

Boosting Engagement and Academic Performance Through Gamification: Leveraging Student Profiles and Game Personas for Enhanced Learning

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Abstract: This study examines the integration of personalized gamification as a strategy to increase student engagement and academic performance, based on the analysis of behavioral profiles and game user personas. Using *Detroit: Become Human* as a tool to identify collaborative and competitive tendencies, the research aims to address the limitations of traditional methods, which often fail to engage students. The application of Game Theory, combined with the personalization of pedagogical interventions according to each student's profile, enabled the creation of more adapted and motivating approaches. The final results indicate a significant improvement in grades and student engagement levels, with 38.6% of students who were initially below average reaching or exceeding expected performance, along with a marked increase in interest in classroom participation. These findings reinforce the potential of gamified and personalized methodologies to transform the educational experience, adapting it to the individual traits and needs of students.

1 INTRODUCTION

Student engagement in teaching and learning activities is a key challenge in contemporary pedagogy, given the diversity of personality profiles and learning styles in classrooms. Game-based learning involves the use of games as complete educational tools, while gamification applies game design elements, such as rewards and challenges, to non-game contexts to enhance engagement and motivation (Deterding et al., 2011; Kilanioti et al., 2024). Narrative games like *Detroit: Become Human* have shown potential for creating immersive experiences that support complex decision-making and social interaction, allowing the collection of data to inform personalized pedagogical interventions.

This research builds on Rückert et al.'s (2021) Theory of Multiple Intelligences and Xavier Junior's (2015) personalized learning approaches. Using *Detroit: Become Human* as a tool, the study assessed collaborative and competitive behaviors while mapping personality profiles based on student interactions and decisions. Supported by educational psychology experts, the analysis included tests such as Wartegg and 16PF to validate interpretations.

The article is structured as follows: Chapter 2 explores the theoretical foundation of gamification in education; Chapter 3 outlines the methodology and application of *Detroit: Become Human*; Chapter 4 discusses data and metrics for behavioral profiling; Chapter 5 analyzes the impact of pedagogical interventions; and Chapter 6 concludes with study limitations, future research directions, and the relevance of gamification and game-based learning for personalized education.

2 THEORETICAL FOUNDATION

This study integrates multiple theories to explore gamification in education, focusing on identifying student profiles and personalizing pedagogical practices to improve engagement and academic performance.

The research draws on Csikszentmihalyi's Flow Theory (1990), which examines immersion and motivation ideal for learning, and Gardner's Theory of Multiple Intelligences (1983), emphasizing the adaptation of educational practices to varied learning styles. Gee's *Game Design Principles* (2003)

highlight elements that make games effective for learning, while Jung's Psychological Typology (1933) provides a foundation for identifying personality profiles. Xavier Junior's (2015) perspective on holistic development and Piaget's (1976) emphasis on student agency further enrich the framework.

By combining these theories, the study presents a gamification model that transcends traditional approaches, addressing individual, social, and emotional aspects of education. This approach critically examines the limitations of isolated theories and proposes pedagogical practices tailored to diverse student needs.

3 EXPERIMENT FORMAT

The experiment involved 44 senior high school students from a private school in São Paulo state in Brazil, chosen due to the suitability of the 16 Personality Factors Test (16PF) for students aged 16 and 17. However, the test's limitation to this specific age range presents a challenge for broader research on personality profiles across different educational levels. One goal of this study is to develop a new method to extend the analysis to other age groups, enabling personalized pedagogical interventions in diverse contexts.

The study followed a systematic methodology combining quantitative and qualitative data collection with an in-depth analysis of student interactions in gamified activities. These steps allowed for the adaptation and validation of a method that surpasses the limitations of the 16PF test, creating a more inclusive and adaptable model for the Brazilian educational context.

- **Initial Interview:** To assess students' engagement with the school environment, an initial interview based on a 5-point Likert scale was developed, ranging from "strongly disagree" (1) to "strongly agree" (5). This method enabled the collection of quantitative data on engagement, allowing a more detailed analysis of participants' predispositions before applying gamified interventions. The foundation of the questions was based on the theory of school engagement, as described by Fredricks, Blumenfeld, and Paris (2004), who identify three main dimensions of engagement: behavioral, emotional, and cognitive. Thus, the questions were designed to explore each of these dimensions, aiming to determine students' level of involvement in school activities and interest in educational practices.

