

# Developing the INGAME Model: Integrating Inquiry and Gamification to Enhance Creative Thinking in Elementary Students

Faridahtul Jannah<sup>1</sup>, Shofia Hattarina<sup>2</sup>, Didit Yulian Kasdriyanto<sup>3</sup>, Ramadhan Kurnia Habibie<sup>4</sup>

<sup>1</sup> Universitas Panca Marga, Probolinggo, Indonesia; [faridahtul@upm.ac.id](mailto:faridahtul@upm.ac.id)

<sup>2</sup> Universitas Panca Marga, Probolinggo, Indonesia; [shofiahattarina@gmail.com](mailto:shofiahattarina@gmail.com)

<sup>3</sup> Universitas Panca Marga, Probolinggo, Indonesia; [didityulian@upm.ac.id](mailto:didityulian@upm.ac.id)

<sup>4</sup> Universitas Negeri Surabaya, Surabaya, Indonesia; [ramadhanhabibie@unesa.ac.id](mailto:ramadhanhabibie@unesa.ac.id)

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## ABSTRACT

The decline in creative thinking among elementary students presents a challenge to 21st-century education, particularly in systems dominated by rote learning. While inquiry-based learning fosters cognitive engagement and gamification enhances motivation, few instructional models integrate both to support creativity development. This study aimed to design, validate, and evaluate the INGAME model (Inquiry Model with Gamification Elements), which combines structured inquiry processes with game-based mechanics to enhance students' creative thinking. Using the ADDIE framework, the model was developed through a research and development (R&D) approach involving expert validation, teacher assessment, and classroom implementation. Data were collected from 23 fifth-grade students and analyzed through descriptive statistics and thematic analysis. Expert validation rated the INGAME model as very valid ( $M = 90.16\%$ ), and teacher assessments confirmed its practicality ( $M = 82\%$ ). Implementation results showed significant improvements in students' creative thinking based on Torrance's four indicators—fluency, flexibility, originality, and elaboration—with an average gain score of +1.13. Student engagement remained high throughout the model's eight gamified inquiry phases, with observation data showing an average engagement level of 85.8%. The INGAME model demonstrates that integrating inquiry with gamification can foster creativity by aligning cognitive challenge with intrinsic motivation. It offers a structured, scalable, and teacher-friendly approach to cultivating creativity in elementary education while supporting broader educational reforms aligned with SDG 4.

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## Corresponding Author:

Faridahtul Jannah

Universitas Panca Marga, Probolinggo, Indonesia; [faridahtul@upm.ac.id](mailto:faridahtul@upm.ac.id)

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## 1. INTRODUCTION

Education in the 21st century is undergoing a paradigm shift from content acquisition toward skill cultivation. The emphasis is no longer merely on what students know but on how they use knowledge to think creatively, solve problems, and adapt to change (C.-H. Chen & Law, 2024). This transformation is driven by global trends in the digital era that demand human resources who can think divergently,

innovate continuously, and collaborate across disciplinary boundaries. The World Economic Forum consistently identifies creativity and analytical thinking as top skills required for the future workforce, underlining that nations failing to cultivate these skills risk losing competitiveness in the knowledge economy (Tang & Tsai, 2023). In Indonesia, this challenge is acute. The 2022 Program for International Student Assessment (PISA) ranked Indonesia 67th among 81 countries, with only 28% of students demonstrating proficiency in solving complex or unfamiliar problems (OECD, 2019). This data reflects not only weaknesses in critical and creative competencies but also a structural issue in the learning culture of Indonesian schools, which remains dominated by memorization, rigid assessments, and teacher-centered instruction.

The predominance of rote learning practices has created a learning environment where students act as passive recipients rather than active constructors of knowledge. In most elementary classrooms, teaching methods still emphasize repetition, recall, and convergent thinking—skills necessary for standardized testing but insufficient for nurturing creative exploration (Vagg & Balta, 2020). Teachers often rely on lectures, worksheets, and textbook exercises, which limit opportunities for students to engage in open-ended questioning, experimentation, or idea generation. Consequently, the four foundational dimensions of creativity as described by Torrance—fluency, flexibility, originality, and elaboration—are rarely cultivated in classroom practice. These dimensions represent not only cognitive capacities but also dispositions toward curiosity, risk-taking, and imagination. When learning activities fail to stimulate these aspects, students may develop an early aversion to uncertainty, preferring safe, single-answer tasks over exploratory thinking. This condition is particularly problematic in the context of early education, where curiosity should be nurtured as the seed of lifelong learning (Lo & Hew, 2020).

At the national level, Indonesia's Asta Cita vision and the Indonesia Emas 2045 agenda explicitly position education as a strategic instrument for developing creative, innovative, and character-driven citizens. Furthermore, Sustainable Development Goal (SDG) 4 calls for inclusive and equitable quality education that promotes lifelong learning opportunities for all, explicitly emphasizing creativity and innovation as learning outcomes. Therefore, improving students' creative thinking skills in the early stages of education is not only a pedagogical necessity but also a developmental imperative that aligns with global and national education agendas.

Despite the recognized importance of creativity, teachers face persistent difficulties translating this goal into effective classroom practice. One major issue is that existing pedagogical models often focus on either cognitive engagement or motivational stimulation, but rarely both simultaneously. Inquiry-Based Learning (IBL), for instance, has proven effective in promoting higher-order cognitive processes (Plass & Homer, 2020; van Joolingen & de Jong, 2021). Rooted in constructivist theories of (Vygotsky, 1978), IBL emphasizes that learners build knowledge through active exploration, hypothesis testing, and reflection. Studies have shown that inquiry-based instruction enhances reasoning, scientific understanding, and problem-solving (Lai & Hwang, 2020; Tang & Tsai, 2023). However, empirical evidence also reveals that prolonged inquiry activities can be cognitively demanding, especially for younger learners, leading to declines in engagement or motivation when tasks become too complex or abstract (Rojas-Libano & Araya, 2021).

