A Portfolio of Game-Based Learning Activities in Software Project Management Education: An Experience Report

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Abstract

The growing complexity of Software Project Management (SPM) education has motivated the adoption of innovative pedagogical approaches that extend beyond traditional expository teaching. This paper presents an experience report on the integration of Game-Based Learning (GBL) in an undergraduate SPM course. Throughout the semester, a set of educational games and interactive dynamics was incorporated into the curriculum to support the development of both technical knowledge and interpersonal competencies in an active learning environment. The study describes the planning, implementation, and evaluation of five activities: "Dealing with Difficult People", "Project Detective", "Risk in Play", "Kanban Game", and "Design Thinking". Data were collected through a structured questionnaire answered by 41 students, complemented by qualitative feedback obtained through open-ended questions. The results indicate predominantly positive student perceptions, although agreement levels varied across the activities and evaluated dimensions. Additionally, students highlighted the practical nature of the dynamics, the opportunity for collaboration, and the simulation of real-world scenarios as key factors contributing to their learning experience. This work contributes by (i) presenting a structured portfolio of educational dynamics aligned with SPM topics, (ii) reporting empirical evidence from their application in a classroom setting, and (iii) identifying practical lessons and design recommendations for educators interested in adopting GBL in software engineering education. Overall, the findings suggest that these game-based dynamics may complement SPM teaching by providing opportunities for experiential practice, collaboration, and student engagement.

Keywords

Software Project Management, Game-Based Learning, Software Engineering Education, Active Learning, Experience Report

1 Introduction

The use of educational games and interactive dynamics has gained prominence as innovative strategies in the teaching and learning process, particularly due to their potential to increase student engagement and participation [11, 19]. These approaches create interactive, motivating, and safe environments in which students can experience practical situations and make decisions in simulated scenarios [38]. Such strategies are particularly promising in the context of Software Project Management (SPM), as the discipline encompasses both technical competencies (hard skills) and interpersonal and managerial competencies (soft skills) [20, 29]. Studies such as those by Hellström, Jaccard, and Bonnier [15] indicate that games foster experiential learning, the application of theoretical concepts, and knowledge retention.

However, traditional teaching in Computing disciplines still relies heavily on expository methods, which tend to emphasize lower cognitive levels of Bloom's Taxonomy [4], such as memorization and comprehension. This approach makes it difficult to develop more complex skills, such as critical thinking, decision-making, and problem-solving, which are essential for professionals working in software development. In SPM education, this challenge becomes even more pronounced given the multidisciplinary nature of the content described in the Project Management Body of Knowledge (PMBOK) [27], which encompasses technical aspects as well as people and risk management.

In this context, educational games emerge as a promising alternative by integrating theory and practice in a contextualized manner. Well-designed dynamics require students to collaborate, plan, communicate, adapt to uncertainty, and analyze results—skills that are highly demanded in the industry [20]. Moreover, these approaches promote motivation, engagement, and meaningful learning. Previous studies highlight the positive impact of these strategies in Software Engineering (SE) education, particularly when applied to topics such as agile methods, risk management, and team leadership [3, 6, 21, 23, 38].

This paper presents an experience report on the use of game-based and collaborative dynamics in a Software Project Management course offered to undergraduate students in Information Systems and Computer Science programs. In addition to describing the implementation of these activities in the classroom, this work aims to derive practical lessons learned, contributing both to educators interested in adopting active learning strategies and to researchers developing educational games.

The main contributions of this work are:

- The selection and integration of five educational dynamics applied throughout a semester in a Software Project Management course;
- The evaluation of these dynamics with the participation of 41 undergraduate students, considering aspects such as engagement, learning, and student perceptions;
- A comparative analysis of the different dynamics, identifying strengths, limitations, and appropriate contexts for their application;

- The systematization of lessons learned from the practical application of the dynamics, offering guidance for educators interested in adopting similar approaches;
- The generation of insights to support researchers in the development and evaluation of new educational games in Software Engineering education.

This paper is organized as follows. Section 2 presents the theoretical background on Software Project Management education, highlighting the importance of active learning methodologies and, in particular, Game-Based Learning. Section 3 describes the methodology adopted for planning, implementing, and evaluating the proposed educational dynamics. Section 4 presents the results obtained from quantitative and qualitative student responses. Section 5 discusses the main findings, lessons learned, practical recommendations, contributions to the design of new games, and threats to validity. Finally, Section 6 presents the final considerations and outlines directions for future work.

2 Background

Project management is an essential discipline for preparing professionals capable of planning, executing, and controlling initiatives that involve multiple organizational and technical dimensions. According to the Project Management Institute (PMI), project management is the application of knowledge, skills, tools, and techniques to deliver value through projects [28]. This practice aims to coordinate people, resources, and time efficiently, enabling the delivery of unique products, services, or results within established schedules and budgets.