The five questions formulated for the initial interview were as follows:

Table 1: Pre-Experiment Engagement Mapping Interview.

1.	I feel motivated to participate in school activities daily. <i>(Assessment of emotional engagement, measuring the feeling of motivation towards the school environment)</i>	1	2	3	4	5
2.	I make an effort to complete school tasks, even when they are challenging. <i>(Behavioral engagement, assessing perseverance and willingness to face academic challenges)</i>	1	2	3	4	5
3.	I consider the content taught at school to be interesting and relevant. <i>(Cognitive engagement, reflecting the perception of relevance and interest in the educational content)</i>	1	2	3	4	5
4.	I feel involved in classroom activities and in interactions with my classmates and teachers. <i>(Emotional and behavioral engagement, analyzing the sense of belonging and interaction in the school context)</i>	1	2	3	4	5
5.	I tend to seek knowledge beyond what is required in class. <i>(Cognitive engagement, measuring the initiative to expand learning beyond the mandatory content)</i>	1	2	3	4	5

The analysis of student engagement levels was conducted based on a comparative evaluation of responses across the five investigated dimensions. Each dimension was individually analyzed, allowing the identification of both strengths and weaknesses in students' engagement with the school environment. Dimensions with consistently high scores indicated strong engagement, while those with lower values highlighted specific areas requiring attention and pedagogical interventions to improve the learning experience and student motivation.

- **Game Application:** During sessions of Detroit: Become Human, qualitative and quantitative data were collected. The students' interactions with their peers provided qualitative insights into their social skills and communication styles. Simultaneously, the choices made within the game were recorded as quantitative data, enabling the identification of behavioral tendencies, such as preferences for cooperative or competitive actions.
- **Application of the Wartegg and 16PF Tests:** Following this, the Wartegg Test and the 16 Personality Factors Test (16PF) were administered and scored by a specialized psychologist, ensuring the attainment of canonical metrics for personality profiles. Both instruments are widely recognized in psychology and were essential for accurately identifying each student's personality traits, forming a foundation for creating pedagogical interventions.

- **Data Analysis:** The results from the psychological tests were integrated with the data collected during the game. This cross-analysis allowed for a deeper understanding of each student's profile, providing a solid basis for creating educational strategies that consider emotional, social, and cognitive aspects. **Development of Personalized Pedagogical Interventions:** Based on the identified personality profiles, customized pedagogical interventions were designed to improve engagement and academic performance. These interventions were crafted according to observed behavioral tendencies and personality traits to maximize the effectiveness of the implemented educational strategies.
- **Reapplication of the Engagement Interview and Assessment of Student Grades:** To assess the impact of the interventions, the initial engagement interview was reapplied at the end of the study, along with an assessment of student grades, allowing for a comparison with academic performance recorded before the experiment.
- **Monitoring of Students Over Six Months:** During the second semester of 2023, personalized pedagogical interventions were implemented and monitored. Throughout this period, students' academic performance and engagement levels were periodically assessed to gauge the effectiveness of the applied strategies and their correlation with personality profiles.

3.1 Students' Grades and Performance Before the Experiment

The grade assessment was conducted through the school's digital platform, with formal consent from students and their parents or guardians, ensuring that all procedures adhered to ethical and legal standards for data privacy and protection.

To calculate the averages, the main subjects in the school curriculum were considered, covering fundamental areas for students' academic development. The evaluated subjects included:

- **Portuguese Language:** Important for communication, interpretation, and critical analysis of texts.
- **History and Geography:** Subjects that promote knowledge of the past and an understanding of geographic space and social relations.
- **Sciences (Biology, Physics, and Chemistry):** Fundamental for understanding natural phenomena and developing scientific thinking.
- **English:** Essential for communication in a second language, fostering students' cultural and academic expansion.

This set of subjects was selected to provide a broad and balanced analysis of students' academic performance, enabling an evaluation of engagement and the impact of gamified interventions across diverse knowledge areas. Data collected directly from the school platform ensured accuracy and facilitated a comparative study of academic performance before and after interventions.

