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From Design to Classroom: Developing a Generative-AI Enhanced Gamified Project-Based Civic Learning Framework

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Abstract: This study aims to developed and preliminarily evaluated a Generative-AI-supported gamified Project-Based Civic Learning (GPBL-Civ) framework to strengthen student engagement and creative performance. This study employed a research and development method using the ADDIE model (analysis, design, development, implementation, and evaluation), The study involved undergraduate Civic Education students and aimed to examine the feasibility and effectiveness of a gamified project-based civic learning strategy supported by generative AI. Data were collected using expert validation instruments and student assessment tools. Feasibility was evaluated by four experts across strategy and content dimensions using Likert-scale questionnaires aligned with course learning outcomes. Effectiveness was examined through a single-group pretest–posttest design in one Civic Education class. Student engagement was measured using a validated engagement scale, while creativity was assessed using rubric-based evaluations of student projects. Data analysis employed descriptive statistics and normalized gain (N-gain) to determine improvements in engagement and creativity. The results indicate that the Generative-AI-assisted gamified Project-Based Civic Learning framework was rated "feasible" to "very feasible" by expert validators assessing both strategy and content. Classroom try-out results showed moderate improvements in student engagement (average N-gain = 0.66) across behavioral, emotional, and cognitive dimensions. Student creativity also demonstrated meaningful gains (average N-gain = 0.68), as reflected in rubric-based assessments of originality, elaboration, and effectiveness. Overall, the findings suggest that the developed framework has strong potential to enhance student participation and improve the quality of project outcomes in Civic Education courses. The instructional package may serve as a practical classroom supplement for university instructors implementing project-based civic learning with responsible use of Generative AI.

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Introduction

Colleges and universities are pressured to develop 21st-century skill sets for cohorts of students who have known only a life mediated through technology and expect learning to be interactive, relevant, and entertaining Higher education institutions are increasingly expected to foster 21st-century competencies among students who have been socialized in digitally mediated contexts, shaping their expectations for learning environments that are interactive, contextually meaningful, and cognitively engaging (Amroni et al., 2024; Hadiyanto et al., 2021; Kennedy & Sundberg, 2020). These students are raised in heavily mediated milieus and often exhibit short attention spans coupled with high expectations for freedom of expression, autonomy, and prompt feedback. Given that Civic Education courses need to prepare democratic, participatory, and responsible citizens, traditional lecture-based approaches often find it challenging to achieve a balance between maintaining behaviors, emotions, and cognitive engagement while at the same time promoting creative problem-solving around public issues (Bramantya et al., 2024; Japar et al., 2023; Tjandra et al., 2023). This disconnect between learner dispositions and classroom practice drives a quest for instructional design that is not just pedagogically rigorous but also experientially significant, particularly in rapidly changing higher-education systems such as Indonesia's.

Project-Based Learning (PjBL) is associated with improved motivation, engagement, knowledge transfer, and creativity, particularly when students engage with authentic problems and generate products for public audiences. This emphasis on purposeful learning through real-world problem-solving positions PjBL as a pedagogical approach that is highly congruent with the development of civic literacy and competencies, such as needs analysis, evidence-based reasoning, deliberation, communication, and collaboration (Kokotsaki et al., 2016a, 2016b; Lenz & Larmer, 2020). However, although PjBL's conceptual serious game has proven to be effective, its implementations often face practical difficulties: persistence at different stages of projects is different, quality of varies across projects, immediacy in formative feedback is lacking, and high-level instructor orchestration burden due to monitoring progress differentiation support maintaining pace (Jagannathan & Komives, 2019; Sutrisno & Nasucha, 2022). These difficulties are particularly evident in large classes and resource-poor environments, where lecturers have to cater to a range of different learners with the limited time available.

