



# Development and Empirical Evaluation of Gamification-Driven Learning Models for Digital Natives in Higher Education

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**Abstract.** Gamification has strong potential to increase student motivation and improve learning outcomes, especially among digital natives in higher education. However, there is still limited research on creating gamification instructional models based on systematic instructional design frameworks. This study employed a Research and Development (R&D) approach, including expert validation, practicality testing, and effectiveness evaluation. Participants consisted of undergraduate students at Universitas Negeri Jakarta, 18 lecturers from various Indonesian universities, and Educational Technology experts. The developed model adopts the CIRCUS syntax (Consider Needs, Inspect Content, Regulate Objectives, Construct Prototype, Utilize Prototype, Summing-Up). Expert validation yielded an average Aiken's V index of 0.87, indicating strong validity. Lecturer assessments resulted in an average practicality score of 85 percent, classifying it as very practical. Effectiveness testing showed an improvement in student learning outcomes, increasing from 68 percent before implementation to 82 percent after applying the model. The CIRCUS model is valid, practical, and effective for use in higher education. It provides theoretical insights to gamification research and practical guidance for lecturers and institutions when designing learning experiences tailored to digital natives in the digital age.

**Keywords:** Development, Empirical Evaluation, Gamification

## 1. INTRODUCTION

Gamification has become one of the innovative strategies in higher education that has quickly developed over the past decade. This approach aims to provide a more engaging, interactive, and meaningful learning experience by integrating game elements into the learning process. Conceptually, gamification is defined as the application of game mechanisms in non-game settings to boost motivation, engagement, and students' learning achievement (Deterding et al., 2011). In practice, gamification can be implemented through points, levels, badges, leaderboards, and mission-based challenges that encourage students to participate more actively (Ariani, 2020). These elements not only foster a competitive environment but also create a sense of achievement and ongoing progress.

Numerous studies have demonstrated that gamification enhances both intrinsic and extrinsic motivation in students. Regularly applying gamification strategies can significantly improve student engagement (Leaning, 2015; Situmorang et al., 2021). Additionally, Surendeleg et al. (2014) observed that gamification helps students develop greater perseverance in finishing academic tasks (Pechenkina, et al., 2017). These insights suggest that gamification holds strong potential as an educational approach to enhance learning in higher education.

Most previous studies tend to examine short-term motivational effects, while there is limited development of gamification-based learning models that incorporate a systematic instructional design framework (Mora, et al., 2017). Many implementations merely add game elements without ensuring they align with learning objectives and instructional principles (Scholz, et al., 2021). Consequently, despite gamification's benefits, its use often lacks a clear structure, fails to effectively support learning outcomes, and has not been empirically validated (Dehghanzadeh, et al., 2024). This gap highlights the need for purposefully designed, theory-based, and empirically tested gamification models in higher education.

Current students belong to the digital natives generation—individuals who have interacted with digital technology since childhood (Prensky, 2001). Unlike earlier generations, digital natives grow up amid digital devices, social media, and immediate access to information. This environment influences their learning traits, leading them to prefer quick, visual, interactive, and tech-enabled learning methods. They seek experiences that offer rapid feedback, gradual

development, and chances for independent exploration, giving them a sense of control over their learning (Beaudoin & Avanthey, 2023).

This trait directly affects higher education. Traditional teaching approaches that are primarily one-way, rely on lengthy lectures, or lack interaction are often less successful in engaging digital natives (Chang & Chang, 2023). Students from this generation need a learning design that goes beyond mere content delivery; it should create a digital ecosystem that is adaptive, dynamic, and highly engaging (Koh & Kan, 2021).

This challenge becomes more evident in courses like Data Science and Programming, which are complex, abstract, and demand advanced analytical skills. These courses are often seen as tough because they require a thorough grasp of concepts alongside technical skills in algorithms, data analysis, and programming logic. When taught through traditional methods, digital-native students may experience lower motivation, engagement, and even diminished learning outcomes (Maini et al., 2021). Consequently, higher education instructors must create learning experiences that are not only tailored to the learning styles of the digital generation but also ensure the achievement of Course Learning Outcomes (CLO).

Gamification, which offers interactive challenges, reward mechanisms, and immediate feedback, has emerged as a promising strategy to address these needs. When game elements are incorporated into a structured instructional design, educators can better connect with digital natives' traits and meet academic requirements in higher education (Abuhassna & Alnawajha, 2023).