One of the main references in this area is the Project Management Body of Knowledge (PMBOK), which consolidates knowledge, practices, and guidance applicable to project management in different contexts [27]. Although widely recognized as a consolidated reference, the PMBOK should be adapted to the characteristics and specificities of each project. In the context of software development, such adaptation is particularly necessary, as software projects present unique challenges, including product intangibility, project uniqueness and variability, and the absence of standardized processes across organizations. These characteristics, highlighted by Sommerville [32], make software project management more complex than in other traditional engineering domains. Additionally, Andrade and Tait [9] observe that, despite its generic origin, the PMBOK provides a robust and comprehensive structure that can be effectively tailored to meet the specific demands of software development when applied with appropriate methodological care. Pressman and Maxim [26] reinforce this perspective by emphasizing the importance of adaptive strategies for managing projects in dynamic technological environments.

From a pedagogical perspective, Software Project Management education is often structured around traditional approaches, such as lectures, technical readings, and theoretical assessments. While these approaches are important for introducing fundamental concepts, they are often insufficient to prepare students for real-world challenges. This is because they tend to focus on lower levels of Bloom's Taxonomy [4], such as memorization and comprehension, leaving aside more complex competencies such as analysis, synthesis, and critical evaluation.

Traditional teaching in Software Project Management also presents significant limitations in the development of interpersonal skills, such as communication, leadership, and conflict resolution, which are essential for professional practice [22]. The multidisciplinary nature of the discipline requires pedagogical strategies that integrate technical knowledge and interpersonal competencies, promoting more active, contextualized, and student-centered learning.

In the context of Software Engineering education, additional challenges arise, including the need to integrate theory and practice, develop technical and interpersonal skills, and address open-ended and complex problems. Curriculum guidelines such as those proposed by ACM/IEEE [1, 16] emphasize the importance of pedagogical approaches that foster practical learning, teamwork, and the development of professional competencies.

In this scenario, the adoption of educational games and interactive dynamics emerges as a promising alternative, bridging theory and practice through the simulation of real-world situations, collaborative problem-solving, and team-based decision-making.

2.1 Active Learning in Software Project Management Education

The inherent complexity of Software Project Management requires pedagogical strategies that encourage active student participation and connect theoretical content to professional practice. In this context, active learning methodologies have been widely adopted in higher education, as they promote student protagonism, critical thinking, and meaningful learning. Ferreira et al. [13] and Da Cunha et al. [7] reinforce this perspective by highlighting the need for innovation in teaching methodologies to address labor market demands and overcome challenges faced by higher education institutions.

Among the main approaches, Problem-Based Learning (PBL) stands out, as it encourages students to solve real or simulated problems, mobilizing prior knowledge and stimulating the search for new information [30]. Collaborative Learning is also relevant, promoting teamwork, idea exchange, and collective knowledge construction—skills that are fundamental for project-based environments [8, 33].

Complementing these strategies, Game-Based Learning (GBL) has gained prominence by combining engagement, simulation of real-world scenarios, and the development of both technical and interpersonal competencies in a playful and safe environment [25]. Given its relevance and alignment with the objectives of this research, the next subsection details the foundations and benefits of GBL in Software Project Management education.

2.2 Game-Based Learning

It is important to distinguish Game-Based Learning from gamification. While gamification uses game elements in educational contexts, Game-Based Learning involves the use of complete games as instructional tools [12].

Game-Based Learning (GBL) has emerged as an effective alternative to traditional teaching approaches, particularly in computing disciplines such as Software Project Management, which require the integrated development of technical and interpersonal competencies [24]. As illustrated in Figure 1, the Revised Bloom's Taxonomy organizes cognitive levels hierarchically, ranging from remembering to creating, providing a basis for evaluating the depth of learning promoted by different methodologies [2, 4]. While expository methods tend to focus on lower levels—such as remembering and understanding—GBL supports higher-order cognitive development by engaging students in practical challenges and simulated contexts.

Game-Based Learning can also be grounded in Kolb's experiential learning theory [18], which emphasizes learning through experience, reflection, conceptualization, and experimentation. In this context, educational games provide an environment for practical experiences, allowing students to experiment with decisions, reflect on outcomes, and actively construct knowledge.

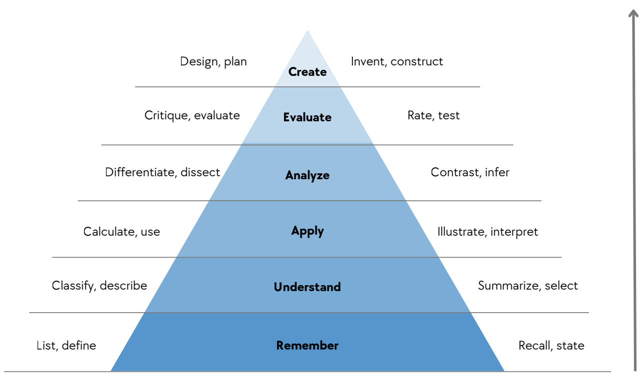

Figure 1: Hierarchical representation of the Revised Bloom's Taxonomy. Adapted from Anderson et al. (2001), based on Bloom (1956).