The purposeful use of game elements such as quests, rules, challenges, progress bars, concepts found in games like points and badges, leaderboards, and narrative has been suggested as a way to address these pain points by foregrounding goals, segmenting complex tasks into manageable stages, and making effort and progress visible (Buckley & Doyle, 2016; Dicheva et al., 2015; Zainuddin et al., 2020). When well-matched to learning objectives and accompanied by clear rubrics, the motivational effects of gamification can help strengthen resolve, foster self-regulation, chip away at excessive competition, and reinforce a shared destination. But gamification in itself may not loosen the feedback bottleneck, nor is it adequate to inform the subtle, task-specific guidance that civic projects demand, when working with students, might need to be syncretized between legal-normative reasoning and ethical deliberation, as well as context-sensitive creativity.

Contemporary developments in Generative Artificial Intelligence (GenAI) offer new affordances for learning design, leveraging both PJBL and gamification. GenAI can offer just-in-time ideation assistance, nearly instant formative feedback based on rubrics prepared by instructors, and adaptation hints in tune with progression to address the task at hand, as well as meta-cognitive triggers for self-awareness (Lin et al., 2022; Ng et al., 2024; Su et al., 2024). Governed by transparent ethical guardrails, GenAI can enable us to scale personalized support without stripping away the instructor's judgment. In Civics, for example, particularly where students are asked to critique sources and weigh competing values, translate from their abstract principles through the actionable into sets of proposals that we might codify or enact yet fail to get right on first drafting, GenAI-mediated scaffolding may serve to reduce friction in early stages of draft work; assist students in trying out alternative framings; speed cycles of feedback and revision. And crucially, the payoffs of screen time rest on principled integration: tool use should be transparent, accountable, and support intended learning, not a replacement for thinking on the part of students.

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Despite their potential, the convergence of civic learning, gamified Project-Based Learning, and Generative AI remains limited, particularly in conceptualizing AI as a pedagogical scaffold that enhances students' cognitive engagement and learning autonomy without replacing their intellectual effort. While individual studies provide valuable insights into each of the three dimensions outlined above, few existing works propose a cohesive, deployable framework that: (a) Connects Civic Education learning outcomes to mechanics-based game design principles, (b) Instantiates GenAI supports in reusable prompt patterns that are associated with rubrics and activity structures, and (c) Generates concrete orchestration routines for instructors across live class sections (Aslanides et al., 2016; Hidayah et al., 2021; Wulansari et al., 2022). Evidence from Global South settings, such as Indonesian universities, is also limited, especially empirical evidence of the end-to-end design, implementation, and reflection cycles supported by qualitative and quantitative data. Far too few instruments exist that consistently monitor student engagement and creativity in civic projects, but none integrate with design principles packaged in a format manageable for educators to adopt or adapt.

This study aims to develop and iteratively refine a classroom-ready gamified Project-Based Civic Learning framework supported by Generative AI for Civic Education courses. The study also seeks to establish the validity of instruments designed to measure student engagement and creativity in alignment with course learning outcomes and assessment rubrics. The effects of the proposed framework on students' engagement and creative performance are examined through classroom implementation. The pedagogical usability and acceptability of the framework for both instructors and students are evaluated within the context of Indonesian higher education.

Research Method

This study employed a research and development approach using the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) to develop a gamified Project-Based Civic Learning strategy supported by Generative Artificial Intelligence (GenAI) to enhance student engagement and creativity. In the analysis phase, a needs assessment was conducted through a literature review and semi-structured interviews with 2 Civic Education lecturers and 5 undergraduate students to identify instructional challenges and requirements for a gamified, GenAI-supported PjBL approach. The design phase focused on developing the ProCiG-AI framework, in which gamification was operationalized through a structured point- and badge-based system aligned with the stages of Project-Based Civic Learning. The development phase involved constructing a prototype and conducting expert validation by content and instructional design specialists, with feasibility assessed using questionnaires measuring usefulness, ease of use, accuracy, and instructional appeal. The implementation phase consisted of limited classroom trials involving 30 undergraduate students enrolled in a compulsory Civic Education course during the odd semester of the 2025/2026 academic year, with 15 students assigned to an experimental group and 15 to a control group, using pretest–posttest measures to examine effects on engagement and creativity. The evaluation phase emphasized iterative revisions based on classroom trial results, expert feedback, and user responses to produce a classroom-ready gamified GenAI-assisted PjBL strategy for broader implementation (Adeoye et al., 2024; Muruganantham, 2015a; Nadiyah & Faaizah, 2015).