In contrast, gamification—the integration of game design elements such as points, badges, leaderboards, and missions into non-game contexts—has emerged as a powerful approach to increase motivation, enjoyment, and persistence in learning (Y.-T. Chen & Wang, 2020). By transforming learning into an interactive, goal-oriented experience, gamification satisfies learners' intrinsic needs for competence, autonomy, and relatedness, as articulated by (Ryan & Deci, 2000) Self-Determination Theory. However, while gamification effectively sustains motivation, it does not inherently guarantee deep cognitive engagement or creativity unless carefully aligned with meaningful learning tasks.

This duality—cognitive depth without sustained motivation in inquiry learning, and motivation without cognitive rigor in gamification—highlights a crucial pedagogical gap. The challenge for educators is to design a learning model that harmonizes these dimensions: maintaining the inquiry structure that drives cognitive development while embedding gamified mechanics that sustain

emotional and motivational engagement. The present research arises from this precise need. The core problem is designing a pedagogical model that transforms elementary students from passive participants into motivated, creative learners by integrating inquiry-based learning and gamification.

The urgency of this research stems from its potential to provide a concrete solution to the long-standing problem of creative stagnation in Indonesian primary education. Without innovation at this foundational level, subsequent educational reforms at higher levels will remain superficial. Moreover, creativity is not a trait that can be easily taught through direct instruction; it requires environments that encourage experimentation, tolerate ambiguity, and celebrate originality. Such environments are rare in traditional classrooms, but they can be intentionally created through the integration of guided inquiry and game-based learning. Inquiry provides the cognitive scaffolding—encouraging questioning, data collection, analysis, and reflection—while gamification introduces motivational drivers that make these cognitive tasks enjoyable and rewarding. Together, they form a holistic ecosystem for cultivating creativity.

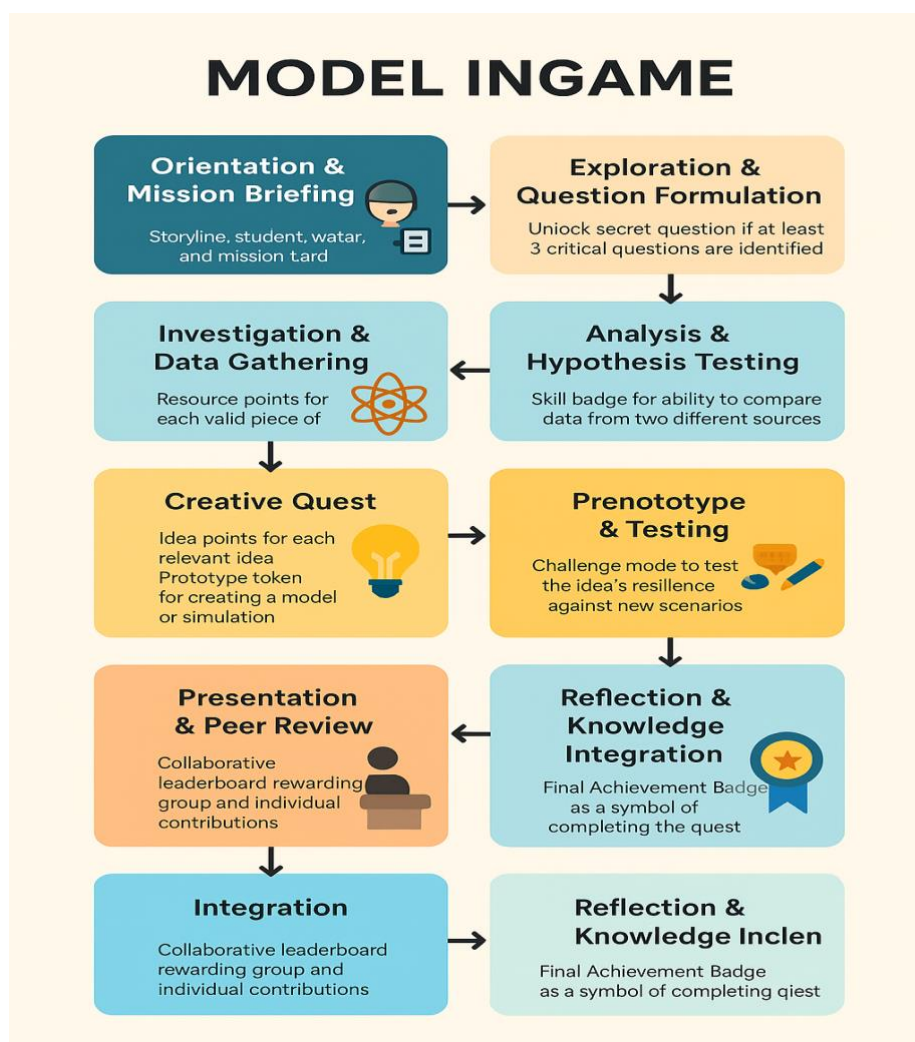
In this context, the present study formulates the following research questions: (1) How can an instructional model that integrates inquiry-based learning and gamification be systematically developed for elementary students? (2) To what extent is the developed model valid, practical, and effective in enhancing students' creative thinking skills? These questions guide the design and validation of the INGAME model—an acronym for Inquiry Model with Gamification Elements—as both a theoretical and practical response to the issues identified above.