Well-structured educational games provide immersive learning experiences with clear objectives, defined rules, engaging narratives, and feedback mechanisms, which contribute to sustained engagement and student motivation [25, 36, 37]. Furthermore, they promote safe experimentation, allowing students to learn from mistakes, make group decisions, and develop skills such as communication, leadership, and collaboration—essential competencies for software project management practice.

Thus, Game-Based Learning not only contributes to more active and meaningful education but also enhances the effectiveness and engagement of the learning process. Educational games offer several benefits, including safe learning environments, opportunities to learn from mistakes, immediate and personalized feedback, and increased immersion, self-confidence, social interaction, and enjoyment—factors that support knowledge retention and the development of competencies relevant to professional practice [17].

3 Methodology

This study is characterized as a descriptive experience report adopting a mixed-methods approach, grounded in the observation and systematic documentation of educational dynamics applied in the classroom. The activities were conducted in the SPM course offered to undergraduate students from the Computer Science and Information Systems programs at the Federal University of Santa Maria (UFSM), a Brazilian public university. The objective was to document the procedures adopted, the data collection instruments, and the criteria used for data analysis.

3.1 Planning

The planning of this pedagogical experience began with the identification of active learning methodologies capable of promoting student engagement and meaningful learning. Considering the practical and multidisciplinary nature of SPM, educational dynamics were incorporated to encourage active participation, team-based decision-making, and reflection on real-world project management problems.

The following criteria were adopted for selecting the educational dynamics:

- Alignment with the course syllabus topics, such as risk management, agile methodologies, interpersonal skills, and project performance analysis;
- Engagement potential and applicability in academic contexts, with emphasis on collaborative and practical approaches;
- Theoretical grounding or prior validation through scientific publications, or development within research projects linked to the academic community.

The selected dynamics were distributed throughout the semester and integrated with the course content as a means of reinforcing conceptual understanding and encouraging the practical application of knowledge. The planning phase also included the development of a questionnaire, administered at the end of the course, to evaluate students' perceptions regarding concept clarity, engagement level, and the relevance of the dynamics to the learning process.

Additionally, observations were recorded during the execution of the activities to identify qualitative perceptions related to student behavior and participation.

3.2 Application of the Games

The educational dynamics were applied throughout the semester in the same order in which they are presented in this section. Their sequence followed the progression of topics established in the SPM course syllabus, allowing each activity to reinforce the corresponding content addressed in class.

Dealing with Difficult People was introduced in the second class as an opening activity focused on interpersonal aspects of project management; *Project Detective* was applied after the Earned Value Management unit; *Risk in Play* followed the risk management unit; *Kanban Game* was conducted after the agile methods and Kanban content; and *Design Thinking* was used in the final portion of the semester as a synthesis-oriented activity.

The activities were selected and implemented to provide students with situations resembling real-world practice and to encourage the application of concepts in simulated, collaborative, and reflective scenarios. By contextualizing the course content and promoting active participation, the dynamics aimed to support a more meaningful learning experience. The five activities are described below.

3.2.1 *Dealing with Difficult People.*

The "Dealing with Difficult People" dynamic [14] was applied in the second class of the course, aiming to introduce, from the outset, the challenges faced by project managers, particularly those related to people management. The activity sought to contextualize the topics covered throughout the semester, allowing students to develop a more concrete understanding of the competencies required to manage software projects.

In this dynamic, students simulated a project kick-off meeting, where one participant assumed the role of project manager and needed to obtain formal commitment from the other team members. The remaining students interpreted difficult personality profiles, such as individuals who constantly complain, display emotional outbursts, or adopt a superior attitude.

The activity was structured to encourage reflection on the importance of interpersonal competencies in team management, challenging participants to handle complex behaviors collaboratively. Thus, the dynamic contributed to raising awareness about communication strategies, mediation, and empathy, which are essential elements for conflict resolution in professional environments.

The activity aimed to approximate real-world situations experienced in software projects without adopting prescriptive leadership models. Its focus was on raising awareness among participants regarding the relevance of interpersonal competencies in managing heterogeneous teams and fostering a productive and cooperative work environment.

3.2.2 Project Detective. The "Project Detective" activity [31, 35] is a paper-based educational dynamic designed to teach key concepts of Earned Value Management (EVM), a technique widely used in project management to evaluate project performance through integrated analysis of cost, schedule, and progress. Earned value analysis enables the identification of whether a project is ahead of or behind schedule, under or over budget, and supports understanding the causes of deviations.

In the activity, students assume the role of consultants for a fictional software company and analyze status reports of a project that was not delivered on time. Based on this information, participants investigate the causes of the delay using indicators such as Planned Value (PV), Earned Value (EV), Actual Cost (AC), and Schedule Performance Index (SPI). Through this analysis, students interpret the project situation and identify the causes of the delivery failure.

The investigative environment, in which students analyze a project scenario based on documentary evidence, fosters engagement and enhances analytical reasoning, facilitating the practical application of concepts often perceived as abstract. Additionally, the playful and investigative nature of the activity makes learning more interactive and participatory.