Feasibility evidence was collected through 2 expert-review questionnaires on instructional strategy/design and content/material quality of the gamified AGI-supported Project-Based Civic Learning. The prototype was also evaluated by a panel of content and

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instruction design experts in Civic Education, through four-point Likert-type items. The instructional instrument reviewed alignment with course learning outcomes, coherence of PJBL phases, appropriateness of gamification mechanics, suitability and ethical use of AGI supports, and assessability/ implementability in class (Sari & Rakhmawati, 2025; Teresi et al., 2022). The mean scores of each category are presented in Table 1 below.

Table 1. Interval for the Average Score in the Feasibility and Practicality Test

Average value	Category
3.26 - 4.00	Very feasible/Very practical
2.51 – 3.25	Feasible/Practical
1.76 – 2.50	Less feasible/Less practical
1.00 - 1.75	Not feasible/Not practical

To strengthen evidence of content validity, we also calculated Aiken's V (per item and overall) as an additional measure of content validity, and described inter-rater agreement; suggested levels for $V \geq 0.80$ were considered acceptable. Written comments from experts were coded thematically to revise learning goals, task sequence steps, prompt rubric-linked patterns, and ethical use instructions. Subsequently, the extent to which each expert's relevance judgment was achieved was determined using Gregory's (2016) inter-rater agreement analysis (Gregory, 2014; Jensen et al., 2019; Lanz et al., 2018), with the formula shown in Table 2 below.

Table 2. Inter-Rater Agreement Approach to Assessing Model Validity

		EXPERT JUDGE #1	
		Weak Relevance (Item rated 1 or2)	Strong Relevance (Item rated 3 or 4)
EXPERT JUDGE #2	Weak Relevance (Item rated 1 or2)	A	B
	Strong Relevance (Item rated 3 or 4)	C	D

The results obtained from the inter-rater agreement analysis were then processed into an expert test index. The data from this index were interpreted according to the following table 3 below.

Table 3. Validity Criteria of the Item

Range Score	Category
0.80-1.00	Very Good
0.60-0.79	Good
0.40-0.59	Enough
0.20-0.39	Poor
0.00-0.19	Very Poor

The effectiveness was evaluated using pretest–posttest items and a student self-assessment questionnaire to track gains in engagement and critical thinking. Improvement scores were derived by standardizing results according to the categories presented in Table 4.

Table 4. Standard N-gain Category

Average value	Category
$(g) \geq 0.7$	High
$0,7 \geq (g) \geq 0,3$	Medium
$(g) \leq 0.3$	Low

(Rahman et al., 2024; Triyono et al., 2024)

Approaches were tailored for pilot tests only; the subjects under study were appropriation of students in general, aiming, accordingly, to amongst them. Surface research covers only one development cycle at the beginning, thus resulting in a prototype that was

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tried out on a small scale and probably not a mass-installed product. Effectiveness was judged with a one-group pre-test-post-test design, which naturally means that there is no way to control what happens outside the experiment. Accordingly, effectiveness findings should be interpreted as preliminary, "proof of concept". Follow-up research employing quasi-experimental or true experimental designs is encouraged in order to strengthen causal assertions.

Results and Discussion

This research produced a classroom-ready strategy in the form of a Generative-AI-supported, gamified Project-Based Civic Learning framework designed to enhance students' engagement and critical thinking through the ADDIE development model, analysis, design, development, implementation, and evaluation. In the analysis phase, preliminary studies identified recurring challenges: irregular persistence across multi-week civic projects, a feedback bottleneck that delayed rubric-aligned guidance, limited visibility of progress toward outcomes, and uncertainty about responsible AI use in coursework. Constraints on timely formative feedback and the scarcity of practical, step-by-step materials that integrate PJBL with gamification and ethical GenAI supports were found to dampen participation and the quality of civic projects. These needs informed the design phase, which prioritized quest-structured milestones, transparent rubrics, motivational mechanics, and reusable GenAI prompt patterns for ideation, feedback, and reflection together forming the basis for the subsequent development, implementation, and evaluation stages.

