like LLMs. Our findings suggest that introducing teachers to LLM tools through active learning can improve their work processes and give them a thorough and accurate understanding of how these tools work. By detailing our process and providing a model for similar initiatives, our work contributes to the broader discourse on teaching professional educators about computing and integrating emerging technologies in educational and professional development settings. © 2025 Elsevier B.V., All rights reserved.
RQ1: How is Generative AI being used in Project-Based Learning?	Professores participantes usaram ChatGPT para criar uma lição como projeto: "**Participants worked on their final project: to create a lesson on ChatGPT, using ChatGPT, for their classrooms. After considering their topics and generating lesson plans using ChatGPT, teachers manually revised the plans and created student activities for their lessons.**"
RQ2: What is the impact of using Generative AI in planning courses, classes, and assessments?	Não responde.

RQ3: What challenges are present in adopting Generative AI for Project-Based Learning?	Não responde.

A25

Paper ID:	A25
Title:	Application of generative artificial intelligence to assessment and curriculum design for project-based learning
Author(s):	T., Wu, Tao; M., Chang, Maiga
Year:	2023
Publication Venue:	International Conference on Engineering and Emerging Technologies
Link:	https://ieeexplore.ieee.org/document/10525933
Abstract	This paper proposes an integrated generative AI learning literacy approach based on project-based learning to harness the transformative potential of generative AI in higher education. It provides a novel framework for integrating generative AI into project-based learning that aims to develop students' skills in three key aspects to grasp the application of generative AI as an effective problem-solving tool: (1) understanding algorithmic mechanisms, (2) identifying biases, and (3) using AI tools to solve problems. The process of integrating generative AI begins with assessing prior knowledge, introducing relevant problem-solving learning and AI tools, and designing course pathways and peer assessments through social media to cultivate students' problem-solving pathways. In addition, this paper recommends evaluating the effectiveness of AI-integrated courses through a comprehensive post-course survey of students and instructors.
RQ1: How is Generative AI being used in Project-Based Learning?	"This paper proposes an integrated generative AI learning literacy approach based on project-based learning to harness the transformative potential of generative AI in higher education. It provides **a novel framework for integrating generative AI into project-based learning that aims to develop students' skills in three key aspects to grasp the application of generative AI as an effective problem-solving tool: (1) understanding algorithmic mechanisms, (2) identifying biases, and (3) using AI tools to solve problems.** The process of integrating generative AI begins with assessing prior knowledge, introducing relevant problem-solving learning and AI tools, and designing course pathways and peer assessments through social media to cultivate students' problem-solving pathways."
RQ2: What is the impact of using Generative AI in planning courses, classes, and assessments?	"This paper proposes competency-based learning model that leverage generative artificial intelligence tools to reform assessment and curriculum. [...] Integrating generative AI into a competency-driven PBL framework will enable higher education to keep pace with technological change. [...] The benefits of integrating generative AI into PBL for instructors and students are

	as follows. [...] **The main points of integrating generative AI as a tool in project based curriculum design are as follows, including purpose, curriculum design components, and assessment.**"
RQ3: What challenges are present in adopting Generative AI for Project-Based Learning?	"Based on the above technical analysis of generative artificial intelligence, two key points must be understood as below: • The key capability of AI is to generate coherent, fluent expressions based on training data. • Generative AI under the LLM model actually knows nothing about the world outside the training data. Therefore, the output content generated by generative AI must be treated with caution." "**Limitations and potential risks include: less critical thinking, questionable authenticity, lack of strong evidence, less innovation and novelty, somewhat superficial, and ethical risk.** [...] Learners should know that generative AI should not replace the expertise and judgment of teachers, but rather be used as a supportive co-pilot. [...] The use of LLM's tools must be in accordance with the school's policies."

A26

Paper ID:	A26
Title:	The AI-Supported Instructional Design in PBL Integrating Chinese Language Learning and Multimedia Creation
Author(s):	S., Sugie, Satoko
Year:	2023
Publication Venue:	-
Link:	https://library.apsce.net/index.php/ICCE/article/view/1062
Abstract	The rapid development of AI (Artificial Intelligence) is enhancing the potential to accelerate a paradigm shift in foreign language teaching and learning. Instructional design must shift beyond knowledge learning and skills training to include more significant opportunities for practical application in authentic contexts. To do so, it is necessary to investigate the pedagogical possibilities of generative AI through specific educational practices. Thus this study intends to explore the potential of using generative AI to improve the efficiency and effectiveness of PBL (Problem/Project Based Learning) which integrates foreign language, information media, and professional education. This study suggests a PBL course design integrating Chinese language, tourism, and multimedia creation learning outcomes at a Japanese university, as a preliminary phase to compare and examine the teaching and learning processes between traditional methods and proactive AI-enabled methods. Through qualitative exploration of integrating generative AI into traditional instructional design, this paper considers how to organize the elements of teaching and learning for a renewed approach with greater efficiency and quality of learning outcomes. © 2024 Elsevier B.V., All rights reserved.