Gamification in higher education should not be seen simply as adding 'game decorations' to the learning process (Pařová & Vejačka, 2022). Without proper integration, it may only offer superficial motivation without affecting learning results (John et al., 2023). Thus, gamification must be integrated within a systematic instructional design framework.

The development of the CIRCUS model is grounded in the solid theoretical foundation of a recognized instructional design framework. Specifically, the Dick & Carey Model was selected because it offers a structured approach to designing learning, covering needs analysis, goal setting, and evaluation (Dick, Carey & Carey, 1996). This model highlights the significance of connecting learning components, ensuring each instructional step supports the others towards achieving the final objective. Consequently, the structure of CIRCUS is crafted to follow a logical, coherent flow that aligns with the systematic principles outlined by Dick & Carey.

Secondly, development also relates to the Instructional Learning Design Framework (ILDF), which focuses on learning design through digital technologies (Bannan, 2009). ILDF is important because it emphasizes creating online, interactive learning experiences that foster collaboration. These features meet the expectations of digital native students who are familiar with digital environments, while also ensuring that gamification can be seamlessly integrated into Learning Management System (LMS) platforms.

This research is based on Merrill's (2002) First Principles of Instruction, which emphasize four key learning processes: activating prior knowledge, demonstrating concepts, applying skills, and integrating experiences into real-world contexts (Merrill, 2017). These principles guide the development of gamification stages within the CIRCUS model, such as providing challenges to activate prior knowledge, using visualizations for demonstration, offering case-based practice for application, and encouraging student reflection through integration activities.

By combining these three frameworks, gamification acts as both a motivation tool and an instructional strategy focused on learning outcomes. This approach ensures that each gamification element in the CIRCUS model is pedagogically sound and encourages digital native students to engage actively in meaningful learning experiences.

Given the background outlined above, it is clear that integrating gamification within a structured instructional design framework is an urgent need in higher education (Yamani, 2021). Digital native students seek interactive and engaging learning experiences, while educational institutions must ensure that learning outcomes are measurable (Vitvitskaya, et al., 2022). This gap presents opportunities for research into gamification-based learning models that focus not only on motivation but also strictly follow instructional design principles.

This study introduces a gamification-based learning model called CIRCUS, designed specifically for digital native students in higher education, using an instructional design framework. The model provides clear guidance for instructors to create, implement, and assess learning activities. The research aims to validate CIRCUS through expert reviews, evaluate its usability with instructors from multiple universities, and measure its impact directly on students. The ultimate goal is to demonstrate that gamification not only increases motivation but also functions as an effective, flexible, and achievement-focused teaching strategy in higher education.

This research makes important contributions to the development of gamification-based learning in higher education, both theoretically and practically. It introduces a gamification instructional model featuring the CIRCUS syntax, which is based on a solid conceptual foundation and has been empirically validated through expert review, practicality assessments, and effectiveness evaluations. This work advances the gamification field, which has mainly focused on motivational effects, by offering a clear, systematic instructional framework centered on learning

outcomes. As a result, the study expands the scope of gamification research from primarily a motivational tool to a comprehensive instructional strategy.

Practically, this research provides guidelines for lecturers to create more interactive, adaptive, and personalized learning experiences for digital native students. The CIRCUS model details clear steps for analyzing learning needs, setting objectives, designing gamified teaching prototypes, implementing them, and assessing outcomes. The simple stages help lecturers incorporate game elements without sacrificing learning goals, thus increasing student engagement while ensuring learning outcomes are achieved.

Furthermore, the contribution of this research is also institutional in nature because its results can serve as a reference for higher education institutions in developing innovative curricula and technology-based learning strategies. The gamification model developed can be adapted for various courses, especially those that are complex and require analytical skills. Thus, this research not only directly addresses the needs of digital native students but also supports the transformation of higher education toward a more relevant learning system in the digital era.

From an academic development perspective, this research opens opportunities for further studies to test the application of the CIRCUS model in other disciplines outside the fields of big data and programming, to determine its flexibility and transferability. Additionally, future research could expand the scope by involving student samples from various cultural contexts and international institutions to observe how different learning environments influence the effectiveness of gamification. Subsequent studies could also incorporate more in-depth quantitative and qualitative analyses, such as measuring motivation, emotional engagement, or students' learning experiences over time. With this direction, the contribution of this research is not only limited to the local context but also relevant for strengthening the global literature on gamification in higher education.