Feasibility evidence was obtained through two expert-review questionnaires on certain sides of the gamified, AGI-supported Project-Based Civic Learning aspect; instructional strategy/design and content/material quality. The prototype was reviewed by a panel of subject-matter as well as instructional-design experts in Civic Education, using five-point Likert items. The strategy instrument looked at alignment with course outcomes; coherence of PJBL phases; suitability of gamification mechanics; appropriateness and ethics of AGI supports; and assessment of whether it worked in real classrooms.

The third stage is development, where the codebase will be built into a comprehensive classroom-ready project. Instructor and student resources were developed as a unified set: 1) An Instructor Guide (orchestration plan, weekly scripts, assessment flow); 2) Quest Cards and Milestone Rubrics; 3) A Gamification Kit (points/badges rules, leaderboard/progress visuals); 4) A GenAI Prompt Library (ideation prompts, rubric-aligned feedback prompts) with built-in ethical-use checklists. After developing the package, a feasibility review was undertaken with two strategy experts and two content experts by means of parallel validation forms developed for this study's outcomes; Table 5 shows summary results from this expert validation.

Table 5. Summary of Validation Scores

Validation	Aspect	Score		Total	Average	Category
		Expert I	Expert II			
Strategy validation	Objective	21	23	44	3.67	Very feasible
	Strategy	24	22	46	3.83	Very feasible
	Evaluation	23	24	47	3.92	Very feasible
Content validation	Curriculum	23	23	46	3.83	Very feasible
	Material	23	22	45	3.75	Very feasible
	Language	24	24	28	4.00	Very feasible
	Evaluation	23	24	47	3.92	Very feasible

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The researchers then conducted an analysis using the inter-rater agreement model to determine each expert's acceptability score, with the results presented in Table 6.

Table 6. Interpretation of Each Expert Evaluation Index

No	Validation Aspect	Total Inter-Rater-Agreement	Score	Category
1	Strategy	18/18	1	Very Good
2	Content	24/24	1	Very Good
Average			1	Very Good

The next step in the process is implementation, which tested only framework validity and reliability for student engagement through a one-group pretest–posttest design. Effectiveness was measured using the normalized gain (N-gain), calculated for each participant (post−pre)/(max−pre) and then averaged at the dimension and total levels. N-gain scores were analyzed according to the classical cutoffs (low, middle, and high) to obtain an intuitive grasp of change. N-gain results of total engagement are presented in **Table 7**.

Table 7. Pre-test Post-test Gain Value of Student Engagement

Students	Pre-Test	Post-Test	N-gain	Interpretation
ASP	64	88	0.67	Medium
AOM	72	96	0.86	High
BK	76	92	0.67	Medium
DAU	68	88	0.63	Medium
DH	72	92	0.71	High
DQA	68	88	0.63	Medium
EP	72	88	0.57	Medium
FAP	68	84	0.50	Medium
HA	68	88	0.63	Medium
JS	80	96	0.80	High
JD	72	88	0.57	Medium
JGY	76	96	0.83	High
LP	68	84	0.50	Medium
MIM	72	88	0.57	Medium
NVA	80	96	0.80	High
Average	71.73	90.13	**0.66**	**Medium**

According to the data, normalized gain (N-gain) analysis shows a statistically significant difference in student engagement measured through the pre-test and post-test engagement scale. The average N-gain of 0.66 belongs to the medium category. The performance of the model regarding creativity is given in Table 8.

Table 8. Pre-test Post-test Gain Value of Creativity Ability

Students	Pre-Test	Post-Test	N-gain	Interpretation
ASP	68	88	0.63	Medium
AOM	72	92	0.71	High
BK	76	96	0.83	High
DAU	68	88	0.63	Medium
DH	64	96	0.89	High
DQA	64	92	0.78	High
EP	76	84	0.33	Medium
FAP	72	88	0.57	Medium
HA	64	88	0.67	Medium
JS	76	96	0.83	High
JD	76	88	0.50	Medium

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JGY	72	96	0.86	High
LP	76	88	0.50	Medium
MIM	72	92	0.71	High
NVA	84	96	0.75	Medium
Average	72.00	91.20	**0.68**	**Medium**

In extension of the analysis for N-gain, the student engagement data also indicate a clear upward shift after the intervention. Most of the participants reached medium gains (average N-gain 0.68), and a few low, yet only some high. Furthermore, the patterns at the dimension level suggest that the enhancements were in terms of behavioral, emotional, and cognitive engagement.