The analysis revealed that 42% of students had grades below 7.0, indicating performance below expectations and highlighting the need for targeted pedagogical interventions. Additionally, 37% of students had averages of 7.0, meeting expectations but with room for improvement, while 21% achieved higher performance, with grades ranging from 7.5 to 9.5.

This distribution underscores the need for pedagogical strategies focused on engagement and performance improvement. Over time, it is expected that gamification and personalized methodologies will reduce the percentage of students with below-average grades, fostering a more balanced and motivating academic environment.

4 PRESENTATION OF THE GAME AND STUDENT BEHAVIOR EVALUATION METRICS

The experiment analyzed students' collaborative and competitive tendencies, conflict resolution skills, and behavioral inclinations during interactions in the game *Detroit: Become Human*. Through an individualized analysis system, students' choices across five missions were mapped to reveal behavioral profiles and personality traits. The game's narrative structure, centered on ethical and moral dilemmas, allowed researchers to observe and record students' strategies, particularly their preferences for cooperation or competition, providing valuable insights into their interaction styles and responses in conflict scenarios.

The selected missions were:

- **Prologue:** Students, as Connor, resolve a hostage situation, assessing cooperative (negotiation) or assertive (confrontation) conflict resolution tendencies.
- **Android's Desires:** Controlling Kara, interactions with a child and household tasks reveal empathy, submission, or adaptation to imposed roles.

- Lost: As Markus, students choose between peaceful protests or violent actions, reflecting leadership styles and goal achievement methods.
- Life Cycle: Connor’s interrogation highlights preferences for collaboration (trust-building) or confrontation in resolving conflicts.
- Courage: Students decide between immediate safety or long-term survival, showcasing problem-solving priorities.

4.1 The Student Behavioral Profile Assessment Matrix

To structure the analysis of student behavior, the Student Behavioral Profile Assessment Matrix was developed. This matrix enables the categorization of each student's responses into distinct profiles based on their decisions in the game, academic performance, and classroom behavior. This method aims to provide a holistic view of each student, integrating game data with information about performance and classroom interactions, as proposed by Gee (2003), who argues that games can mirror complex behavioral traits when observed through a systemic lens.

The matrix is divided into three main evaluation criteria, as shown in Table 1:

Table 2: Student Behavioral Profile Assessment Matrix-

Evaluation Criterion	Evaluation Value	Implications for Student Profile
Game Decisions	Choices made by students during the game <i>Detroit: Become Human</i> , indicating collaborative or competitive tendencies	Students who choose options that benefit everyone, avoiding conflicts, are considered collaborative; those who favor their own interests are competitive. Sacrificial behaviors for others indicate an altruistic profile, while alternating between competition and cooperation suggests a mixed profile.
Academic Performance	Students' performance in school activities	Students who excel in group projects may have a collaborative profile; those who shine in academic competitions, a competitive profile; those who frequently assist peers may be altruistic; and those who perform well in both individual and group activities may have a mixed profile.
Classroom Behavior	Interactions and participation in school activities	Collaboration and good relationships with peers indicate a collaborative profile; high competitiveness and independence indicate a competitive profile; helping others indicates an altruistic profile; and a mix of behaviors suggests a mixed profile.

4.2 Profiles Identified Based on Student Choices

The analysis of decisions made by students in Detroit: Become Human was conducted using the concept of Average Profile Score (APS), which classifies behaviors as collaborative, competitive, or tangential (mixed). This classification was inspired by Game Theory, where students with collaborative profiles tend to prefer choices that promote collective benefit, while those with competitive profiles seek individual advantages.

The formula to calculate the APS is:

$$APS = \frac{\sum(\text{Numerical Value of Choices})}{\text{Total Number of Choices}}$$

The experiment began with a questionnaire to assess students' engagement levels in main school subjects, aiming to identify their perceptions and interest in academic content. This initial survey provided a baseline for student engagement, enabling later comparisons and analysis of the impact of game-based interventions on participants' behavior and attitudes. Using a Likert scale, the questionnaire consisted of five questions designed to evaluate engagement levels across various subjects, offering valuable insights into the students' academic involvement prior to the experiment.