Previous applications in undergraduate courses reported positive results in terms of student engagement and perceived learning, particularly regarding conceptual clarity and knowledge applicability. The strategy also proved effective in reinforcing the importance of critical data analysis in projects, as well as promoting collaborative work and knowledge sharing among participants.

3.2.3 Risk in Play. Risk in Play [6] is a board game developed to support the teaching of SPM, with emphasis on risk management. The proposal aims to make learning more practical and contextualized, allowing students to apply theoretical concepts in simulated situations that reproduce typical challenges of real-world projects. The game is grounded in project risk management concepts commonly addressed in the PMBOK [27] and promotes experiential learning through an interactive and strategic environment.

During the activity, students act as members of competing project teams. Each team manages tasks and resources that may experience positive or negative impacts depending on risks and opportunities that arise during the rounds. At each turn, participants interpret cards representing events that may affect project schedule or budget, requiring critical analysis, decision-making, and collaboration.

One of the central objectives of the game is to emphasize that risks are inherent to uncertainty. To represent this aspect, the dynamic uses dice as an element of randomness, reinforcing the unpredictable nature of certain events. Additionally, the game raises awareness about the importance of proper risk identification and the development of artifacts such as the Risk Management Plan.

The structure of the game integrates technical and behavioral aspects, combining risk management content with the development of interpersonal skills such as communication and teamwork. Due to its flexibility, the dynamic can be adapted to different educational contexts, enhancing engagement and knowledge internalization.

3.2.4 Kanban Game. The “Kanban Game" [5] was designed to teach the fundamentals of this agile methodology in a practical, collaborative, and playful manner. The activity simulates the workflow of a software development team, allowing students to experience concepts such as Work in Progress (WIP) limits, task prioritization, bottleneck identification, and continuous improvement.

During the game, students are organized into competing teams. Tasks are represented by activity cards placed on a physical Kanban board with the columns "To Do", "Doing", "Review", and "Done". Each card corresponds to a mini-game related to software engineering concepts, representing the execution of project tasks.

When selecting a card, the team must complete the corresponding mini-game. If the challenge is successfully completed, the task is considered finished and the card is moved to the next column. Otherwise, the task remains in progress, simulating rework or common development difficulties.

Teams work in short cycles, with three-minute iterations, recording metrics at the end of each round. Unexpected events are introduced throughout the activity, simulating real-world situations such as priority changes or communication failures, requiring real-time strategic decisions.

The dynamic aims to promote understanding of Kanban principles, stimulate teamwork, and develop skills such as communication, decision-making, and problem-solving.

3.2.5 Design Thinking. The “Design Thinking" dynamic was structured as a practical and collaborative activity aimed at introducing students to the application of this approach in the context of SPM [10]. The activity focused on stimulating creativity, empathy, and innovation through the development of educational games related to course topics.

During the activity, students followed the stages of Design Thinking — immersion, definition, ideation, prototyping, and development — with the challenge of designing a game addressing course content. In the immersion stage, groups collected data about their own experiences with the course and previously used educational games, such as Risk in Play and "Project Detective". Subsequently, they defined relevant problems, generated ideas, created prototypes, and presented their proposals to the class.

In addition to providing hands-on experience with Design Thinking principles, the dynamic encouraged teamwork, active listening, and iterative idea refinement based on feedback. The activity reinforced the importance of empathy, experimentation, and collaboration in developing creative solutions, promoting the development of interpersonal competencies relevant to professional practice.

3.3 Evaluation Method

To assess students' perceptions of the dynamics applied throughout the Software Project Management course, a structured questionnaire was developed with specific questions for each activity. The instrument aimed to measure the level of engagement, clarity of the concepts addressed, and the perceived contribution of the dynamics to the learning process. To ensure that responses reflected actual experiences, students were instructed to answer only the sections corresponding to the dynamics in which they had participated.

The questions were designed based on the pedagogical objectives of each dynamic and structured to evaluate specific learning dimensions, such as conceptual understanding, practical application, engagement, simulation realism, collaboration, and creativity. Although adapted to the context of each activity, the questions followed a standardized structure, allowing comparisons across the different dynamics.

Each dynamic was evaluated through three closed statements using a five-point Likert scale [34], ranging from "Strongly Disagree" to "Strongly Agree", along with one open-ended question for qualitative feedback.

Additionally, the questionnaire included general questions about prior experiences with educational games and a final section in which students indicated their favorite dynamic, justifying their choice based on predefined criteria.

Table 1 presents the pedagogical objectives and evaluated dimensions for each dynamic, while Table 2 presents the complete structure of the evaluation instrument. The collected responses constitute the basis for the analysis presented in the following sections.

3.4 Data Collection and Analysis

The questionnaire was administered at the end of the academic semester, after the completion of all educational dynamics planned for the SPM course. A total of 41 responses were collected from students who participated in one or more of the proposed activities.

The data analysis combined a descriptive quantitative analysis of the closed-ended questions, structured using a five-point Likert scale, with a qualitative analysis of the open-ended comments provided by participants. Additionally, observations recorded during the classroom application of the dynamics were considered, including observed student engagement, spontaneous reactions, and debriefing discussions held at the end of the activities.

