

## A Gamified Learning Model for Business Intelligence in Technopreneurship Education: Case Study at FTI UNIBI

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### Abstract

This study designs a gamified learning model for the 'Technopreneur Portal' to enhance Business Intelligence (BI) mastery within the Technopreneurship course at Universitas Informatika dan Bisnis Indonesia (UNIBI). While BI is a crucial competency for developing data-driven startups, teaching these complex concepts through traditional, passive e-learning often results in high cognitive load and low student engagement. Furthermore, a significant research gap exists: although gamification is widely used to boost general motivation, its specific integration in teaching technical entrepreneurship and BI remains underexplored. To address this, this study adopts the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) framework to systematically transform the syllabus into interactive, gamified modules. Traditional learning activities are reimaged as "Business Quests," where students earn Experience Points (XP) and specialized "Badges," fostering healthy competition through a class "Leaderboard." The integration of gamification shifts the learning paradigm from passive observation to active, experiential participation, effectively scaffolding the mastery of practical BI skills. This contextually tailored approach significantly boosts students' motivation, analytical abilities, and overall entrepreneurial readiness. Additionally, the model enables students to build a tangible business portfolio, culminating in a Certificate of Achievement with a QR code for digital, accountable validation of their competency credentials.

**Keywords:** Business Intelligence, Educational Technology, Gamification, Technopreneurship, Business Portfolio

## 1 INTRODUCTION

The rapid advancement of digital transformation necessitates a paradigm shift in higher education entrepreneurship programs [15]. Modern higher education institutions must increasingly function as entrepreneurial and digitally enabled ecosystems that prepare students for technology-driven business environments [1]. In response to this demand, the Faculty of Technology and Informatics at Universitas Informatika dan Bisnis Indonesia (FTI UNIBI) implemented the Technopreneurship course, supported by a dedicated learning management system known as the "Technopreneur HUB Portal." A core competency heavily emphasized in this curriculum is Business Intelligence (BI) [8]. Students are tasked not merely with conceptualizing abstract business ideas, but with building data-driven startups. Consequently, complex BI topics—such as designing Key Performance Indicators (KPIs), dashboard visualization, and evidence-based

decision-making—form the crux of their entrepreneurial training.

Despite the operational deployment of the Technopreneur Portal as the primary learning medium, significant pedagogical and cognitive challenges persist [4], [5]. Delivering BI content and startup simulation exercises involves the transfer of intricate, procedural knowledge. Relying on traditional, passive reading modules or linear presentations to teach these highly technical subjects often results in cognitive overload and student disengagement. Students struggle to internalize dynamic, real-world business scenarios, leading to a stagnation in their practical analytical skills. This phenomenon aligns with the findings of Shofwan et al. [2], which highlight the urgent need for multimodal and interactive learning models to effectively stimulate creativity and entrepreneurial courage. Without targeted instructional interventions, existing digital platforms like the Technopreneur Portal risk functioning merely as static task repositories rather than dynamic, immersive business simulation environments [10].



To address these instructional barriers, gamification—the integration of game design elements in non-game contexts—emerges as a promising solution. However, a critical review of existing literature reveals a distinct research gap concerning the intersection of gamification, entrepreneurship education, and high-level technical subjects like BI. While gamification has been widely studied, its application often remains superficial [9]. For instance, a systematic literature review by Seguí-Mas et al. [3] indicates that gamification in higher education predominantly focuses on enhancing basic learning motivation through generic point systems, rather than being strategically designed to scaffold complex procedural knowledge. Furthermore, recent studies emphasize that the efficacy of gamification is highly context-dependent; indiscriminately adding game mechanics without aligning them with the specific cognitive demands of the subject matter yields minimal pedagogical value [15]. Prior studies lack empirical models that tailor game mechanics specifically to the rigorous analytical demands of Business Intelligence within a technopreneurship framework.

To bridge this critical gap, the primary objective of this research is to design and implement a structured, contextually relevant gamified learning model within the Technopreneur Hub Portal at FTI UNIBI. By transforming traditional curriculum delivery into interactive game scenarios, this research seeks to systematically support students' comprehension of Business Intelligence concepts and their practical application in startup creation, effectively shifting the learning paradigm from passive observation to active entrepreneurial execution [11].