Previous research provides important foundations for this integration, but also reveals key limitations. Inquiry-based approaches have been widely studied and shown to enhance scientific reasoning and problem-solving. Sailer & Homner, (2020) demonstrated the effectiveness of inquiry-based learning in promoting scientific understanding across cultural contexts, while Rahmawati et al. (2022) identified its role in supporting 21st-century skill development. However, these studies rarely address the motivational dimension that sustains engagement during inquiry. On the other hand, research on gamification has shown consistent improvements in motivation and learning outcomes (Sung & Wu, 2021; Zainuddin & Chu, 2021). However, many gamified learning designs remain superficial—focused on extrinsic rewards such as points or badges—without integrating cognitive structures that foster creativity. Recent works by (Hsu & Chang, 2021; Su & Cheng, 2022) have begun exploring this intersection, combining gamified tasks with open inquiry in higher education settings. These studies report positive effects on engagement and collaboration but do not provide detailed instructional frameworks or empirical validation in elementary education contexts.

This review exposes a critical gap in current research. Few studies have systematically developed and validated instructional models that embed gamification mechanics within each phase of inquiry learning. Even fewer have applied such designs to primary school students, whose cognitive and motivational characteristics require careful adaptation. Moreover, most previous research focuses on isolated activities or short-term interventions, lacking a comprehensive design framework that ensures pedagogical coherence and scalability. Consequently, there remains insufficient understanding of how gamification can be strategically aligned with inquiry stages—question formulation, investigation, data analysis, and reflection—to enhance creative thinking processes. Addressing this gap is vital for building an empirically grounded model that bridges theory and classroom practice.

Conceptually, INGAME is grounded in two complementary theoretical frameworks. First, Torrance's Theory of Creative Thinking provides the cognitive foundation, emphasizing fluency, flexibility, originality, and elaboration as measurable indicators of creativity. These dimensions correspond to the inquiry stages in which students generate ideas, test hypotheses, and refine solutions. Second, Ryan and Deci's Self-Determination Theory (SDT) provides the motivational foundation, explaining how gamification elements—points, missions, badges, and feedback—satisfy intrinsic psychological needs that drive engagement. By integrating these theories within the systematic stages of ADDIE, the INGAME model ensures that creativity is not treated as a spontaneous byproduct but as an intentionally cultivated outcome of structured learning design.

The objective of this study is twofold. Theoretically, it seeks to operationalize the conceptual relationship between guided inquiry and gamification into a coherent pedagogical model grounded in the ADDIE framework (Analysis, Design, Development, Implementation, Evaluation). Practically, it aims to test the model's validity, practicality, and effectiveness in improving students' creative thinking abilities, focusing on the four Torrance indicators: fluency, flexibility, originality, and elaboration. By combining the cognitive depth of inquiry with the motivational reinforcement of gamification, the INGAME model is expected to create an engaging, student-centered learning experience that enhances creativity while remaining feasible for teachers to implement.



**Figure 1.** The Phases of INGAME Model

Figure 1 illustrates the INGAME model as a structured, cyclical framework that integrates principles of inquiry-based learning with carefully designed gamification elements to foster sustained engagement and creative thinking. The model unfolds across eight interconnected phases, guiding learners systematically from initial exploration to reflective synthesis. Each phase aligns specific game mechanics with corresponding cognitive inquiry processes, ensuring a balance between intellectual rigor and motivational appeal. The first phase, Orientation and Mission Briefing, situates learning within a narrative scenario that reframes the topic as a purposeful "quest," thereby stimulating curiosity and clarifying objectives. In the second phase, Exploration and Question Formulation, students generate and refine critical questions, supported by incentives such as unlocking advanced inquiry prompts for high-quality contributions. This stage cultivates divergent thinking and analytical curiosity as foundational components of the inquiry process.

During the Investigation and Data Gathering phase, learners collect, evaluate, and validate information from diverse sources, earning “resource points” to acknowledge accuracy and persistence. By transforming research into an interactive endeavor, this mechanism reinforces careful reasoning and sustained effort. The subsequent Analysis and Hypothesis Testing phase deepens conceptual understanding as students interpret patterns and evaluate emerging hypotheses, with “skill badges” recognizing demonstrated analytical competence. The fifth phase, Creative Quest, constitutes the model’s central creative moment: students generate ideas and develop prototypes grounded in their findings. Through “idea points” and “prototype tokens,” the framework promotes fluency, originality, and elaboration—key dimensions identified in Torrance’s theory of creative thinking. In the Prototype and Testing phase, learners iteratively refine their solutions within a gamified “Challenge Mode,” reframing rigorous evaluation as an engaging problem-solving process. The Presentation and Peer Review phase emphasizes communication and collaboration, as students share outcomes, exchange constructive feedback, and gain recognition through a leaderboard that values both individual initiative and collective contribution. Finally, the Reflection and Knowledge Integration phase encourages learners to synthesize insights, connect new understandings with prior knowledge, and consolidate learning through the awarding of a “Final Achievement Badge” symbolizing mastery.

Collectively, the INGAME model reconceptualizes learning as a dynamic yet coherent cycle in which inquiry provides the epistemological foundation and gamification sustains motivational momentum. By integrating these complementary dimensions, the framework mitigates fear of failure, maintains engagement, and cultivates creative dispositions. Learning thus emerges not merely as task completion, but as an intrinsically meaningful process of discovery, experimentation, and reflective growth.

## 2. METHODS

This study employed a Research and Development (R&D) approach guided by the ADDIE model, which consists of five systematic stages—Analysis, Design, Development, Implementation, and Evaluation. The R&D method was chosen to produce a validated and practical instructional model, namely the Inquiry Model with Gamification Elements (INGAME), aimed at enhancing elementary students’ creative thinking skills. The ADDIE framework ensured that model development followed a cyclical and iterative process where feedback from experts, teachers, and students was continuously integrated into revisions.

The study was conducted in an elementary school located in Probolinggo, East Java, Indonesia. Participants consisted of 23 fifth-grade students (11 boys and 12 girls), aged 10–11 years, from a public primary school with moderate digital readiness and prior exposure to inquiry-based science learning. One classroom teacher also participated as an implementing partner during the limited trial stage. The selection of this class was based on convenience sampling, considering accessibility, teacher willingness, and school consent to participate in model testing.