This combination of quantitative, qualitative, and observational evidence provided a broader understanding of students' perceptions of the applied strategies, particularly regarding engagement, conceptual clarity, and their perceived contribution to the learning process.

4 Results

The analysis of the 41 responses collected at the end of the course revealed relevant student perceptions regarding the use of educational games in SPM education. Initially, students' familiarity with this type of approach was investigated: 78% reported having previous experiences with educational games in the classroom, while 22% indicated no prior experience.

Regarding perceptions of effectiveness and engagement, most participants (78%) considered the strategy "very effective and fun." Additionally, 12.2% evaluated it as "effective, but not very fun," while 7.3% classified it as "fun, but not very effective." Only 2.5% expressed a negative perception, indicating a broadly positive acceptance of the game-based approach in the course context.

The following sections present the specific results of each dynamic applied during the course. For each activity, student responses to the three evaluation statements, answered using a five-point Likert scale, were analyzed. For analysis purposes, responses of "Agree" and "Strongly Agree" were aggregated as a "Top-two Box" indicator of acceptance.

The figures present the distribution of responses, allowing the identification of patterns and recurring perceptions, as well as highlighting strengths and aspects that could be improved in future applications.

Dealing with Difficult People. This dynamic involved 31 students. The results indicate a very positive reception. Most participants strongly or partially agreed that the activity contributed to understanding the challenges of dealing with diverse team profiles (87%) and encouraged reflection on the importance of interpersonal skills in project management (93.5%).

However, perceptions regarding simulation realism showed greater variation. Only 58% of students agreed with this statement, while 42% selected neutral or disagreeing responses. This result may be related to the fact that the behavioral profiles represented in the dynamic were intentionally exaggerated to make situations more explicit and facilitate the identification of different behavior types.

Figure 2 presents the distribution of responses for the three evaluated statements.

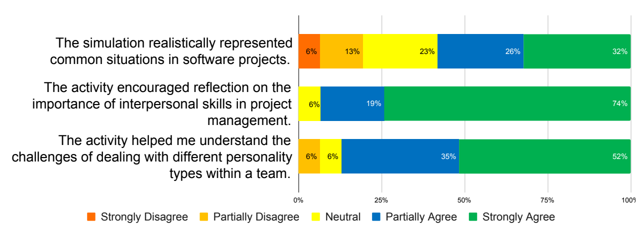

Figure 2: Distribution of responses for the "Dealing with Difficult People" dynamic.

Project Detective. This dynamic involved 35 students. The results indicate a very positive evaluation, especially regarding the practical application of theoretical concepts: 86% of respondents agreed that the activity was useful in this regard.

Additionally, 94% of participants reported that the investigative approach contributed to a more critical analysis of project data, reinforcing the potential of the dynamic as a tool for stimulating

Table 1: Pedagogical objectives and evaluated dimensions for each dynamic

Dynamic	Pedagogical Objectives	Evaluated Dimensions
Dealing with Difficult People	Understand different behavioral profiles in teams, develop interpersonal skills, and recognize conflict situations in software projects	Conceptual understanding, interpersonal skills, simulation realism
Project Detective	Develop critical analysis of project data and apply theoretical concepts to practical situations	Critical thinking, practical application, simulation realism
Risk in Play	Understand risk management concepts and identify the impact of risks on projects	Conceptual understanding, impact perception, importance of risk management
Kanban Game	Understand Kanban principles and continuous workflow, promoting team collaboration	Conceptual understanding, workflow, collaboration
Design Thinking	Understand Design Thinking stages and stimulate empathy, collaboration, and creativity in problem-solving	Process understanding, empathy, collaboration, creativity

Table 2: Questions included in the evaluation instrument

Section	Questions
General	- Have you previously experienced educational games in the classroom? - Do you believe that the use of games as a teaching-learning tool is (select one option): *Very effective and fun; Effective, but not very fun; Fun, but not very effective; Neither effective nor fun; I have no opinion on the matter.*
Dealing with Difficult People	- The dynamic helped me understand the challenges of dealing with diverse team profiles. - The activity encouraged reflection on the importance of interpersonal skills in project management. - The simulation realistically represented common situations in software projects. - Comments about this dynamic.
Project Detective	- The simulation realistically represented common situations in software projects. - The investigative approach helped me analyze project data more critically. - The activity was useful for applying theoretical knowledge in practice. - Comments about this dynamic.
Risk in Play	- The dynamic facilitated understanding of project risk management concepts. - The game helped me understand how risks impact the progress of a real project. - The experience helped me understand the importance of risk mapping. - Comments about this dynamic.
Kanban Game	- The activity helped me understand the principles of the Kanban method. - The simulation represented well the logic of continuous flow and visual task management. - The dynamic, through mini-games, contributed to reinforcing concepts related to visual task management and team collaboration. - Comments about this dynamic.
Design Thinking	- The dynamic helped me better understand the stages of the Design Thinking process, such as immersion, ideation, and prototyping. - The practical experience helped me think more empathetically and collaboratively in problem-solving. - The activity stimulated my creativity by proposing innovative solutions related to the proposed theme (Games for Software Project Management course). - Comments about this dynamic.
Favorite Dynamic	- Among all applied dynamics, which one was your favorite? - Justify your choice based on: *Engagement; Interaction with peers; Practical application; Clarity of objectives; Enjoyment; Challenge; Autonomy; Real-world relevance; Use of visual or physical resources; Organization of the activity; Feedback received.*

analytical reasoning. The perception of simulation realism was also well evaluated, with 79% agreement, although 18% of students remained neutral.