## 2 LITERATURE REVIEW

The gamification approach in higher education extends beyond mere entertainment; it functions as a strategic pedagogical tool to enhance student engagement and foster an entrepreneurial mindset [1], [3]. Studies have demonstrated that gamification provides students with autonomy and builds their self-confidence in proactively tackling academic challenges [6]. The effectiveness of this mechanism in shaping an adaptive mindset is crucial for technopreneurship, as evidenced by recent research showing that gamification helps students build a solid foundation of design logic and problem-solving skills essential for digital entrepreneurship [1]. The positive impact of gamification on student participation in digital learning platforms is well-documented [4], [5]. Furthermore, comprehensive reviews confirm that game-based learning approaches have evolved into a leading pedagogical framework globally [9].

However, when integrated with highly technical domains like Business Intelligence (BI), gamification takes on a more strategic, yet underexplored, role. BI

requires students to process raw data into actionable corporate strategies and conduct complex tasks such as market sentiment analysis [8]. Research in the context of experiential business simulations further reinforces that gamification directly influences behavioral changes and the mental resilience of an entrepreneur [15]. Therefore, integrating gamification into the Technopreneur Portal is expected to not only increase engagement but also strategically facilitate the effective transfer of rigorous BI knowledge.

Unlike general academic subjects, teaching Business Intelligence requires managing a significant intrinsic cognitive load due to complex procedural tasks like predictive analytics, startup validation, and data visualization. To address this, the proposed gamified learning model integrates Cognitive Load Theory (CLT) and Self-Determination Theory (SDT) [11]. By applying CLT, the Technopreneur Portal segments these complex, high-level BI processes into manageable, micro-step 'Business Quests' to prevent cognitive overload. Concurrently, SDT is applied to fulfill students' fundamental psychological needs: Autonomy is achieved by allowing students to choose their operational approaches and decision-making paths within the quests; Competence is fostered through immediate feedback via earning Experience Points (XP) and exportable Skill Badges (e.g., 'Data Architect'); and Relatedness is cultivated through competitive yet healthy class Leaderboards. This dual-theory application ensures that the integrated game mechanics are not merely decorative elements, but act as essential pedagogical scaffolds tailored specifically for mastering Business Intelligence in technopreneurship education [16].

## 3 RESEARCH METHODS

This study adopts a qualitative approach and follows a systematic instructional design development methodology to create and assess the effectiveness of a gamification-based learning model. The focus is on engineering the learning interactions within the "Technopreneur Portal" at the Faculty of Technology and Informatics. The research uses the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation), a widely recognized framework for instructional design, ensuring the methodical creation and evaluation of the gamified system [7], [12].

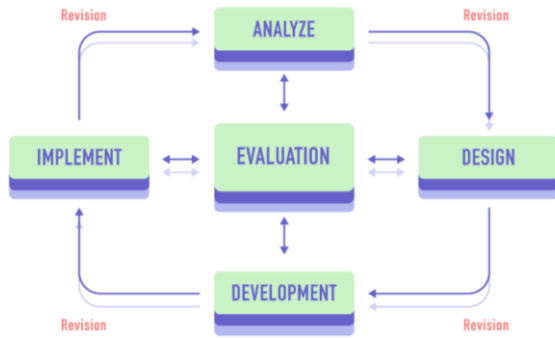


Figure 1. Flowchart of the research methodology based on the ADDIE framework,

### 3.1 Analysis Phase

The Analysis phase serves as the foundational step of this study, which includes a comprehensive diagnosis of the existing Technopreneurship course, particularly its Business Intelligence (BI) curriculum. This phase primarily focuses on identifying cognitive load challenges and instructional gaps that hinder effective learning, particularly when teaching BI concepts and startup validation procedures.

- **Learner Profiling and Cognitive Load Assessment:** Students enrolled in the Technopreneurship course come from diverse academic backgrounds, with varying levels of exposure to data analytics, programming, and business strategy. The cognitive load analysis seeks to identify barriers that students face when learning complex BI concepts, such as data aggregation, statistical analysis, and predictive modeling. The goal is to pinpoint cognitive overload areas caused by the integration of technical software (e.g., BI dashboards) with abstract business theories (e.g., market analysis and strategic decision-making).
- **Technological Infrastructure Audit:** The study also evaluates the current Learning Management System (LMS) at FTI UNIBI, assessing its ability to support interactive and gamified modules. It explores whether the existing system can integrate dynamic XP trackers, secure badge repositories, and real-time leaderboards. The results of this analysis guide the customization and development of the Technopreneur Portal, ensuring the platform's readiness to support gamification features without performance issues.