Following the ADDIE sequence, the Analysis phase identified learning needs and gaps in creative thinking activities through teacher interviews and student questionnaires. The Design phase involved developing INGAME’s conceptual structure, lesson plans, and learning materials, integrating inquiry and gamification elements. During the Development phase, prototypes were created and reviewed by two content experts and two learning-model experts, who validated their relevance, structure, and clarity. The Implementation phase was carried out through a limited classroom trial in which the INGAME model was applied over three learning sessions. Finally, the Evaluation phase included formative evaluation during expert validation and summative evaluation through student and teacher feedback, supported by quantitative data on validity, practicality, and effectiveness.

Data in this study were collected using a combination of quantitative and qualitative instruments designed to assess the validity, practicality, and effectiveness of the INGAME model. Three primary categories of instruments were employed, namely expert validation sheets, teacher and student

questionnaires, and creative thinking assessment rubrics. The validation instruments were developed to evaluate the accuracy, coherence, and relevance of both the model structure and learning materials. Two content experts and two learning-model experts assessed the product using a four-point Likert scale (1 = less valid, 4 = very valid), covering aspects such as construct alignment, clarity of language, procedural feasibility, and alignment with inquiry and gamification principles. The teacher and student questionnaires were used to measure the model's practicality and perceived effectiveness during classroom implementation. These questionnaires focused on indicators such as clarity of instructions, engagement level, time efficiency, and ease of integration into the learning process. Responses were analyzed quantitatively through percentage scores and qualitatively through open-ended reflections provided by participants.

To evaluate students' creative thinking skills, an analytic assessment rubric was used, adapted from Torrance's Creative Thinking Theory. The rubric consisted of four dimensions—fluency, flexibility, originality, and elaboration—each rated on a four-point scale ranging from "limited" (1) to "advanced" (4). The rubric was applied during classroom observations, analysis of student worksheets, and assessment of creative products generated in the "Creative Quest" and "Prototype Testing" phases of the INGAME cycle. Observers, including the classroom teacher and two trained raters, used the rubric consistently to ensure inter-rater reliability. The average score across the four indicators represented each student's overall creative thinking level, which was then compared before and after the model's implementation to determine relative improvement.

In addition, semi-structured interviews were conducted with the classroom teacher to gather qualitative feedback on the implementation process, perceived strengths, and challenges of the INGAME model. Field notes and observational data were also collected to triangulate quantitative findings and ensure validity through methodological convergence. All instruments were pilot-tested for clarity and reliability before data collection. Quantitative data were analyzed using descriptive statistics to calculate mean percentages for validity, practicality, and effectiveness, while qualitative data were coded thematically to extract insights related to motivation, engagement, and creativity. This combination of instruments provided a comprehensive understanding of how the INGAME model functioned as a pedagogical tool and its impact on the development of students' creative thinking.

The research adhered to ethical standards for educational studies. Written consent was obtained from the school principal, the participating teacher, and the parents of all student participants. Students were informed that their participation was voluntary, and all data were treated confidentially. The study protocol was reviewed and approved by the Research Ethics Committee of Universitas Panca Marga, ensuring compliance with institutional and national guidelines on educational research involving minors.

**Table 1.** Overview of INGAME Phases Integrating Inquiry and Gamification Elements

Phase	Inquiry Activity	Gamification Element	Expected Creative Thinking Outcome
1. Orientation & Mission Briefing	Teacher introduces topic and sets context through a problem scenario.	Narrative mission; "quest" storyline to capture attention.	Motivation and focus on learning goals.
2. Exploration & Question Formulation	Students generate critical questions and identify knowledge gaps.	Unlocking secret questions for quality inquiry.	Fluency and flexibility in questioning.
3. Investigation & Data Gathering	Students collect, observe, and record data from various sources.	Resource points for valid and diverse data collected.	Persistence, accuracy, and exploration skills.
4. Analysis & Hypothesis Testing	Students analyze data, identify patterns, and draw conclusions.	Skill badges for comparing and interpreting data accurately.	Analytical thinking and originality.

Phase	Inquiry Activity	Gamification Element	Expected Creative Thinking Outcome
5. Creative Quest (Idea Generation & Prototyping)	Students design creative solutions or models.	Idea points and prototype tokens for innovative outcomes.	Fluency, originality, and elaboration.
6. Prototype & Testing	Students test, refine, and improve their models.	“Challenge Mode” for model resilience testing.	Risk-taking and adaptive reasoning.
7. Presentation & Peer Review	Students present and critique each other’s work.	Collaborative leaderboard for group and individual performance.	Communication, collaboration, and evaluative creativity.
8. Reflection & Knowledge Integration	Students reflect on learning and transfer insights to new contexts.	Final achievement badge symbolizing mastery.	Metacognitive awareness and creative synthesis.

In summary, the research employed a rigorous R&D approach using the ADDIE model to develop, validate, and evaluate the INGAME instructional model. The methodological design ensured transparency, ethical compliance, and empirical robustness, providing comprehensive evidence of the model’s validity, practicality, and effectiveness in enhancing elementary students’ creative thinking through inquiry-driven, gamified learning.