Overall, the results suggest that the dynamic supported students' critical analysis and the practical application of project management concepts.

Figure 3 presents the distribution of responses.

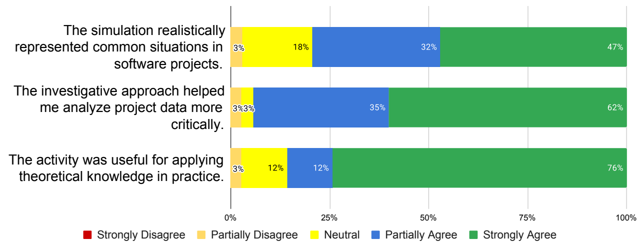

Figure 3: Distribution of responses for the "Project Detective" dynamic.

Risk in Play. This activity involved 33 students. The results suggest a predominantly positive perception, with 70% of respondents agreeing that the activity helped them understand key concepts related to project risk management.

Additionally, 88% reported a better understanding of how risks impact real project progress, and 88% also stated that the experience contributed to understanding the importance of risk mapping. These results suggest that students perceived the dynamic as supporting their understanding of key risk management concepts.

Figure 4 presents the response distribution.

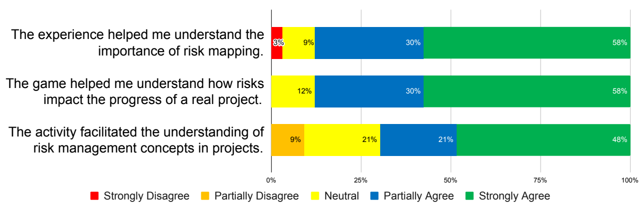

Figure 4: Distribution of responses for the "Risk in Play" dynamic.

Kanban Game. This dynamic involved 36 students. Results indicate a positive reception. Most participants agreed that the dynamic contributed to understanding Kanban principles (80.6%) and that the simulation adequately represented continuous flow and visual task management (80.5%).

Additionally, 66.7% stated that the mini-games contributed to reinforcing concepts related to visual task management and teamwork. Although this percentage is lower than the others, it still indicates a predominantly positive perception while pointing to aspects that could be refined in future iterations.

Figure 5 presents the response distribution.

Design Thinking. This dynamic involved 40 students. Results indicate a very positive evaluation, with more than 80% of respondents agreeing with all three statements. Specifically, 92.5% agreed that the activity helped them better understand the stages of Design Thinking; 87.5% agreed that the experience encouraged more empathetic and collaborative thinking; and 90% agreed that the activity stimulated creativity in proposing innovative solutions.

Figure 6 presents the response distribution.

At the end of the questionnaire, students were asked to indicate their favorite dynamic. The *Design Thinking* dynamic was the most

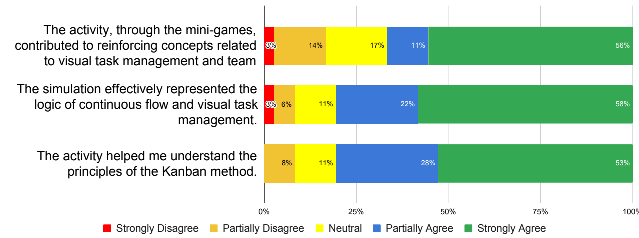

Figure 5: Distribution of responses for the Kanban Game dynamic.

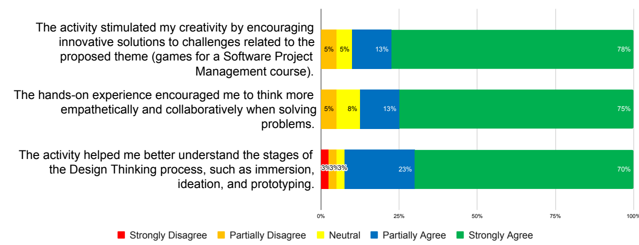

Figure 6: Distribution of responses for the Design Thinking dynamic.

frequently selected activity (36.6%), followed by *Dealing with Difficult People* (19.5%), *Project Detective* (17.1%), *Risk in Play* (14.6%), and *Kanban Game* (12.2%).

Overall, Design Thinking was the most frequently selected activity. Participants were also asked to justify their preferred dynamic by selecting relevant attributes. However, as these attributes are presented in aggregate across all activities, the results do not allow the reasons for the preference for Design Thinking to be identified specifically.