## 2. RESEARCH METHOD

This research adopts a Research and Development (R&D) approach focused on creating and testing a gamification-based instructional model called CIRCUS (Consider Needs, Inspect Content, Regulate Objective, Construct Prototype, Utilize Prototype, Summing-Up). The main goal of this study is to assess the validity, practicality, and effectiveness of the model, both in its structure and in the implementation of the developed gamification.

The research participants consisted of three groups. First, three experts in Educational Technology assessed the syntactic appropriateness of the CIRCUS model based on the principles of instructional design development. Second, eighteen university lecturers in Indonesia evaluated the practicality of the CIRCUS model's syntax, especially from the perspective of potential users who might implement this model in their courses. Third, students from Universitas Negeri Jakarta across various faculties, enrolled in Big Data and Programming courses, participated in the field trial stage to evaluate the effectiveness of the gamification developed using the CIRCUS syntax.

The research process has two main stages. The first is the syntactic evaluation of the CIRCUS model. In this stage, two primary activities take place. First, Educational Technology experts assess whether the syntax aligns with the principles of instructional design development, ensuring the steps in the model correspond with the instructional framework. Second, lecturers from various universities evaluate the practicality of the syntax from the perspective of potential users, focusing on aspects like clarity, ease of implementation, and the model's usefulness for learning.

The second stage of the research involves the gamification assessment developed based on the syntax of the CIRCUS model. The gamification tool is integrated into the Learning Management System (LMS), allowing its use in a digital learning environment. Before being tested with students, the gamification is first reviewed by subject matter experts and media specialists (Step 2b). The subject matter experts evaluate the content's alignment with the course learning outcomes, while media specialists assess the design quality, interactivity, and system functionality. This validation ensures that the gamification product is both feasible and effective from a substantive and technical perspective.

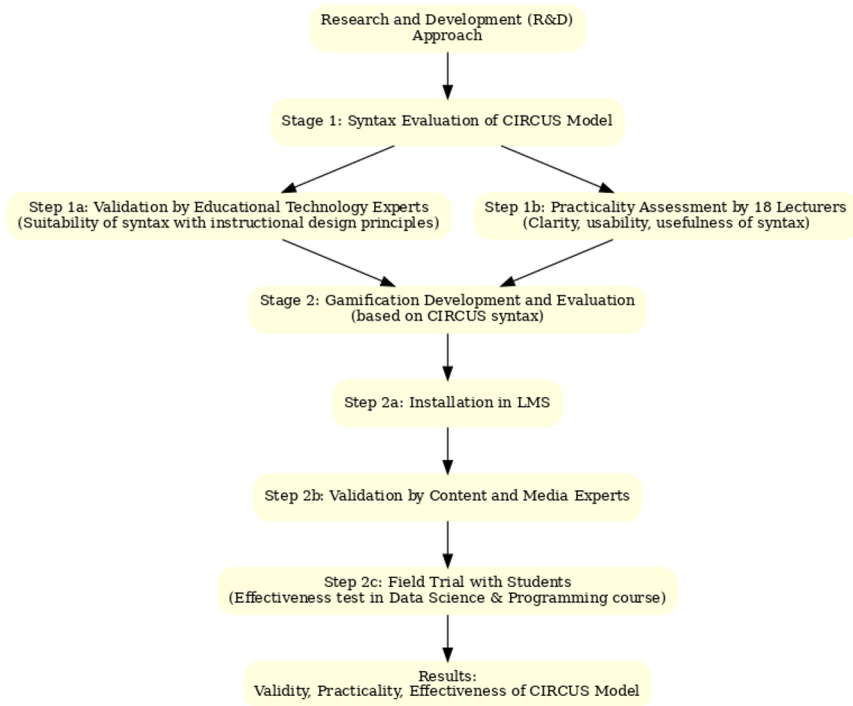


Figure 1. Research Flow

After completing the validation stage, the research proceeded to a field trial (Step 2c) with students at Universitas Negeri Jakarta enrolled in Big Data and Programming courses. This field test aimed to assess the model's effectiveness in a real learning environment. Effectiveness was measured not only through students' perceptions but also via learning achievement indicators, such as their success in completing gamification activities within the LMS. These metrics are demonstrated by students earning the five badges provided and completing the instructional game included as part of the gamification design.

The flow of this research does not fully follow the Tessmer formative evaluation procedure, which usually includes one-on-one and small-group evaluations before field testing. The decision not to include these two stages was based on the belief that validation by subject matter experts and media experts is sufficient to ensure the content quality and technical aspects of the product, while effectiveness is better measured by students' success in achieving real learning outcomes. Therefore, combining expert validation and field trials is considered enough to confirm the validity, practicality, and effectiveness of the CIRCUS model in higher education.