Discussion

Student engagement demonstrated a moderate overall improvement N-gain = 0.66, with gains observed across behavioral, emotional, and cognitive dimensions. This magnitude of improvement is consistent with prior studies reporting that gamified Project-Based Learning tends to yield moderate rather than high engagement gains due to the cognitive demands and coordination challenges inherent in extended inquiry-based tasks (Dichev & Dicheva, 2017; Hanus & Fox, 2015). Similar to findings by (Muruganantham, 2015; Najuah et al., 2021), the present study also found improvements in rubric-rated originality, elaboration, and usefulness. However, unlike studies that report gamification effects primarily on extrinsic motivation and short-term participation (Hanus & Fox, 2015; Toda et al., 2019), the observed creativity gains in this study suggest deeper cognitive engagement with average N-gain = 0.68. This difference may be attributed to the integration of rubric-aligned prompts and GenAI-supported scaffolding, which guided students' reasoning, evidence use, and iterative refinement rather than rewarding surface-level task completion.

The categorization of these gains as moderate rather than high may reflect that the PjBL environments often involve an initial adjustment period, during which students negotiate autonomy, collaboration, and sustained effort over time (Bell, 2010; Krajcik et al., 2006). In contrast to studies where AI tools are positioned as productivity enhancers or answer generators, sometimes resulting in reduced learner agency. The present findings resonate with recent work showing that Generative AI can support higher-order thinking and creative elaboration when used explicitly as a pedagogical scaffold (Kasneci et al., 2023; Lim et al., 2023). Within this context, the observed N-gain of 0.66 reflects not a ceiling effect but the inherent complexity of combining civic inquiry, collaborative project work, and responsible AI use, reinforcing the interpretation of this study as a proof of concept rather than an optimization study.

Several mechanisms likely explain the observed engagement gains. First, quest-consuming milestones broke down large-scale civic issues into manageable, bite-sized pieces of work that allowed students to experience progress more frequently and plan their work based on observable landmarks. Second, clear rubrics and progress bars made expectations clear and cast feedback as a path to growth rather than a post-hoc evaluation. Third, the narrative frame provided a cohesive structure to civic issues, and students told us that it made them feel more personally attached to and interested in the "story." Overall, these design decisions align with established motivational levers: autonomy (through choice within a shared structure), competency (due to clear criteria and proximal successes), and relatedness (team-based progression and peer reviews), which, when combined, are also congruent with the increases in behavioral/attitudinal engagement.

It was in cognitive engagement and creative elaboration processes that Generative AI made its most obvious contribution. By using prompt patterns, students could combine

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divergent reframing, evidence checking, rubric-aligned critique, and shortcuts that accelerated drafts. They could also try out alternative framings of public problems (Nurjanah et al., 2024). This has meant that the loop guardrails human supervised practices (disclosure, attribution, bias checks, and required instructor/peer review of any AI-assisted rewrites) focus instead on adopting AI as a supportive means rather than fulfill on behalf of students. For one thing, this has transformed the role of the instructor from being the sole source of detailed feedback to an orchestrator who validates direction, mediates between competing claims for power and attention, and attends to standards of civic-normative quality. AI, in turn, has become simply a means employed to handle initial copy editing and quick points about where ideas could be fleshed out further. Students said that they could get more evidence that connected more reliably.

The gamification layer took careful tuning to prevent counterproductive competition. In the early stages of the pilot, we updated leaderboard specifications to instead reward positivity and consistency. Badges were "earned" in relation to particular pro-social behaviors (e.g., rubric-referenced reviews), and points were issued as a reward, not for a last-minute dash but for timely incremental work. This tuning was coincident with more steady submission rhythms and fuller peer commentary, indicating that when gamification is aligned with civic and collaborative learning, it may not only be used to amplify immediate short-term performance but rather through cultivated habits of sustained effort (Kusdiyanti et al., 2022; Wangi et al., 2018). The pedagogical implication is that the concept of game mechanics should be that of motivational scaffolding rather than ends in themselves, and integrated with learning goals and classroom behaviors.

