Design Thinking as an Educational Tool for Project Management Classes

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ABSTRACT

Design Thinking has gained wide acceptance in the software industry as an effective approach for fostering innovation and user-centered solutions. This paper presents the design and application of a classroom activity aimed at introducing Design Thinking within the context of a Software Project Management course. The activity engaged undergraduate students in Computer Science and Information Systems in the creation of educational game prototypes based on course topics, enabling them to experience each stage of the Design Thinking process. Due to time constraints in academic settings, we adapted the original method to fit within limited class sessions, resulting in a relevant outcome of this work. Through collaborative problem-solving and iterative prototyping, students explored alternative ways to approach technical content. The results indicate that the use of Design Thinking in this setting not only supported conceptual understanding and teamwork but also encouraged creativity and a stronger alignment between academic learning and industry-relevant practices.

KEYWORDS

Design Thinking, Education, Software Management, Students, Educational Games

1 Introduction

Design Thinking emerges as a tool that encompasses principles people can apply to solve a wide range of problems [4]. Its distinctive feature lies in being a user-centered process grounded in three main activities: inspiration, ideation, and implementation.

In the corporate context, the goal of applying Design Thinking is to make the product development process more empathetic, collaborative, and experimental. It is empathetic because it requires the team to place itself in the users' position—sometimes even involving them directly in the creation process [14]. It is collaborative in that teams applying the method should be interdisciplinary, bringing together people from diverse areas such as design, technical roles, and sales. It is experimental due to its emphasis on quickly ideating, prototyping, and testing solutions [5]. With this in mind, the practice is typically guided by five stages, which may be followed linearly or iteratively, as the process is inherently flexible and cyclical.

As Design Thinking gained popularity, its application led to several success stories in the industry, highlighting its impact. One example is Netflix, which identified that users' main pain point was having to leave home to rent DVDs. Design Thinking allowed the company to experiment, test, and iterate on its ideas until it found a solution that met users' needs. After much experimentation, the streaming platform was created [7]. Another example is Airbnb, which used design thinking to explore the reasons behind user dissatisfaction and redesigned its property listings, resulting in a significant increase in the company's revenue [7].

According to Liedtka [9], by fostering empathetic understanding of user needs and generating multiple tangible ideas through structured prototyping, Design Thinking has a positive impact on companies. This is reflected both in the increased perceived value of products by stakeholders and in the reduction of risks and failures through early testing. Therefore, the method proves highly valuable in corporate environments, which is adopted by professionals in different roles.

A study by Bonini and Sbragia [3], which surveyed design professionals from Brazil, the United States, and the United Kingdom, found that Design Thinking is seen as a reliable model for organizational innovation. Among the 55 respondents, 87% had worked with Design Thinking, and approximately 67% had applied it in more than ten projects.

In this context, within higher education in Computing—where future technology and innovation managers are trained—it is essential to include methodologies such as Design Thinking in the curriculum. In the fields of Software Engineering and Software Project Management, there is often a heavy emphasis on theoretical content delivered through traditional lectures [11]. This dense curriculum often leaves little room for practical experiences and deeper exploration of impactful tools such as Design Thinking, which are typically acquired through real projects [13].

Connecting Design Thinking to Software Project Management is essential because it shifts the focus from a rigid, process-driven approach to a flexible, human-centered one. By integrating it into the curriculum, students learn to go beyond simply managing scope and budget. They develop crucial skills for understanding real user needs through empathy, managing project uncertainty by embracing continuous learning, and fostering better team collaboration. This prepares future project managers to not only deliver software on time and within budget, but also to create products that are truly useful, desirable, and valuable to the end-user, ultimately leading to more successful and impactful projects.

Given this scenario, the present work highlights the importance of introducing industry-valued methods to students through dynamic and engaging activities, recognizing the benefits of active learning strategies in higher education Computing programs [2, 12]. This dynamic experience involves applying the stages of Design Thinking in the classroom to tackle a specific challenge: developing educational games to support the teaching of Software Project Management.