Table 1. Competency Objective Alignment in the BI Curriculum

Core Competency Domain	Specific Technical/Business Skills Required	Target Cognitive Outcome
Data Aggregation	Scraping, cleaning, and structuring raw datasets.	Procedural Application
Predictive Analytics	Utilizing regression models to forecast market trends.	Synthesis and Evaluation
Data Visualization	Engineering dashboards (Tableau/Power BI) for clarity.	Comprehension and Application
Startup Validation	Formulating pivot/persevere decisions based on data.	Higher-Order Critical Thinking

### 3.2 Design Phase

In the Design phase, a detailed blueprint for the gamified learning experience is created. The design process ensures that game mechanics align with the pedagogical goals of the BI and Technopreneurship curriculum. This includes restructuring traditional academic assignments into narrative-driven Business Quests, transforming passive learning activities into interactive, mission-based challenges.

- **Curriculum Transformation:** The existing course syllabus is restructured to include interactive gamified elements. For example, BI-related tasks such as data cleansing or market trend analysis are embedded into the Business Quests. Students will progress through the quests, earning Experience Points (XP), unlocking specialized badges, and climbing the Leaderboard based on their task completion and analytical success,
- **Game Mechanics and Learning Objectives:** Each quest is designed with specific learning objectives aligned to the course's core competencies. For example:
  - **Data Aggregation Quests:** Require students to clean, structure, and analyze raw datasets using BI tools such as Tableau or Power BI.
  - **Predictive Analytics Quests:** Engage students in applying regression models to forecast market trends, thereby transitioning them from intuition-based decision-making to data-driven strategies.

The game mechanics used include XP, badges, leaderboards, and experience-based rewards, which are calibrated to match the learning phases (beginner, intermediate, advanced)

Table 2. The Gamification Mechanics Matrix: Integrating SDT and CLT

Game Mechanic	Pedagogical Purpose	Psychological Need (SDT)	Cognitive Load Function
<b>Experience Points (XP)</b>	Granular, continuous tracking of micro-interactions (e.g., daily logins, completing a single SQL query).	Competence (Immediate Feedback)	Reduces intrinsic load by rewarding incremental, micro-step progress.
<b>Business Quests</b>	Replaces linear, chapter-based modules with goal-oriented, problem-solving narrative challenges.	Autonomy (Choice of operational approach)	Segments complex BI processes into manageable, highly focused schemas.
<b>Skill Badges</b>	Visual, exportable representation of mastery in specific, highly technical domains (e.g., "Data Architect").	Competence (Achievement and Status)	Provides clear, hierarchical learning milestones without grade anxiety.
<b>Relative Leaderboards</b>	Ranks students based on the simulated financial success of their venture	Relatedness (Social comparison and community)	Fosters healthy competitive engagement while mitigating discouragement.

Game Mechanic	Pedagogical Purpose	Psychological Need (SDT)	Cognitive Load Function
	and analytical accuracy.		
<b>Experience Points (XP)</b>	Granular, continuous tracking of micro-interactions (e.g., daily logins, completing a single SQL query).	Competence (Immediate Feedback)	Reduces intrinsic load by rewarding incremental, micro-step progress.

### 3.3 Development Phase

In the Development phase, the design is transformed into functional digital assets within the Technopreneur Portal. This involves system engineering to integrate game mechanics, interactive content, and BI software into a cohesive and interactive platform.

- **System Integration:**  
The development process includes integrating dynamic tracking systems for XP and automated badge distribution. For example, when students complete a data visualization quest, the system will automatically award badges such as "Data Architect" or "Market Validator", based on their proficiency in using BI tools
- **Interactive Content Creation:**  
Traditional static lectures are transformed into interactive, multimedia-rich quests. For instance, a Market Demographics Quest might present a synthetic dataset that students need to clean and analyze, with immediate feedback provided by the system based on their performance. The system's interactive feedback loops ensure real-time learning without instructor bottlenecks

### 3.4 Implementation Phase

The Implementation phase involves deploying the gamified Technopreneur Portal to the student cohort and conducting empirical testing. The platform is tested in a live academic setting over one semester, where students engage in the gamified learning experience.