Data analysis in this study combined quantitative and qualitative approaches to ensure a comprehensive evaluation of the INGAME model’s validity, practicality, and effectiveness. Quantitative data were obtained from expert validation sheets, teacher practicality questionnaires, and student creative thinking assessments. All numerical data were processed using descriptive statistics to calculate mean scores, percentages, and categories of achievement. The main analytical formula applied followed Akbar’s (2013) model, expressed as:

$$x = \frac{\sum X}{\sum Xi} \times 100\%$$

Where  $\sum X$  represents the total score obtained and  $\sum Xi$  the maximum possible score, the resulting percentages were then interpreted using the following criteria: 85–100% = “very valid/practical/effective,” 70–84% = “valid/practical/effective,” 50–69% = “fair,” and below 50% = “needs revision.” These thresholds provided clear standards for determining the developmental quality of the INGAME model across the ADDIE stages. To assess the improvement of students’ creative thinking, pre- and post-intervention rubric scores were compared using descriptive gain calculations. Each student’s performance in fluency, flexibility, originality, and elaboration was analyzed to identify individual and group-level growth trends. The results were interpreted to determine whether the INGAME model produced meaningful enhancement in creative thinking indicators. Mean score increases were complemented with qualitative interpretation derived from classroom observations and student reflections to contextualize statistical findings.

Qualitative data from interviews, open-ended questionnaire responses, and field notes were analyzed using thematic analysis. This process involved transcribing, coding, and categorizing the data into emergent themes that reflected teachers’ and students’ perceptions of engagement, motivation, and usability of the model. Triangulation between data sources (expert validators, teachers, and students) was performed to ensure the validity and reliability of interpretation. Moreover, qualitative insights were used to explain and enrich the quantitative results, particularly in areas where numerical scores alone could not fully capture behavioral or attitudinal changes.

By integrating both statistical and interpretive analyses, the study ensured a robust understanding of the INGAME model’s performance. This mixed analytical strategy not only validated the model’s structural and pedagogical soundness but also revealed how inquiry and gamification elements interacted dynamically to foster creative engagement and deeper learning among elementary students.

### 3. FINDINGS AND DISCUSSION

The results of this research describe the outcomes of each stage of the R&D process conducted using the ADDIE framework. The findings are presented in three main categories: (1) the validity of the INGAME model as evaluated by experts, (2) its practicality as assessed by teachers, and (3) its effectiveness in enhancing students' creative thinking skills. Quantitative data were obtained from validation sheets, questionnaires, and rubric-based creative thinking assessments, supported by qualitative observations and teacher interviews. The presentation of results follows the logical order of the ADDIE stages, highlighting the iterative process of model refinement and empirical verification.

Validation was carried out by four experts—two content experts and two model experts—to evaluate the quality, coherence, and relevance of the INGAME model and accompanying materials. Each expert provided ratings on a four-point Likert scale (1 = less valid, 4 = very valid) covering content relevance, linguistic clarity, pedagogical alignment, and integration between inquiry and gamification components.

**Table 2.** Expert Validation Results of the INGAME Model

Aspect Evaluated	Expert Group	Mean Percentage (%)	Category
Content validity (materials and learning content)	Content Experts (n = 2)	86.66	Very Valid
Structural and procedural validity (model design and flow)	Model Experts (n = 2)	93.63	Very Valid
Overall Mean		90.16	Very Valid

Table 2 shows that the INGAME model achieved an overall mean validity score of 90.16%, classified as very valid. The content experts rated the learning materials at 86.66%, indicating high relevance to the intended learning objectives and developmental level of elementary students. Meanwhile, the model experts' validation score of 93.63% confirms that the conceptual framework, inquiry-gamification integration, and phase sequencing were methodologically sound and theoretically aligned with the ADDIE design logic. Qualitative comments from experts emphasized the clarity of the model's structure and its firm theoretical grounding in creative thinking and motivation theories (Ryan & Deci, 2000; Torrance, 1966). These findings establish that the INGAME model possesses a high degree of content and construct validity before classroom implementation.

The practicality test was conducted to determine the extent to which teachers found the INGAME model feasible, straightforward, and applicable in real classroom settings. The participating teacher assessed practicality before and after the classroom trial based on indicators such as instructional clarity, time efficiency, resource availability, and ease of classroom management.

**Table 3.** Teacher Practicality Assessment of the INGAME Model

Assessment Phase	Mean Percentage (%)	Category
Before implementation	84.00	Practical
After implementation	80.00	Practical
Overall Mean	82.00	Practical

As shown in Table 3, the teacher's practicality scores indicate consistently high levels of usability. The pre-implementation score (84%) reflects the teacher's initial perception that the INGAME guidebook, lesson plans, and gamified activities were clear and well-structured. After implementation, the practicality score slightly decreased to 80%, yet remained within the "practical" category. This marginal reduction is natural and reflects the teacher's more profound understanding of classroom constraints such as time management and student readiness. Nonetheless, the model was found to be operationally feasible without causing excessive workload or instructional disruption. Observational data further indicated that the model's gamified elements—points, badges, and missions—effectively maintained student engagement while allowing the teacher to guide inquiry efficiently.

Effectiveness was measured through student questionnaires and creative thinking assessments. The questionnaire results captured students' perceptions of motivation, engagement, and enjoyment, while rubric-based evaluations provided objective measures of creative thinking performance.

**Table 4.** Student Effectiveness Results

Instrument	Mean Percentage (%)	Category
Student motivation and engagement questionnaire	79.00	Effective
Creative thinking rubric (post-implementation)	78.30	Effective
Overall Mean	78.65	Effective

Table 4 indicates that students perceived the INGAME learning experience positively, with an average effectiveness score of 79%, classified as effective. The gamified inquiry structure was successful in creating a stimulating environment where students were motivated to explore, collaborate, and take creative risks. Rubric-based evaluations of creative thinking also revealed meaningful improvement in students' fluency, flexibility, originality, and elaboration after participating in INGAME-based lessons. Observations showed that students became more proactive in generating questions and developing prototypes during the "Creative Quest" and "Prototype Testing" phases, suggesting that the combination of inquiry structure and game mechanics fostered both cognitive and emotional engagement.

To measure learning gains, students' creative thinking scores were compared between pre- and post-implementation assessments. The rubric evaluation focused on the four Torrance indicators.