Data analysis in this study was conducted in stages focusing on the validity, practicality, and effectiveness of the CIRCUS model. The syntactic validity of the model was evaluated using Aiken's V index to assess the level of agreement among Education Technology experts regarding the syntactic conformity with instructional development design principles. Aiken's V value is interpreted based on the criterion that a value  $\geq 0.80$  indicates a high level of validity.

The practicality of the model was assessed descriptively using survey results from 18 lecturers. The scores, obtained via a Likert scale, were converted into average percentages and grouped into practicality ranges: 61–80% (practical) and above 80% (very practical). This analysis seeks to evaluate how easily the model is understood, implemented, and beneficial from the perspective of potential users.

The feasibility of the gamification product was evaluated based on the results of a study by content and media experts. These experts assessed the relevance of the content to the course learning outcomes, as well as the technical quality and interface design within the LMS. The analysis was conducted descriptively by comparing the findings to standard indicators.

The effectiveness of the model is assessed based on a field trial with students. Effectiveness is indicated not only by comparing learning achievements before and after implementation but also by students' success in completing gamification activities in the LMS. The model is considered effective if students earn all five available badges and successfully finish the instructional game. Quantitative achievement data (pre- and post-implementation) is supplemented by students' performance data within the gamification system, offering a complete view of the model's impact on learning success.

**TABLE 1.** Data Analysis Methods

Aspect of Evaluation	Source of Data	Analysis Technique	Indicator of Success
Validity of Syntax	Educational Technology Experts (n = 3)	Aiken's V Index	$V \geq 0.80$ = High validity
Practicality of Syntax	Lecturers from various universities (n = 18)	Descriptive statistics (mean %)	61–80% = Practical; >80% = Very Practical
Feasibility of Product	Content Experts and Media Experts	Expert judgment (qualitative & quantitative checklists)	Content aligned with learning outcomes; media meets technical & design standards
Effectiveness of Model	Students in Data Science & Programming course (field trial)	Descriptive comparison (pre–post learning outcomes); performance tracking in LMS	Improvement in learning outcomes; students earn 5 achievement badges and complete the instructional game

### 3. RESEARCH RESULTS

The validity assessment of the CIRCUS model syntax was performed by three Educational Technology experts. Analysis using Aiken's V index showed an average score of 0.87, including syntax clarity at 0.88, component suitability at 0.85, and alignment with instructional design principles at 0.89. All scores are above the minimum threshold of 0.80, indicating that the CIRCUS syntax is valid. These results demonstrate strong agreement among the experts that the model stages align with instructional development principles.

**TABLE 2.** Results of Expert Validation

Aspect	V Index	Category
Clarity of syntax	0.88	Valid
Component relevance	0.85	Valid
Alignment with instructional principles	0.89	Valid
<b>Average</b>	<b>0.87</b>	<b>Valid</b>

A total of 18 lecturers from various universities in Indonesia assessed the comprehensibility, ease of implementation, and benefits of the CIRCUS model syntax. The descriptive analysis showed an average score of 85 percent, categorized as very practical. The comprehension score was 84 percent, the ease of implementation was 86 percent, and the model's benefits were 85 percent. This suggests that the lecturers find the CIRCUS syntax easy to understand, adaptable in teaching practice, and beneficial for enhancing the quality of the learning process.

**TABLE 3.** Lecturer Practicality Assessment

Indicator	Mean Score (%)	Category
Ease of understanding	84	Very Practical
Ease of implementation	86	Very Practical
Perceived benefit	85	Very Practical
<b>Average</b>	<b>85</b>	<b>Very Practical</b>

The gamification product developed using the CIRCUS syntax was successfully installed and operated within the Learning Management System (LMS). This integration enables students to access materials, complete challenges, and earn achievement badges online. This stage acts as an important bridge before experts conduct the content and media feasibility validation. The gamification integrated into the LMS was then reviewed by subject matter experts and media specialists. The validation results indicated that the learning content aligns with the learning outcomes of the Big Data and Programming courses. Regarding media, the interface appearance, navigation, and interactivity are considered appropriate and meet digital instructional design standards. Therefore, the gamification product is deemed feasible to move forward to the field trial stage.