Through this approach, students not only apply theoretical concepts but also contribute to research in educational games, as they

reflect on the potential of the solutions they develop from a user-centered perspective.

This article presents the design and implementation of a classroom activity based on Design Thinking. The article is organized as follows: Section 2 provides a detailed overview of Design Thinking and its steps, which informed the activity's planning. Section 3 describes the research method explaining the steps followed in this study. Section 4 details the application of the technique in the classroom. Section 5 presents the outcomes of the activity, the results achieved by the students, their reflections on Design Thinking, and suggestions for improving the study based on participant feedback. Finally, Section 6 concludes the paper and outlines directions for future work.

2 Background

In his book Design Thinking: A Powerful Methodology for Ending Old Ideas [5], Tim Brown argues that a design project should move through three key spaces: inspiration, ideation, and implementation. However, these spaces alone are not always sufficient to ensure that a project meets corporate deadlines. To address this, Brown proposes a model based on divergence and convergence: first generating a wide range of ideas, then filtering and selecting the most suitable solution.

In addition, there is a more structured way to apply Design Thinking through specific stages, as promoted by the Nielsen Norman Group. This work adopts the phases described by Gibbons [6], which are detailed in the following sections.

The empathize (or immersion) phase takes place when the team gathers to better understand the users. At this point, their needs, preferences, and difficulties are explored with an emphasis on empathy for the target audience of the product or solution. Interviews and surveys are common in this initial stage, as they help uncover how users think and interact with the problem space.

The second phase, define, involves analyzing the data collected in the previous step and identifying what is truly relevant for solving the problem or designing the product. This stage acts as a filter, allowing the team to focus only on the most critical aspects identified through user contact.

The third phase is ideation, where the goal is to generate as many solutions as possible based on the definitions from the previous stage. The key to making this phase productive is to avoid constraining ideas, even if they seem unrealistic or difficult to implement, as the final solution may emerge as a combination of several earlier ideas. At this point, no idea should be dismissed prematurely.

Next is the prototyping phase, which transforms selected ideas into minimally tangible representations. Prototyping aims to validate concepts quickly, allowing room for failure and iteration, helping guide the team toward the most viable solution. The form of the prototype can vary widely depending on the domain of the project.

Finally, in the testing or development phase, the team validates the most promising prototype. This may involve user testing, pilot launches, or gathering market feedback. Although this last phase is quite broad, its purpose is clear: to choose a final idea and refine it until it is ready for release. It is also important to highlight that Design Thinking is inherently iterative and allows for errors and revisiting earlier phases. If any step is not completed successfully, the process can return to previous stages in order to build a stronger foundation for the project. In this way, the method supports a focus on solution quality while avoiding rigid, linear workflows. The paper, as an experience report, would also benefit from a Related Work section to better position the work within the state of the art. Citing relevant research, such as Souza et al. Souza et al. [15] on teaching Design Thinking to software engineering students or Vilela and Silva Vilela and Silva [18] on using it in a requirements engineering course, would provide context and highlight the unique contributions of our work to the academic discourse.

3 Research Methodology

This work is the result of a scientific initiation project titled "Design Thinking Applied to the Development of Educational Games on Software Engineering and Project Management", and it was carried out in three main phases: research, planning, application, and discussion of results.

Figure 1 illustrates the phases of the research methodology used throughout the project.

3.1 Research Phase

During the research phase, we explored the Design Thinking technique through articles and literature reviews on the topic. One of the main references consulted was Tim Brown, a pioneer in defining Design Thinking as a structured process within his company IDEO [4]. Reviews such as Hassi and Laakso [8] and Tschimmel [16] were essential for understanding the breadth of Design Thinking research and its particularities, along with works that cover each stage of the process in detail, such as Vianna et al. [17]. Based on these sources, we defined the main aspects of Design Thinking to be addressed in the classroom activity, with an emphasis on empathy and prototyping, aiming to capture the central principles of the methodology and effectively convey them to students.