The package provides a specific way to join democratic competences with project work: the nature of needs analysis, evidence gathering, deliberation, and public communication is built into the quest structure and repeated for practice under exampled-criteria. The prompt library that comes with it translates amorphous outputs into cognitive moves one can make (e.g., value-tension mapping or stakeholder feasibility checks), and so does the ethical-use policy that operationalizes how organizations are expected to use what they've deployed around AI. From a workload standpoint, faculty take advantage of reusable assets, weekly scripts, milestone rubrics, and disclosure templates that hammer away at the startup cost and mean that orchestration is relatively predictable across cohorts. These are features that enhance the potential of scalability to courses beyond a single course, in particular in large-enrollment and mixed-preparation situations.

The study employed an uncontrolled experimental design and was non-representative, limiting internal and external validity. The validation was limited to strategy and content only; media/technical validation was deliberately beyond scope, with very limited end-user feasibility data collected. Self-report measures induce common methods variance, and although rater agreement was controlled for in scoring creativity, the short temporal window limited the number of projects per evaluator. Lastly, the pilot study included immediate learning outcomes and not retention of engagement or transfer of civic competences to the later years' courses or community.

This study highlights the need for sound AI integration grounded in transparency, student agency, and well-defined criteria. There are ways this ethical-use checklist and these statements of disclosure can be adapted by institutions to pass down course syllabi, and in professional development, prompt-design literacy for educators should prioritize making GenAI a predictable partner to formative assessment rather than an opaque tool. Considering the modest context-level engagement gains from typical classroom practice, this framework presents a practical route for programs that wish to refresh Civic Education while retaining normative rigor. Through the packaging of methods, orchestration, and measurement tools, this work adds a shareable model that can be implemented by other teachers and refined as well.

Conclusion

As a result of this development study, the Generative-AI-assisted gamified, Project-Based Civic Learning framework received a "feasible" to "very feasible" rating from expert validators who reviewed both strategy and content with two specialists in background Civic education and learning design. In a classroom try-out, this framework demonstrated medium gains in student engagement (average N-gain = 0.66), with positive benefits observed in the behavioral, emotional, and cognitive domains. Supporting analyses also found that creativity changed significantly for the better (average N-gain = 0.68) according to rubric items for originality, elaboration, and effectiveness. Taken together with the evidence from feasibility and effectiveness, these results point toward the potential of developed guidelines as a factor significantly increasing students' participation in Civic Education courses and the quality of project output. The package, which includes an instructor's guide, quest cards, and milestone rubrics, a calibrated gamification kit, a reusable prompt library, and ethical protocols on how to use AI, could be used as a classroom supplement for university instructors who want to lead project-based civic learning that responsibly deploys Generative AI. We suggest that, in light of the small-scale and single-group nature of this study, future quasi-experimental work is necessary both to strengthen claims for causality and to explore longer-term transfer. However, the findings of this study give practical direction and source assets that could be easily implemented to other Indonesian higher education institutions.

Recommendation

Future research is necessary to build on this study with quasi-experimental or randomized designs to determine the causal impact of this model on learning outcomes at diverse institutions. Lecturers are encouraged to pilot the framework within selected course modules before full-scale adoption, adjusting gamification intensity and GenAI support to align with course objectives and student readiness. Large-scale implementations for several classes or universities are encouraged to examine scalability, retention, and transfer of engagement and creativity beyond the immediate course. Future research can enhance the framework's AI-supported feedback cycles through learning analytics dashboards that offer real-time, equity-aware insights while preserving ethical transparency and data privacy. Future work must also encompass longitudinal tracking of civic competence development and professional readiness, as well as qualitative explorations of instructor experiences in managing AI-supported gamified classrooms. These extensions will help towards augmenting the theoretical foundation, generalizability, and practical adoption of the Generative-AI Supported Gamified Project-Based Civic Education model for higher education.

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