The effectiveness test was carried out through a field trial involving students from Universitas Negeri Jakarta enrolled in the Big Data and Programming courses. The results showed an increase in learning achievement from 68 percent before implementation to 82 percent afterward, a 14 percentage point rise. Additionally, most students successfully earned all five achievement badges available in the LMS and completed the designed instructional game. These indicators confirm that gamification based on the CIRCUS model not only motivates students but also effectively enhances their learning outcomes.

**TABLE 4.** Effectiveness According to Student Learning Outcomes

Stage	Average Achievement (%)	Category
Before implementation	68	Moderate
After implementation	82	High
<b>Improvement</b>	<b>+14</b>	<b>Effective</b>

Overall, the research findings show that the CIRCUS model meets three main criteria in development research: validity, practicality, and effectiveness. Validity is supported by how the syntax aligns with instructional design principles. Practicality is demonstrated through positive feedback from lecturers. The feasibility of the product is confirmed by evaluations from content and media experts, while its effectiveness is evidenced by improvements in students' learning achievements and their success in completing all gamification activities in the LMS.

**TABLE 5.** Research Findings by Stage

Step	Focus of Evaluation	Participants	Key Findings	Outcome Category
1a	Validity of CIRCUS syntax	3 Educational Technology Experts	Aiken's V = 0.87 (Clarity = 0.88; Component relevance = 0.85; Alignment = 0.89)	Valid (≥ 0.80)
1b	Practicality of CIRCUS syntax	18 Lecturers from Indonesian universities	Average score = 85% (Comprehension = 84%; Implementation = 86%; Usefulness = 85%)	Very Practical (>80%)
2a	Integration of gamification into LMS	System-level implementation	Gamification successfully installed in LMS; enabled challenges, badges, and instructional game	Ready for validation
2b	Feasibility (Content & Media validation)	Content experts and media experts	Content aligned with course learning outcomes; media design, interface, and functionality deemed feasible	Feasible
2c	Effectiveness (Field trial with students)	Undergraduate students in Data Science & Programming	Learning outcomes increased from 68% to 82% (+14%); most students earned 5 badges and completed instructional game	Effective

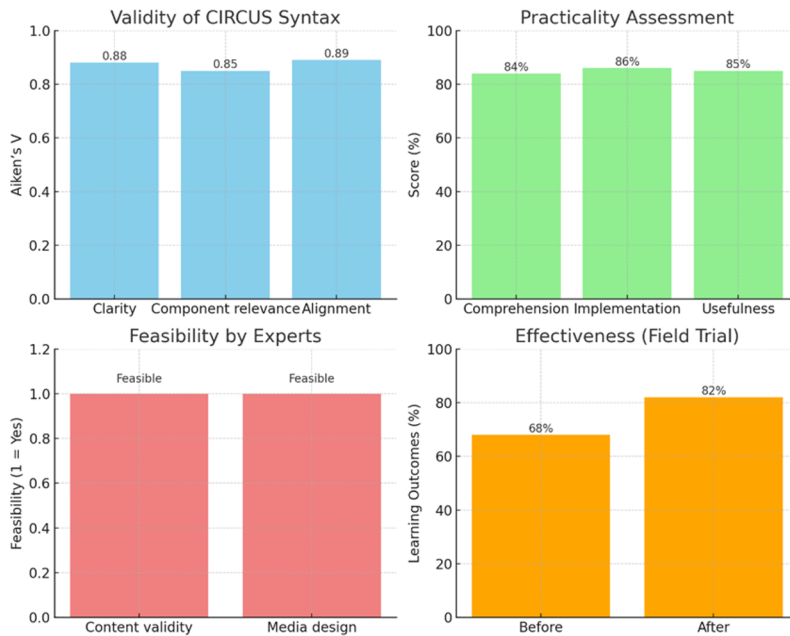


Figure 2. Research Results

#### 4. DISCUSSION

The research results show that the gamification-based learning model developed, called CIRCUS, fulfills three main criteria in development research: valid, practical, and effective. This model is built with six consecutive syntactic stages: Consider Needs, Inspect Content, Regulate Objectives, Construct Prototype, Utilize Prototype, and Summing-Up, which create a systematic instructional framework to incorporate gamification elements into the higher education learning process.

Validation by three Educational Technology experts resulted in an average Aiken's V index of 0.87, demonstrating that the CIRCUS syntax aligns with instructional design principles. In the Consider Needs and Inspect Content stages, the experts assessed that the student needs analysis and content mapping had been clearly formulated, enabling the selection of gamification elements relevant to digital natives' characteristics.