3.2 Planning Phase

In the planning phase, we defined the specifications of the classroom activity, including its duration, content, and scheduled dates. The activity was divided into distinct stages to guide students to produce deliverables at each phase and allow them to visualize their ideas taking shape over time. We proposed a single problem statement for all groups: the development of educational games. This decision helped maintain consistency across the projects while encouraging diverse interpretations of the same objective. It is important to note that the activity took place at the end of the academic term, by which point students had already acquired substantial knowledge of the Software Project Management course content and had participated in various dynamics and educational games throughout the semester. As a result, all groups started the activity with a similar level of preparation, promoting equity in the learning experience. Assigning different problems to each group could hinder the effectiveness, as students may be less familiar with certain topics. Since the proposed challenge was aligned with the content of the course they were currently taking, all participants were able to draw on shared experiences.

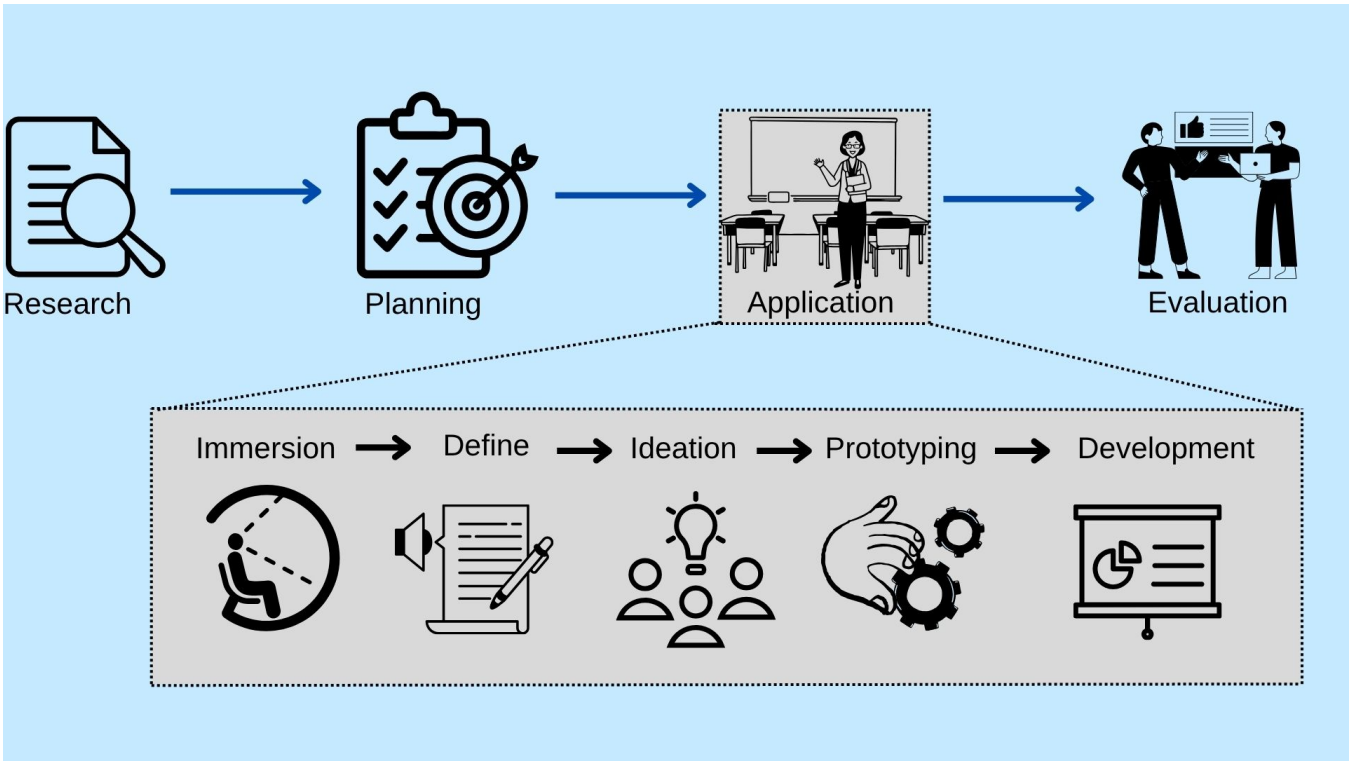

Figure 1: Phases of Research Methodology

Based on the first two phases, we developed two supporting materials: a presentation introducing the activity and the concept of Design Thinking, and a detailed specification document outlining the instructions for each phase. These materials served as a guide during classroom implementation. We used the presentation at the beginning of the activity to explain the project's objectives, the fundamentals of Design Thinking, and its stages, offering practical tips for applying the methodology in the context of educational games related to Software Project Management. The specification document provided a breakdown of each phase, including evaluation criteria, objectives, and expected outcomes for the student groups. Figure 2 shows a portion of this specification which details the first day of the activity. It is essential to note that the original materials (e.g., the activity specification, posters, prototypes) were not translated in this article to maintain fidelity to the original content.

Objetivo da aula: A partir da apresentação sobre o Design Thinking, realizar as três primeiras etapas de desenvolvimento do jogo.

Durante a **imersão**, os grupos devem reunir informações sobre jogos no geral, jogos educacionais, aprendizado em cursos de graduação e compartilhar experiências a respeito de jogos e da disciplina. O objetivo é juntar o maior número de informações possível sobre o produto e seu público-alvo, exercitando o pilar da empatia inerente ao Design Thinking. Aproveitem que vocês e seus colegas também são possíveis usuários deste projeto e relembrem experiências anteriores na disciplina (Detetive, Risco em Jogo, Lidando com Pessoas Difíceis e Kanban Game). A entrega referente a este primeiro momento é uma foto do cartaz contendo os dados levantados escritos em sua superfície. **Não utilizem post-its por enquanto.**