- Approximately 40% of students show responses concentrated in the lower ranges of the scale (1 to 2). This score level indicates that these students have low engagement in several dimensions evaluated, suggesting they may not feel motivated or interested in the content of school subjects. The predominance of low scores highlights a possible disconnect between the school environment and students’ interests, reinforcing the need for strategies that promote greater engagement.
- Approximately 35% of students show an average response between 2 and 3 across the five questions. These students demonstrate an intermediate level of engagement, which suggests that, while they are moderately involved, there is still room to improve their perception and participation in school activities. This intermediate range indicates that these students may only be engaged in certain activities or subjects, while others do not elicit the same interest.
- Only about 25% of students have scores close to 4 or 5 across all questions, representing a group with higher engagement.

The analysis revealed that 75% of students demonstrated low to medium engagement levels,

while only 25% showed high involvement with school content, highlighting a lack of motivation or connection to academic activities. This diagnosis justified the implementation of gamified interventions using the game *Detroit: Become Human*, which provides an interactive environment filled with moral dilemmas that encourage collaborative and competitive behaviors, enabling a rich analysis of behavioral preferences.

Data collection was conducted during monitored game sessions, with researchers recording students' choices and decisions in real-time, preserving the authenticity of their natural reactions. This non-intrusive approach minimized interference, ensuring spontaneous decision-making. Participants were randomly selected from high school classes to ensure diverse academic and behavioral profiles, offering a comprehensive basis for analyzing collaborative and competitive tendencies within the game. Detailed video recordings and notes allowed for thorough post-session analysis of each decision, contributing to a deeper understanding of students' engagement and behavior patterns.

The research execution relied on a series of resources to ensure the accuracy and quality of the data collected:

- **Gaming Equipment:** PlayStation 5 consoles and controllers were used to provide a smooth and interactive gaming experience.
- **Dedicated Environment:** A room equipped with all the necessary resources for the experiment, ensuring a controlled environment without external distractions.
- **Research Team:** A researcher and assistant teachers were responsible for observing and documenting students' choices to assist in the data collection process.
- **Video Recordings:** All game sessions were recorded on video, allowing for a detailed review of students' decisions.
- **Notes:** During each session, notes were taken on students' choices and decisions, complementing the video recordings and providing additional context for analysis.

These resources enabled the creation of a holistic and multifaceted dataset, suitable for an in-depth analysis of student behavior in an interactive environment.

After the completion of the game phase, the collected data was analyzed. The notes were organized and categorized based on the principles of Game Theory, allowing each decision made by students to be classified as either collaborative or competitive behavior. This categorization, inspired

by Johnson and Johnson's (1989) studies on cooperation and competition in the school context, enabled the identification of underlying behavioral patterns, reflecting students' preferences and inclinations in situations simulating real social interactions.

To evaluate each student's profile, a classification system was used that considered both collaborative and competitive decisions, with each choice analyzed to determine the predominant nature of the behavior. The identification of behavioral profiles was guided by three main categories: Collaborative, Competitive, and Tangential. Below is a breakdown of these categories:

- **Collaborative Profile:** Students who consistently made choices that benefited other characters or avoided conflicts, indicating a natural tendency for cooperation and group problem-solving.
- **Competitive Profile:** Students who opted for decisions that favored their own interests or displayed an assertive and independent approach, showing a tendency toward competition.
- **Tangential Profile:** Students who exhibited a combination of collaborative and competitive behaviors, adapting to situational demands and revealing flexibility in alternating between cooperation and competition.

5 DATA ANALYSIS OF THE EXPERIMENT WITH HIGH SCHOOL STUDENTS

The experiment aimed to investigate the behavioral dynamics of 12th-grade high school students in a gaming environment, focusing on cooperation and competition tendencies. Students' choices during the game missions were analyzed to map behavioral profiles, reflecting intrinsic dispositions when faced with dilemmas.

The missions challenged students to make decisions ranging from peaceful negotiations to competitive actions, revealing their collaborative or competitive tendencies. While the study highlights the objectives of five selected missions, only one is detailed due to space constraints. Additional analyses, including the 16PF and Wartegg personality tests, will be addressed in a separate article.