As shown in Figure 7, the most frequently selected attributes across all favorite-dynamic choices were interaction with peers (33 responses), engagement (32), practical application (29), clarity of objectives (27), and real-world relevance (26).

These results indicate that students particularly value collaborative, active, and practice-oriented activities.

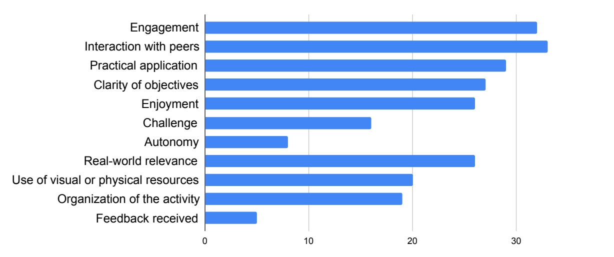

Figure 7: Attributes highlighted in the favorite dynamic selection.

Open-ended comments revealed a preference for dynamics that required active participation and decision-making. In the *Dealing with Difficult People* activity, students highlighted the fun factor and leadership reflection, although some reported difficulty interpreting roles.

The *Project Detective* dynamic was considered useful for content retention, despite initial difficulties with EVM calculations. *Risk in Play* received mixed perceptions, with some participants indicating excessive randomness.

In the *Kanban Game*, some students reported initial difficulty understanding the rules. Finally, the *Design Thinking* dynamic received strong positive feedback, with suggestions to include it earlier in the semester due to its collaborative and creative nature.

5 Discussion and Lessons Learned

The results obtained are consistent with the literature on Game-Based Learning and suggest that integrating a portfolio of educational dynamics may help connect theoretical SPM content with simulated practical experiences. However, during the application of the dynamics, several relevant challenges were identified that should be considered in future implementations.

- **Clarity of rules and initial guidance:** It was observed that a partial understanding of instructions by students can compromise the flow of activities, leading to moments of confusion and uncertainty. This factor highlights the importance of providing clear and structured explanations before starting the dynamics.
- **Balancing content depth and approach lightness:** A challenge was identified in calibrating the complexity of the dynamics. Overly dense activities may become tiring and demotivating, while overly simplified approaches may reduce their pedagogical value.
- **Preparation and execution time demand:** Implementing the dynamics requires a significant time investment from the instructor, both in preparation and execution, particularly in larger classes.
- **Need for constant adaptation:** The dynamics require continuous adjustments to match student profiles, class experience levels, and course-specific characteristics each semester.
- **Risk of frustration:** In some cases, students may experience frustration when rules are not sufficiently clear or when the pedagogical objectives of the dynamic are not adequately explained at the beginning of the activity.

5.1 Main Observed Benefits

In addition to the identified challenges, the results also highlight relevant benefits from the use of educational dynamics. Among the main observed aspects, the following stand out:

- Positive student engagement, supported by the interactive nature of the activities;
- Opportunities to apply theoretical content in simulated practical situations and discuss abstract concepts in a contextualized manner;
- Opportunities to practice interpersonal skills, such as communication, negotiation, and decision-making;
- A safe environment that supported experimentation, discussion of different decisions, and reflection on mistakes;
- Opportunities for creativity and critical reflection, particularly in collaborative dynamics.

5.2 Lessons Learned and Practical Recommendations

Based on the challenges observed during the application of the dynamics, a set of guidelines was systematized to assist researchers and educators interested in replicating or adapting these activities in similar contexts.

(1) **Managing Complexity and Rules:** It was observed that dynamics such as the *Kanban Game* and *Risk in Play* may generate initial cognitive overload, especially when multiple rules and mechanics are introduced simultaneously.
Recommendation: It is suggested to provide supporting materials in advance, such as short explanatory videos (2–3 minutes) or quick reference cards during the activity. This strategy may reduce the time required for initial explanations and allow for more efficient use of the time dedicated to the dynamic.

(2) **The Role of Debriefing and Reflection Time:** It was observed that connecting the practical experience with the underlying theoretical concepts was particularly important during the reflection stage of the dynamics. However, the high level of engagement immediately after the activities may hinder deeper reflections. This was particularly evident in *Project Detective*, where students benefited from the opportunity to connect the calculation of EVM indicators with the causes of project deviations.
Recommendation: When class time is limited, it is recommended to conduct an initial *debriefing* focused on students' immediate perceptions and reserve the beginning of the following class for a more in-depth theoretical discussion. This interval may contribute to a better articulation between practical experience and SPM concepts.

(3) **Balancing Luck and Decision-Making:** In the *Risk in Play* dynamic, excessive randomness generated frustration among some groups, who reported feeling overly dependent on luck.
Recommendation: It is recommended to adjust the mechanics of the dynamic so that participants' decisions have a greater impact on outcomes. This approach may help participants perceive a clearer relationship between management decisions and project outcomes.

(4) **Group Formation and Cohesion:** The *Dealing with Difficult People* dynamic revealed that a lack of prior familiarity among participants may hinder role interpretation and interaction among group members.
Recommendation: It is suggested that dynamics involving greater social exposure be applied after initial integration activities or later in the semester, when students have developed greater familiarity with one another.