- **Onboarding and Initial Familiarization:**  
A structured Tutorial Quest is introduced to students, familiarizing them with the system's

mechanics, user interface, and objectives. The onboarding phase is designed to be low-stakes and engaging, ensuring that students can acclimate to the system before facing the main content quests

- **Active Learning Dynamics:**

Throughout the semester, students engage with BI software, interact with the Gamified Business Quests, and submit their empirical findings. The instructor's role shifts from a traditional lecturer to a facilitator or "Game Master", guiding students through challenges and fostering collaborative discussions

### 3.5 Evaluation Phase

The Evaluation phase focuses on assessing the effectiveness of the gamified model, including its impact on student engagement and learning outcomes.

- **Formative Assessment and Analytics:**

The system's learning analytics will track key indicators such as XP acquisition, leaderboard progress, and quest completion times. Real-time data will allow for adjustments to the gamified elements (e.g., adjusting the difficulty level of quests) if engagement drops or students face difficulties

- **Summative Assessment:**

The students' digital business portfolios will be evaluated for BI competence and entrepreneurial readiness. These portfolios will be assessed on the accuracy of data models, the validity of business decisions, and the practicality of the BI insights. Additionally, students will receive cryptographically verified Certificates of Achievement upon completing the gamified curriculum, offering proof of competency and readiness for the industry

## 4 RESULTS AND DISCUSSION

### 4.1 Results

The Technopreneur Portal has been successfully developed as a gamification-based learning system designed to enhance student engagement and the mastery of Business Intelligence (BI) in the Technopreneurship course at FTI UNIBI. Following the ADDIE instructional design framework, the portal's architecture was optimized to handle real-time data tracking, interactive modules, and gamification mechanics.

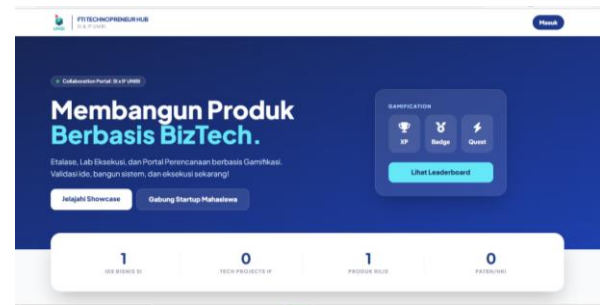


Figure 2. The Technopreneur Portal interface.

To foster an interactive and immersive learning experience, the system directly translates traditional syllabus requirements into specific game mechanics. The detailed design and implementation of these gamification elements are as follows:

1. **Business Quests and Experience Points (XP):** Traditional linear assignments were reimagined as "Business Quests" (e.g., Data Aggregation, Predictive Analytics, and Market Validation). Each quest is assigned a specific XP value based on its complexity and cognitive demand. For instance, successfully cleaning a dataset yields base XP, while creating a predictive BI dashboard yields high-tier XP. *Alignment with Learning Objectives:* This mechanism shifts the learning paradigm from a punitive grading system to a reward-based progression system, encouraging students to learn through trial and error without the fear of immediate failure.
2. **Skill Badges:** Badges act as micro-credentials awarded upon reaching specific XP thresholds or mastering a cluster of related quests. For example, completing all data visualization tasks unlocks the "Data Architect" badge. *Alignment with Learning Objectives:* Badges provide tangible, exportable proof of specific technical competencies, directly translating academic efforts into professional portfolio assets for the students.
3. **Relative Leaderboard:** Instead of a traditional, absolute ranking system that might demotivate lower-performing students, the portal implements a "Relative Leaderboard." It highlights top overall performers but primarily shows students the peers immediately above and below their own rank. *Alignment with Learning Objectives:* This design fosters healthy, continuous competition and peer-to-peer benchmarking, motivating students to complete additional quests to climb the ranks

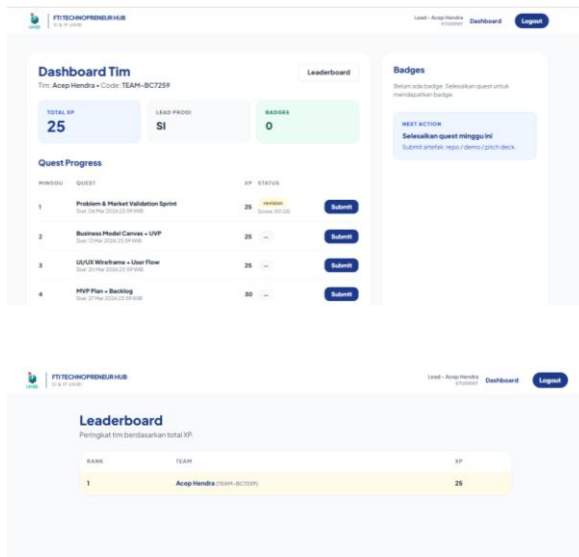


Figure 3. Team Dashboard interface visualizing real-time learning progression.