**Table 5.** Comparison of Students' Creative Thinking Scores

Indicator	Pre-Test Mean	Post-Test Mean	Gain	Category
Fluency	2.10	3.25	+1.15	Improved
Flexibility	2.05	3.18	+1.13	Improved
Originality	2.00	3.10	+1.10	Improved
Elaboration	2.08	3.22	+1.14	Improved
Overall Mean	2.06	3.19	+1.13	Improved

As seen in Table 5, the overall creative thinking score increased from 2.06 (pre-test) to 3.19 (post-test) on a four-point scale, resulting in a mean gain of +1.13, which is categorized as improved. The most substantial growth occurred in fluency and elaboration, reflecting students' enhanced ability to generate multiple ideas and develop them with greater detail. This outcome aligns with the theoretical expectation that combining inquiry exploration with gamified reinforcement enhances both cognitive fluency and creative elaboration. The results also demonstrate that gamification effectively lowered affective barriers such as fear of failure, enabling students to experiment more freely and engage in divergent thinking. Teacher observations corroborated these findings, noting that students displayed greater curiosity, independence, and persistence throughout the learning cycle.

The collective findings confirm that the INGAME model meets the three essential criteria for educational product development—validity, practicality, and effectiveness. High expert validation scores demonstrate that the model is theoretically grounded and pedagogically sound. The practicality results affirm that it is feasible for classroom application, requiring no extraordinary resources or training. Finally, the effectiveness analysis provides empirical evidence that the integration of inquiry and gamification enhances elementary students' creative thinking performance. These findings collectively support the hypothesis that the INGAME model serves as both a cognitive framework (through inquiry) and a motivational engine (through gamification), successfully bridging theoretical aspirations of creative education with classroom realities.

**Table 6.** Summary of INGAME Model Evaluation Results

Aspect	Mean Score (%)	Category
Validity	90.16	Very Valid
Practicality	82.00	Practical
Effectiveness	78.65	Effective

As summarized in Table 6, the INGAME model achieved high ratings across all three evaluation dimensions, confirming its readiness for broader implementation and future scalability. The consistent outcomes across validity, practicality, and effectiveness underscore the coherence between the model's theoretical foundation and its operational design.

**Table 7.** Descriptive Statistics of Students' Creative Thinking Scores (Pre–Post Implementation)

Indicator	N	Pre-Test Mean	SD (Pre)	Post-Test Mean	SD (Post)	Gain
Fluency	23	2.10	0.42	3.25	0.38	+1.15
Flexibility	23	2.05	0.40	3.18	0.35	+1.13
Originality	23	2.00	0.39	3.10	0.37	+1.10
Elaboration	23	2.08	0.41	3.22	0.36	+1.14
Overall Mean		2.06		3.19		+1.13

Table 7 presents descriptive statistics showing consistent improvement across all indicators of creative thinking following the implementation of the INGAME model. The average pre-test mean (2.06) increased to 3.19 in the post-test, yielding an average gain of +1.13 on a 4-point scale. The relatively low standard deviations (0.35–0.42) indicate homogeneous performance growth among students, suggesting that the INGAME framework benefits both high- and moderate-ability learners. The most notable improvement occurred in fluency and elaboration, indicating that students became more capable of generating multiple ideas and expanding them with greater depth and detail. This aligns with Torrance, (1966) the claim that creativity flourishes when learners are encouraged to explore ideas without premature judgment. In the INGAME model, the "Creative Quest" and "Prototype Testing" phases appear particularly effective in promoting these outcomes, as the integration of gamified rewards (idea points and prototype tokens) incentivized students to take creative risks and iterate on their ideas. These findings support the model's premise that coupling cognitive scaffolding (inquiry) with motivational mechanics (gamification) results in meaningful and sustained creative growth.

**Table 8.** Observation Summary of Student Engagement Across INGAME Phases

INGAME Phase	Observed Student Activity	Engagement (%)	Category
Orientation & Mission Briefing	Listening, understanding context, identifying mission objectives	95.0	Very Active
Exploration & Question Formulation	Generating and discussing inquiry questions	87.5	Active
Investigation & Data Gathering	Collecting information from multiple sources	83.2	Active
Analysis & Hypothesis Testing	Analyzing data, testing hypotheses	78.4	Moderately Active
Creative Quest & Prototyping	Designing creative solutions or models	91.0	Very Active
Presentation & Peer Review	Presenting results, giving and receiving feedback	85.6	Active
Reflection & Knowledge Integration	Summarizing insights and lessons learned	80.3	Moderately Active
Overall Mean	–	85.8	Active

The observation data in Table 8 provide behavioral evidence of students' active participation throughout the INGAME learning cycle. The mean engagement level of 85.8% places overall classroom

activity in the active category, indicating that most students consistently participated in inquiry and gamified learning tasks. The highest engagement occurred during the Creative Quest (91%) and Orientation & Mission Briefing (95%) phases, confirming that gamification elements such as missions, challenges, and points effectively capture and sustain attention. Engagement slightly decreased in the Analysis & Hypothesis Testing phase (78.4%), a finding consistent with prior studies (Hung & Khine, 2020), which note that analytical reasoning requires sustained cognitive effort that may temporarily reduce visible participation levels. Overall, these results substantiate the claim that INGAME successfully converts inquiry learning—which can often be abstract and demanding—into a dynamic, emotionally engaging process. The consistent activation of students’ curiosity and persistence across all phases demonstrates the model’s capacity to integrate motivational and cognitive dimensions in a balanced manner.