RQ1: How is Generative AI being used in Project-Based Learning?	Estudantes usam GenAI para auxiliar na criação de seus projetos: "The class has two main themes. [...] **Second, the students create a tourism promotional video in Chinese. For this purpose, students make a video in groups that discovers, co-creates, and promotes local attractions from the learner's perspective.** This requires extracurricular collaboration." "**Consider the focus of the plan based on the keywords of the concept interacting with AI.**" "**Generate images and videos interactively with AI.**" "**Translate Japanese into Chinese using AI.**" "**Input the sentences via AI chat and translation APPs, practice through listening to the synthetic voice pronunciation.**" "**Creating Synthesized Speech with AI.**" Professores usam GenAI para auxiliar na gestão do projeto: "**Collect information from AI on trends in preferences and needs of Chinese inbound tourists (data prior to 2021).**" "**Categorize the focus and evaluation perspectives using AI based on the requirements of the structure chart.**" "**Consider more appropriate wording using AI.**" "**Summarize students' comments and create mind maps with AI.**"
RQ2: What is the impact of using Generative AI in planning courses, classes, and assessments?	Não responde.
RQ3: What challenges are present in adopting Generative AI for Project-Based Learning?	Necessidade de supervisão dos professores: "However, **human teachers are still needed to provide integrated instruction based on their experience in dealing with each diverse learner. In conversations and collaborative work, teachers must provide pedagogical instruction that fosters autonomous, interactive, and in-depth learning.**"

A27

Paper ID:	A27
Title:	AI Mentors for Student Projects: Spotting Early Issues in Computer Science Proposals
Author(s):	G., Aher, Gati; R., Schmucker, Robin; T.M., Mitchell, Tom M.; Z.C., Lipton, Zachary Chase
Year:	2025

Publication Venue:	Proceedings of Machine Learning Research
Link:	https://arxiv.org/abs/2503.05782
Abstract	When executed well, project-based learning (PBL) engages students' intrinsic motivation, encourages students to learn far beyond a course's limited curriculum, and prepares students to think critically and maturely about the skills and tools at their disposal. However, educators experience mixed results when using PBL in their classrooms: some students thrive with minimal guidance and others flounder. Early evaluation of project proposals could help educators determine which students need more support, yet evaluating project proposals and student aptitude is time-consuming and difficult to scale. In this work, we design, implement, and conduct an initial user study (n = 36) for a software system that collects project proposals and aptitude information to support educators in determining whether a student is ready to engage with PBL. We find that (1) users perceived the system as helpful for writing project proposals and identifying tools and technologies to learn more about, (2) educator ratings indicate that users with less technical experience in the project topic tend to write lower-quality project proposals, and (3) GPT-4o's ratings show agreement with educator ratings. While the prospect of using LLMs to rate the quality of students' project proposals is promising, its long-term effectiveness strongly hinges on future efforts at characterizing indicators that reliably predict students' success and motivation to learn. © 2025 Elsevier B.V., All rights reserved.
RQ1: How is Generative AI being used in Project-Based Learning?	Avaliar se estudantes estão prontos para participar de PBL: "In this work, we design, implement, and conduct a user study for **a software system that collects project proposals and aptitude information that may help educators determine whether a student is ready to engage with PBL.**" "Our findings suggest that LLMs show promise for **scaling the automatic grading of project proposals.**"
RQ2: What is the impact of using Generative AI in planning courses, classes, and assessments?	Não responde.
RQ3: What challenges are present in adopting Generative AI for Project-Based Learning?	Eficácia depende da informação presente na proposta dos estudantes: "Our findings suggest that LLMs show promise in scaling the automatic grading of project proposals; however, **the effectiveness of using LLM grades to guide instructional design decisions hinges on whether project proposals and grading criteria contain information that reliably predicts whether a student can benefit from project-based learning.**"