(5) **Time Allocation and Structured Guidance:** Applying the *Design Thinking* activity after students had developed

a shared background in SPM and experienced previous dynamics provided a common starting point for the proposed challenge. However, the limited time available made it difficult for some groups to fully understand and apply the process and further develop their prototypes.
Recommendation: It is suggested to allocate sufficient time for each stage or narrow the proposed challenge. Providing concrete examples and clearly defined deliverables for each stage may reduce initial confusion and support students' progression throughout the activity.

5.3 Contributions to the Design of New Games

This experience report also provides insights for researchers and educators interested in developing new educational artifacts for teaching Software Project Management. The experience accumulated throughout the application of the dynamics made it possible to identify gaps and opportunities for designing additional educational games. For instance, a limited availability of diverse educational games addressing topics such as *Earned Value Management* (EVM) in a playful manner was observed, without compromising the conceptual and mathematical rigor required to understand these contents.

Based on the results obtained, several relevant guidelines for developing new educational games in this area were identified. First, the importance of modularity is highlighted, allowing dynamics to be applied in different contexts and time frames, preferably between 60 and 90 minutes, facilitating their integration into course planning. Second, the use of structured collaborative mechanics is recommended, encouraging negotiation among distinct roles, such as project manager, developer, and client, promoting simulations close to professional reality.

In addition, the relevance of incorporating monitoring and feedback mechanisms is emphasized, enabling instructors to track group progress in real time and conduct more grounded reflection sessions. Such mechanisms may include visual boards, simplified metrics, or performance indicators to support understanding of the results achieved during the dynamics.

Another important guideline concerns the balance between complexity and accessibility. Educational games for Software Project Management should present sufficiently realistic challenges to stimulate decision-making without overwhelming students with excessively complex rules. The adoption of progressive instructions or introductory rounds may support better participant adaptation.

Finally, the need for explicit alignment with learning objectives is highlighted, ensuring that each game mechanic is directly related to the competencies to be developed. This approach supports not only student engagement but also pedagogical effectiveness, contributing to consolidation of the concepts addressed in the course.

In summary, the results indicate that game-based educational dynamics represent a promising strategy for teaching Software Project Management, fostering integration between theory and practice and promoting greater student engagement. Although implementing these activities involves challenges related to complexity, preparation time, and continuous adjustments, they may provide valuable opportunities for contextualized practice. The lessons learned presented in this work provide support for replicating and adapting the dynamics in different educational contexts and contribute to the development of new educational games aligned with the technical and interpersonal competencies required in Project Management education.

5.4 Threats to Validity and Limitations

As an experience report in an educational context, the presented results should be interpreted considering their exploratory and descriptive nature. The goal of this study is not statistical generalization, but rather the presentation of a pedagogical practice, its perceptions, and lessons learned that may support future applications and investigations.

Nevertheless, some limitations should be considered. The first concerns external validity, since the application occurred in a single Software Project Management course at a specific institution. This context may influence the observed results. However, the instructor responsible has more than 15 years of experience applying educational dynamics, which contributes to the maturity of the activities and consistency of the reported observations.

Another limitation relates to the subjective nature of the data, since part of the evidence is based on student self-reports. This type of evaluation may be influenced by individual factors, such as engagement level, prior experience, and motivation.

Additionally, formal pre-test and post-test instruments were not applied, which limits objective measurement of learning gains. Future studies may complement this approach with quantitative assessments and replications in different educational contexts.

Despite these limitations, the presented results provide relevant contributions to teaching practice and to the development of new educational dynamics in Software Project Management education.

6 Final Considerations

This work presented an experience report on the use of game-based educational dynamics in an SPM course. The proposal was grounded in Game-Based Learning, aiming to make the teaching process more active, meaningful, and aligned with professional context demands.

The results indicated predominantly positive student perceptions regarding content understanding and the connection between theory and practice. In addition, participants reported positive engagement and opportunities to practice interpersonal skills, such as communication, collaboration, and decision-making. Activities involving greater participant agency and less dependence on random elements were particularly well evaluated.

Despite the positive results, challenges were identified related to rule complexity, the need for detailed planning, and the absence of objective learning assessment instruments. These aspects highlight the importance of continuous refinement and the adoption of complementary evaluation strategies.

In summary, the experience reinforces the potential of game-based dynamics as a complementary strategy in SPM education. As future work, the expansion of the study to other classes and contexts is proposed, along with the application of assessment instruments before and after the dynamics (pre- and post-tests) and the development of new activities addressing additional course topics. Furthermore, future efforts include refining the games based on student feedback and investigating ways to integrate these approaches with digital game technologies.

Artifact Availability

The questionnaire is described in Table 2, and the aggregated results are presented in the Results section. The raw dataset is not publicly available due to participant re-identification risks. The educational dynamics analyzed in this paper are documented in the corresponding publications cited in the manuscript and were adapted for classroom use in the present study. For dynamics originally reported by other authors, readers are referred to the original publications. Interested readers may contact the authors for further information.

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