**Table 9.** Teacher Interview Summary on INGAME Implementation

Theme	Teacher’s Statement (Summary)	Researcher’s Interpretation
Model Feasibility	“The procedure is clear and easy to follow because each phase is well defined in the guidebook.”	The model is considered structurally coherent and user-friendly for teachers.
Student Response	“Students were more enthusiastic and less easily bored since there were points and missions.”	Gamification elements effectively enhance intrinsic motivation and engagement.
Implementation Challenge	“Time management needs adjustment to fit class periods.”	Minor logistical challenges suggest that adaptation to different schedules may be needed.
Impact on Creativity	“Students are braver in expressing opinions, and their ideas are more diverse.”	The model supports the development of fluency and originality dimensions of creative thinking.

Teacher feedback corroborates the quantitative findings by providing qualitative depth. The teacher emphasized that the INGAME guidebook offers clear, step-by-step procedures, which facilitated smooth implementation without requiring extensive prior training. The integration of game elements such as badges, missions, and point systems transformed classroom dynamics, making students more proactive and intrinsically motivated. Although time management emerged as a minor concern, this issue is typical during initial adoption of inquiry-based methods and can be addressed through iterative refinement. The teacher’s testimony that students demonstrated greater confidence and idea diversity further validates the observed improvements in creative indicators. Overall, this qualitative evidence underscores the practicality and pedagogical soundness of the INGAME model in real classroom conditions.

### Discussion

The findings of this study reaffirm the fundamental premise that practical instructional innovation in elementary education must balance cognitive challenge and motivational engagement. The INGAME model, developed through a structured instructional design framework, exemplifies this balance by uniting inquiry-based learning and gamification into a coherent pedagogical system. Its implementation demonstrates that learning environments grounded in exploration, questioning, and creative production can successfully coexist with playful, emotionally engaging elements. This synergy transforms the learning process from a teacher-centered transmission of knowledge into a student-centered experience of discovery and meaning-making.

The model’s underlying logic reflects a dual mechanism of educational change. On one hand, guided inquiry provides the intellectual scaffolding through which students construct understanding, analyze problems, and generate ideas. On the other hand, gamification supplies the motivational structure that sustains attention, encourages persistence, and reduces affective barriers such as fear of failure or

disengagement. The interaction between these two mechanisms creates a psychologically safe yet cognitively demanding space where students can take intellectual risks and express original ideas—conditions widely recognized as essential for creativity development (Cai & Wang, 2022; Vlachopoulos & Makri, 2021).

In essence, the INGAME model illustrates how instructional design can be intentionally structured to nurture creativity not as an incidental outcome but as a deliberate goal of teaching. Rather than treating creative thinking as a spontaneous talent, the model situates it as a learnable and assessable competency developed through inquiry cycles enriched by motivational design. This perspective resonates with modern pedagogical theories that view creativity as a process of iterative problem-solving, reflection, and elaboration. Through the integration of meaningful goals, narrative context, and feedback systems, students are encouraged to engage in sustained cognitive effort while finding intrinsic satisfaction in the process itself (Lee & Kim, 2021; Tsai & Hsu, 2020; Yoon & Wang, 2022). The theoretical grounding of the INGAME model is situated at the intersection of constructivist learning theory, creative cognition frameworks, and motivational psychology.

From a constructivist standpoint, learning is conceived as an active, self-regulated process of meaning-making, wherein learners construct knowledge through exploration, collaboration, and reflection. The inquiry-based component of the INGAME model reflects this principle by providing structured opportunities for students to formulate questions, investigate phenomena, and derive conclusions through dialogue and experimentation. This process not only supports conceptual understanding but also nurtures metacognitive awareness and intellectual autonomy—two core prerequisites for creative thinking (C.-H. Chen & Law, 2024).

Complementing this cognitive foundation is Torrance's Theory of Creative Thinking, which identifies four key dimensions of creativity: fluency, flexibility, originality, and elaboration. These dimensions serve as both instructional targets and assessment indicators within the INGAME framework. Each phase of the model—exploration, analysis, prototyping, and reflection—maps directly onto these dimensions, ensuring that creativity is systematically cultivated rather than left to chance. For instance, the Exploration and Question Formulation stage develops fluency and flexibility through divergent questioning, while the Creative Quest and Prototype Testing stages encourage originality and elaboration through iterative problem-solving and design. This deliberate alignment transforms creativity from an incidental byproduct of inquiry into a measurable learning outcome embedded in the instructional sequence.

While constructivist and creative cognition theories explain how learning and creativity develop, Self-Determination Theory (SDT) by (Ryan & Deci, 2000) elucidates why students choose to engage in such cognitively demanding processes. SDT posits that intrinsic motivation arises when three basic psychological needs are satisfied: autonomy (a sense of control and choice), competence (a sense of mastery and effectiveness), and relatedness (a sense of belonging and social connection). Gamification provides the motivational infrastructure to meet these needs by integrating game mechanics such as missions, badges, progress tracking, and collaborative leaderboards. These elements are not merely decorative; they serve as psychological reinforcers that transform cognitive effort into emotionally rewarding experiences. By embedding gamified rewards within inquiry phases, the INGAME model leverages intrinsic motivation to sustain persistence, a relationship supported by (Capraro & Slough, 2022; Domenici, 2022), who found that gamification enhances both engagement and achievement when tied to meaningful tasks.

The combination of inquiry and gamification also finds empirical support in recent international studies. (Barma & Daniel, 2021), through the "Experiverse" project, researchers demonstrated that the integration of inquiry-based science learning with gamified environments significantly increases student collaboration and engagement. Similarly, (Panadero, 2022) explored the "Gamification of Open Inquiry" and concluded that game-based elements amplify the sense of autonomy and achievement during inquiry activities. The INGAME model builds upon and extends these findings by situating the integration within a systematic instructional design framework—ADDIE—that ensures theoretical coherence, iterative

refinement, and empirical validation. In doing so, the model bridges a methodological gap in prior research, where inquiry and gamification were often combined informally without explicit design or validation procedures.