The practicality test involving 18 lecturers from various universities in Indonesia showed an average score of 85 percent, categorized as highly practical. The Regulate Objective and Construct Prototype stages were rated as highly applicable because goal setting linked to game levels and the development of prototypes based on badges and rewards were considered easy to understand and could be implemented in various learning contexts. Therefore, the CIRCUS model is not only theoretically valid but also practically usable by educators across different institutions.

The feasibility aspect of the product, tested through validation by content and media experts, supports the previous results. Content experts verify that the learning content presented in gamification aligns with the course learning outcomes, while media experts evaluate whether the interface, navigation, and functionality within the LMS meet the standards. This stage replaces the one-on-one and small group evaluation processes in Tessmer's formative evaluation because the content and media feasibility confirmed by experts are sufficient to ensure the product's quality before testing on students.

Furthermore, an effectiveness test conducted on students at Universitas Negeri Jakarta showed an increase in learning achievement from 68 percent before implementation to 82 percent after applying the model. Additional

indicators of effectiveness are also evident from the success of most students in earning five achievement badges and completing instructional games within the LMS. The alignment between learning content, students' needs, and the game elements used forms the main foundation for the success of gamification. This confirms that the learning styles of digital natives demand quick, interactive, and technology-based learning experiences (Helsper & Eynon, 2010). These achievements are closely related to the Utilize Prototype and Summing-Up stages, where students respond positively to interactive challenges, reward systems, and quick feedback, which in turn increases engagement in learning. The final evaluation stage allows instructors to adjust strategies according to students' needs, thereby strengthening the success of the learning process.

These results support the findings of Koivisto et al. (2019), who stated that gamification boosts student motivation and engagement. However, this study adds to the evidence by demonstrating that gamification, when designed using instructional design principles, not only motivates students but also significantly enhances learning achievement. For digital native students, the presence of levels, badges, and interactive challenges in the CIRCUS model corresponds well with their preferences for digital learning experiences that are adaptive and provide quick feedback (Prensky, 2001).

Thus, this discussion confirms that the CIRCUS syntax is not just a conceptual framework but has been empirically proven to be effective. Its high validity shows that the model has a strong theoretical base, high practicality indicates that the model is easy to implement, the feasibility of content and media demonstrates that the product is ready for use, and significant effectiveness proves that the model has a real impact on students' learning achievements. Therefore, this model can be seen as an instructional innovation that connects the needs of digital natives with the demands of systematic academic success in higher education.

## 5. CONCLUSION

This research developed a gamification-based learning model using the CIRCUS syntax (Consider Needs, Inspect Content, Regulate Objective, Construct Prototype, Utilize Prototype, Summing-Up), which was systematically designed based on instructional design principles. Expert validation results show that this model is valid, with an average Aiken's V index of 0.87, indicating the syntax's alignment with instructional principles. Feedback from 18 lecturers from various universities further supported these findings, with an average practicality score of 85 percent, classifying it as highly practical. The gamification product created through the CIRCUS syntax was also deemed feasible by content and media experts, ensuring content alignment with learning outcomes and technical quality within the LMS. Field testing with students from Universitas Negeri Jakarta demonstrated the model's effectiveness, with learning achievement rising from 68 percent before implementation to 82 percent after. Most students successfully earned five achievement badges and completed the instructional game.

This finding confirms that the CIRCUS model is not only a conceptual framework but also a proven, practical, feasible, and effective instructional strategy for enhancing learning quality among digital native students in higher education. The CIRCUS syntax offers clear guidance for instructors in designing, implementing, and evaluating gamification-based learning. With its structured approach, this model sets itself apart from gamification practices that simply add game elements without integrating them into instructional design.

The implications of this research cover several areas. First, for educators, the CIRCUS model can act as a practical guide for creating interactive learning experiences that cater to digital natives while still achieving learning outcomes. Second, for researchers, these results add to the gamification literature by offering empirical evidence that carefully designed gamification can boost motivation and improve learning results. Third, for higher education institutions, adopting this model can represent an innovative curriculum approach suited for the digital age, especially for complex and data-driven courses. Additionally, the research's methodological rationale can serve as a reference for similar development studies.

Thus, this research offers both theoretical and practical contributions: presenting an empirically validated gamification instructional model that can be adapted to various learning environments and supporting the shift of higher education toward a more interactive, adaptive system that caters to the needs of digital native students in the digital age.

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