Figure 2: Snippet of the document specifying the activity

3.3 Application Phase

In the practical application phase, we carried out the activity based on the planning defined in the previous stages. Students enrolled in the Software Project Management course during the first semester of 2025 at the Federal University of Santa Maria participated in the activity. This phase is detailed in Section 4.

3.4 Evaluation Phase

To systematically evaluate the impact of applying Design Thinking in an educational setting, we adopted the Goal-Question-Metric (GQM) approach [1]. GQM provides a structured framework that connects high-level evaluation goals to specific questions, which are then assessed using well-defined metrics.

The general goal of the evaluation was to validate the relevance and effectiveness of Design Thinking as a pedagogical strategy for project management education. To this end, we developed a set of 10 statements that reflect key aspects of the classroom activity and the students' interaction with Design Thinking. These statements covered a range of aspects, including students' affinity with Design Thinking, their understanding of the technique, the perceived ease of engaging with the activity, and their impressions of core elements such as collaboration, creativity, and prototyping.

The following presents the decomposition of the general evaluation goal into specific objectives, along with the statements used to collect student feedback.

General Goal:

- Evaluate the effectiveness of applying Design Thinking as a pedagogical approach in teaching Software Project Management.

Goal 1: Assess conceptual understanding of Design Thinking

- S01: I understood the stages of Design Thinking and their objectives.
- S02: The activity helped consolidate my understanding of the user-centered design process.

Goal 2: Evaluate active and collaborative participation

- S03: The application of Design Thinking enabled my active participation, contributing ideas and listening to my peers.
- S07: Collaboration with people of different perspectives was essential to applying the method.

Goal 3: Measure perceptions of creativity and innovation

- S05: The application of Design Thinking is relevant to innovation in the field of Computing.
- S08: The application of Design Thinking stimulated me to be more creative and innovative.

Goal 4: Evaluate confidence and future applicability

- S04: Design Thinking is a good method for idea generation and problem solving.
- S06: I feel confident applying Design Thinking to new projects.