Furthermore, the INGAME model resonates with (Çulha, 2022) conception of “teaching creative thinking,” which emphasizes deliberate design of environments where students can take intellectual risks and explore ideas without fear of failure. The gamified structure of INGAME serves precisely this purpose by reframing errors as opportunities for growth and experimentation. Immediate feedback loops, score-based milestones, and narrative progression lower affective barriers and encourage persistence—a phenomenon often described as productive struggle in constructivist learning. This design perspective transforms assessment from a summative endpoint into a formative, motivational process embedded within the act of teaching itself.

Previous studies have widely examined the separate benefits of inquiry-based learning (IBL) and gamification but rarely explored how the two can be systematically integrated to promote creativity, especially at the elementary level. Research on inquiry-based learning (Jong & Shang, 2023) consistently highlights its effectiveness in developing reasoning, problem-solving, and conceptual understanding. However, these studies also note that students often experience declining motivation during extended inquiry activities. Conversely, research on gamification (Papamitsiou & Economides, 2024) shows that game elements increase motivation and participation but sometimes fail to sustain deep learning when disconnected from cognitive goals. The present study bridges these limitations by combining inquiry and gamification in a unified instructional framework, ensuring that motivation supports, rather than distracts from, meaningful learning and creative development.

Recent works have begun to explore this integration, such as (Çulha, 2022) with Gamified Open Inquiry and (Gresalfi & Horn, 2020) with the Experiverse model, both of which confirmed that gamified inquiry enhances engagement and collaboration. However, these studies were primarily conducted in higher education contexts and lacked a systematic design framework for younger learners. The INGAME model extends their contributions by applying the integration to the elementary classroom context using a structured ADDIE development process, thus ensuring theoretical consistency, empirical validation, and classroom feasibility. In contrast to previous research that treated creativity as a secondary outcome, this model positions creative thinking as the central objective of instruction. Consequently, the INGAME model advances prior work by demonstrating that inquiry and gamification can be intentionally designed to complement one another—producing learning environments that are both cognitively challenging and intrinsically motivating.

Although the INGAME model demonstrates firm theoretical grounding and promising pedagogical potential, several limitations should be acknowledged to contextualize the findings and guide future research. First, this study was conducted within a limited scope, involving a single elementary school and a relatively small sample of students within a specific age group and local context. Such a constrained setting may limit the generalizability of the findings across diverse educational environments. Future studies should therefore apply the INGAME model in broader and more heterogeneous samples, encompassing different school types, regions, and sociocultural backgrounds, to examine its adaptability and consistency across learning contexts. Expanding the participant base will allow for cross-comparison and a deeper understanding of how contextual factors—such as school culture, resource availability, and teacher expertise—affect model implementation.

Second, the research design adopted a descriptive R&D approach without a control group, which limits the ability to establish causal relationships between the implementation of the INGAME model and the observed improvement in creative thinking. Future research could employ quasi-experimental or mixed-method designs to test the model’s effectiveness more rigorously. Incorporating control or comparison groups would provide stronger empirical evidence of its impact relative to traditional or non-gamified inquiry models. Additionally, future studies might include inferential statistical analysis (e.g., *n*-gain, effect size, or ANCOVA) to validate further the magnitude and significance of the learning gains observed.

Third, the measurement of creative thinking relied primarily on a rubric-based assessment focused on four Torrance indicators. While this method provided structured and measurable outcomes, it may not capture the full spectrum of creative behaviors and dispositions manifested during gamified inquiry activities. Subsequent studies could enrich the assessment process by integrating digital learning analytics, peer evaluation, or student creative portfolios to provide multi-dimensional evidence of creativity development. Longitudinal tracking could also reveal whether creative thinking improvements achieved through INGAME are retained and transferred to other subjects or real-world problem-solving situations.

Finally, while this study focused on the student perspective, further investigation into teacher experiences, instructional adaptations, and classroom dynamics during INGAME implementation is recommended. Understanding how teachers internalize and modify the model in different contexts will provide insights for scaling and professional development. It would also be valuable to explore the potential of digital or hybrid versions of INGAME, incorporating learning management systems or educational apps, to enhance accessibility and scalability in the post-pandemic learning era.

In summary, while the present study provides substantial evidence of the INGAME model's validity, practicality, and pedagogical promise, future research should aim to refine, expand, and longitudinally validate its application across diverse settings and age levels. Through iterative testing and interdisciplinary collaboration, the INGAME framework can evolve into a versatile instructional model that continues to inform theory, practice, and policy in creative and engaging learning design.

#### 4. CONCLUSION

In conclusion, the INGAME model—developed through the ADDIE-based research and development process—represents an empirically grounded and theoretically robust innovation that integrates inquiry-based learning and gamification into a coherent pedagogical framework designed to foster creative thinking in elementary education. By aligning the cognitive depth of guided inquiry with the motivational dynamics of gamified learning, the model bridges the long-standing gap between meaningful learning and sustained engagement. Its validation demonstrates that creativity can be intentionally cultivated through structured, inquiry-driven, and playfully engaging experiences rather than treated as a spontaneous byproduct of instruction. Theoretically, the study strengthens the bridge between constructivist and motivational theories, advancing the notion of “motivated constructivism” as a foundation for 21st-century pedagogy. Practically, the INGAME framework provides teachers with a replicable guide for designing lessons that encourage autonomy, curiosity, and collaboration while supporting national education goals such as SDG 4, Merdeka Belajar, and the Asta Cita 2045 vision. To extend its impact, future initiatives should focus on large-scale implementation across diverse contexts, integrating digital platforms and teacher professional development to ensure sustainability. Ultimately, this study contributes to both theory and practice by reaffirming that practical educational innovation does not rely on novelty alone but on the purposeful alignment of cognition, motivation, and creativity to cultivate lifelong learners equipped for the complex challenges of the modern world.

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