I. Prologue: Students, as Connor, negotiated with a rogue android. Peaceful approaches indicated a collaborative profile, while aggressive tactics reflected assertiveness and competitiveness.

- II.A New Home: Controlling Kara, students chose between empathy and emotional connection with Alice or prioritizing tasks objectively. Empathetic choices were linked to collaboration; task-oriented actions indicated competitiveness.
- III.From the Dead: As Markus, students led peaceful demonstrations (collaborative) or violent uprisings (competitive), reflecting preferences for gradual change or assertive actions.
- IV.The Interrogation: Choices in interrogation style with Connor revealed problem-solving tendencies—empathy and patience (collaborative) versus intimidation and pressure (competitive).
- V.Fugitives: Protecting Alice’s safety highlighted long-term planning (collaborative) versus immediate, risky decisions (competitive).

These missions provided valuable data on students' collaborative and competitive tendencies, emotional control, and decision-making strategies, directly informing behavioral profiles for pedagogical applications.

To consolidate the understanding of student behavior, a Multifaceted Student Profile Assessment Matrix was developed, which considers three main dimensions. This matrix provided a framework for categorizing students' behavioral profiles, allowing for a detailed and individualized analysis.

1. Game Decisions: Each decision made in the game was evaluated to identify cooperative or competitive tendencies. Students who made decisions that benefited other characters and avoided conflicts were classified with a collaborative profile. Those who chose actions that maximized their self-interests were identified with a competitive profile. Students who alternated between collaborative and competitive behaviors were classified as "Tangential," displaying flexibility in their interactions.
2. Academic Performance: Students' grades were used as an indicator of decision-making skills and teamwork. Students who performed well in collaborative projects displayed a more cooperative profile. Those who excelled in competitions and individual exams were identified with a competitive profile. Students who maintained good results in both types of activities presented a mixed, or tangential, profile.
3. Classroom Behavior: Students' interactions with peers and teachers, as well as their participation in school activities, provided a comprehensive view of their behavioral profile. Students who collaborated and had good relationships with peers were considered collaborative. Those with a

more independent and assertive approach were classified as competitive. Students who balanced collaborative and competitive behaviors were considered tangential.

The Student Profile Assessment Matrix provided a holistic view of student behavior by combining decision-making tendencies in the game with psychological insights obtained from the applied tests, academic grades, and classroom observations. This approach was essential for identifying behavioral trends, correlating profiles with academic performance, and understanding the dynamics of social relationships within the school.

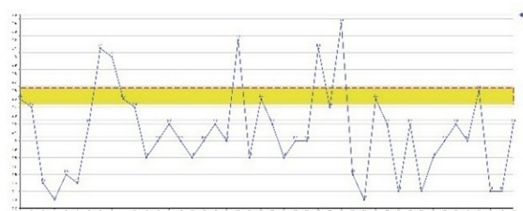


Figure 1: Average Profile Score After Experiment.

5.1 Analysis of Two Students Based on the Student Profile Assessment Matrices

The following analysis of two students was conducted based on the choices each made during the game and illustrates the procedure applied to all 44 students, taking into account their behavioral preferences, academic performance, and predominant profile according to Game Theory.

To calculate the Average Profile Score (APS) for each student and generate the individual graph illustrating behavioral tendencies regarding cooperation and competition, it was necessary to:

I.Step 1: Assigning Values to Game Choices

Each choice made by the student during the missions was classified as collaborative, competitive, or balanced. A scoring scale was used for this purpose:

- Collaborative Choices: Assigned a value of 1. These choices reflected behaviors that prioritize collective well-being, peaceful conflict resolution, and empathy.
- Competitive Choices: Assigned a value of 3. These were more assertive choices where the student prioritized their personal advantage, even if it created conflict.
- Balanced Choices: Assigned a value of 2, reflecting a more tangential or adaptive behavior

where the student may alternate between collaboration and competition depending on the situation.

II. Step 2: Calculating the Average Profile Score (APS) for Each Student

- After assigning values, all scores from the choices made by the student in the game missions were summed. This total was then divided by the total number of choices to obtain the average. This average is the Average Profile Score (APS), as previously described, which indicated the student's behavioral tendency.