4. Initial Testing and Feedback: During internal testing, the portal was successfully evaluated for usability. Early feedback from instructors indicated that the platform was intuitive and effectively aligned with the course objectives. Technical aspects—such as real-time XP calculation, dynamic badge awarding, and leaderboard synchronization—performed optimally under simulated academic conditions.

## 4.2 Discussion

This section discusses how the developed gamification elements operationalize psychological learning frameworks and outlines the implementation strategy for the upcoming semester.

Alignment with Theoretical Frameworks: The successful design of the Technopreneur Portal is not merely a technical achievement but a pedagogical intervention grounded in established theories:

- Cognitive Load Theory (CLT): Teaching complex, data-heavy BI subjects often overwhelms students. By segmenting the syllabus into manageable "Business Quests," the portal minimizes extraneous cognitive load. Students must master foundational quests before unlocking advanced analytical challenges, ensuring a structured cognitive scaffold.
- Self-Determination Theory (SDT): The game elements are explicitly mapped to fulfill students' psychological needs:

- *Autonomy* is facilitated by allowing students to choose the sequence of non-linear side-quests and select the industry sectors for their data analysis.
- *Competence* is continuously reinforced through immediate feedback provided by the XP system and the attainment of Skill Badges.
- *Relatedness* is cultivated through the Team Dashboard and Relative Leaderboard, which build a sense of community and collaborative competition akin to a real-world startup ecosystem.

Plans for Implementation: The portal will be fully deployed in the upcoming semester with a strong focus on real-world entrepreneurial application. The rollout will occur in three structured phases:

1. Phase 1 (Onboarding): Students will complete a "Tutorial Quest" to familiarize themselves with the portal's interface, XP mechanics, and educational objectives. This low-stakes phase reduces initial technological apprehension.
2. Phase 2 (Active Learning): Students will engage in core gamified quests, applying BI concepts to real-world business scenarios. Tasks will range from data cleaning to designing market analysis dashboards.
3. Phase 3 (Evaluation and Feedback): Real-time performance data (via XP and Leaderboard analytics) will be continuously monitored by instructors. This data-driven approach allows educators to track student progress and offer personalized scaffolding to students struggling with specific technical tasks.

Anticipated Outcomes: The integration of these precisely designed gamification elements is expected to significantly increase student engagement. Furthermore, the digital business portfolios and Skill Badges generated through the portal will serve as tangible, verified evidence of the students' entrepreneurial readiness and BI proficiency, highly enhancing their future career prospects [10].

## 5 CONCLUSION

The development of the Technopreneur Portal marks a fundamental pedagogical shift in integrating gamification with the Business Intelligence (BI) curriculum at FTI UNIBI. Built upon the ADDIE framework [7], this study successfully designed a system

that translates complex, procedural BI concepts into structured "Business Quests." By aligning with Cognitive Load Theory (CLT) and Self-Determination Theory (SDT), the model is specifically engineered to minimize cognitive overload while fulfilling students' psychological needs for autonomy, competence, and relatedness.

To systematically evaluate the impact of this gamification approach, the portal's architecture incorporates built-in learning analytics designed to capture measurable performance indicators. Unlike traditional, passive e-learning platforms where evaluation is limited to final exams, the gamified portal establishes a continuous evaluation framework. Student Engagement is quantitatively measured through daily login frequencies, interaction times, and the completion rates of optional side-quests. Learning Outcomes are continuously tracked via the accumulation of Experience Points (XP) and the successful acquisition of technical Skill Badges. Entrepreneurial Competencies are evaluated based on the quality of the final exportable digital business portfolios, culminating in the issuance of QR-coded Certificates of Achievement for industry validation [14], [18].

While the current study focuses on the rigorous design and development phases, the establishment of these measurable indicators provides a robust foundation for the upcoming full implementation in the 2026 academic semester. The gamified model transitions the educational paradigm from passive observation to active, experiential startup simulation. Future research will utilize the portal's integrated analytics to conduct a longitudinal empirical study, providing a comparative quantitative analysis between the gamified cohort and traditional learning cohorts to definitively measure its impact on data-driven entrepreneurial success.

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