III. Step 3: Interpreting the APS

- APS close to 1: Predominantly collaborative profile. The student tends to avoid conflicts and seeks cooperative solutions.
- APS between 2.4 and 2.6: Tangential or Balanced Profile. The student navigates well between cooperation and competition, adapting to the context.
- APS close to 3: Predominantly competitive profile. The student prefers to take risks and adopts strategies focused on personal benefit. This score allowed us to identify each student's tendency toward collaborative, competitive, or balanced (tangential) behaviors. The analysis of this chart provided insights into each student's behavioral profile, facilitating the planning of personalized pedagogical strategies. For this classification, the following interpretations of the Average Profile Score Ranges were created:
 - i. Tangential Range (2.4 to 2.6): Represented by the yellow area on the graph, this range denotes students with a balanced behavioral profile. These students are adaptable and able to navigate between collaborative and competitive behaviors as the context demands. We can observe that some points fall within this area, suggesting that these students have a tangential tendency, meaning they can adjust their attitudes between collaboration and competition.
 - ii. Collaborative Zone (below 2.4): Students with an APS close to 1 exhibit predominantly collaborative behavior. They demonstrate a preference for solving problems cooperatively and avoid confrontation. Several points on the graph are below 2.4, indicating that a significant portion of the students is more inclined toward collaboration. Many of these

students have an APS between 1.4 and 2.0, reinforcing their cooperative profile.

- iii. Competitive Zone (above 2.6): Students with an APS close to 3 tend to adopt competitive behaviors. These students prefer strategies that give them individual advantage, being more assertive in their choices. Few students exceed the 2.6 line, suggesting that the number of students with a competitive profile is smaller compared to collaborative ones. However, the points above the yellow range indicate students with a strong inclination toward competition.

Following this analysis, educational intervention proposals were developed to suit the profile of each group of students. Here, we highlight some of those implemented during the second academic semester:

- For Collaborative Students: Activities emphasizing cooperation and teamwork were proposed, such as group projects, debates, and collaborative problem-solving. This approach was chosen because these students tend to feel more motivated in environments where collective success is valued.
- For Competitive Students: Individual challenges, academic competitions, and activities that allow self-improvement were incorporated. This method was suggested because, in general, these students are more engaged in tasks where they can stand out and measure their individual performance.
- For Tangential (Balanced) Students: Mixed activities were used, alternating between collaborative work and individual challenges, allowing these students to explore both styles depending on the demands of the activity.

6 CONCLUSIONS

Following the implementation of personalized pedagogical interventions based on the identified behavioral profiles, an analysis of student performance and engagement results was conducted once more. The approach of using the game as a tool to identify collaborative and competitive tendencies, combined with the development of specific pedagogical strategies, proved effective in promoting increased engagement and improved student grades.

To measure the impact of the interventions, two main indicators were considered: final grades in key subjects and the level of student engagement,

evaluated through the reapplication of the initial questionnaire.

- Improvement in Academic Performance
The reapplication of the engagement questionnaire also revealed significant changes in students' attitudes toward the subjects:
- 59.1% of the students demonstrated a noticeable increase in their level of engagement, participating more actively in class and showing greater interest in the proposed activities.
- 27.3% of the students maintained a level of engagement similar to that observed at the beginning but reported feeling more comfortable and motivated in the school environment, especially during group activities.
- 13.6% of the students showed a moderate improvement in engagement, particularly in subjects that required more interaction and cooperation, suggesting that there is still room to enhance engagement strategies for this group.

The results highlight the effectiveness of pedagogical approaches that consider individual behavioral profiles. Gamified and personalized activities fostered a richer learning experience, promoting socio-emotional skills and increasing student interest.

The study's limitations include the small sample size, restricted to high school students from a private school, which may hinder generalization. Additionally, the game *Detroit: Become Human* demonstrated benefits in engagement and behavioral assessment but may face limitations in broader educational contexts due to its specific nature and required infrastructure.

Future research should expand the sample to include diverse age groups, public schools, and cultural contexts, enabling a more comprehensive understanding of personalized gamification effects. Investigating other games and educational technologies could further evaluate the adaptability of pedagogical interventions to students' individual needs.

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