Goal 5: Analyze structure and practical usefulness of the process

- S09: The prototyping process was useful even though the final product was incomplete.
- S10: The organization of the method into stages contributed to the development of my idea.

These statements were designed to elicit students' agreement or disagreement on a Likert scale from 1 (strongly disagree) to 5 (strongly agree), following the model proposed by Likert [10].

In addition to the Likert-scale items, the questionnaire included two open-ended questions that invited students to share any additional comments or suggestions about the activity. This qualitative feedback was useful for capturing individual perspectives, highlighting unexpected outcomes, and identifying opportunities for improving the use of Design Thinking in future editions of the course.

By analyzing both the structured responses and the open-ended feedback, we aimed to identify strengths of the method in the context of computing education and to understand how students—future professionals—perceive the value of this methodology. Section 5 discusses these findings.

4 Practical Application

This phase was divided into five steps and took place on June 25 and 30, with in-class participation and one stage to be completed outside the classroom. Figure 3 shows students working in groups during the first day of the activity.

Figure 3: Students from the Software Project Management course during the practical application

On the first day, we introduced the concept of Design Thinking and explained how the activity would be conducted, based on the supporting materials outlined in Section 3.2 After this initial presentation, students were divided into groups and received the materials needed to carry out the activity, such as post-its and poster board. During this first session, students completed the first three steps of the method: empathize (immersion), define, and ideate.

In the immersion step, the groups explored the topic of educational games, gathering as much relevant information as possible. The main goal was to understand the people involved in the problem by collecting data and identifying users' emotions, difficulties, and needs. We allocated 20 minutes for this phase.

In the definition step, students concentrated on the collected information and identified meaningful connections, selecting the most relevant aspects to guide the ideation process over 20 minutes. In addition to organizing the data from the previous stage, they were expected to identify patterns, recurring challenges, and opportunities for improvement. This phase aimed to focus the team's efforts and set a clear direction for the creative process.

Finally, in the ideation step, students generated multiple potential solutions for educational games based on the elements identified earlier, within a 15-minute timeframe. Without judgment or premature evaluation, the objective was to encourage out-of-the-box thinking and multidisciplinary collaboration. Emphasis was placed on generating a large number of ideas rather than refining them, so that high-impact and feasible options could later be identified. The outcomes of these steps were visually organized on the teams' posters, as illustrated in Figure 4.

Afterward, the student groups planned their prototypes and carried out the prototyping phase outside the classroom, between June 25 and 30. During this stage, each group was responsible for selecting only one idea to prototype, due to the limited time available for the activity. The goal was to quickly validate whether the selected idea was viable.

Then, on June 30, students completed the fifth and final stage: the presentations. In this phase, each group prepared a brief presentation of their prototype and shared their experience applying the Design Thinking methodology.

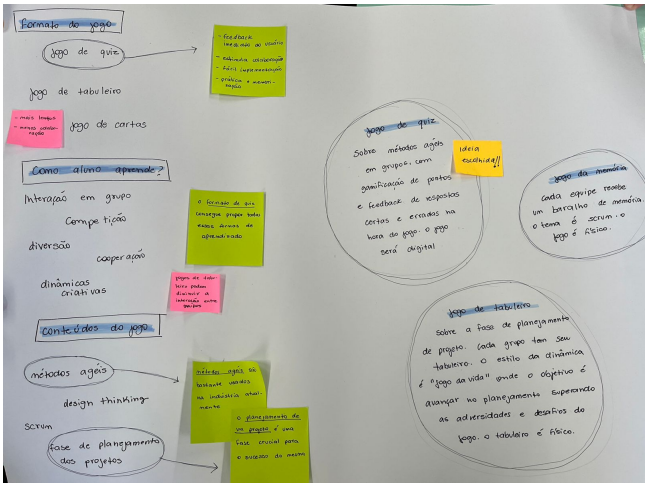

Figure 4: Poster completed by a student group after the first day of the activity

The next section includes a brief description of each group's idea. Figures 5 and 6 show examples of the prototypes created by the students.

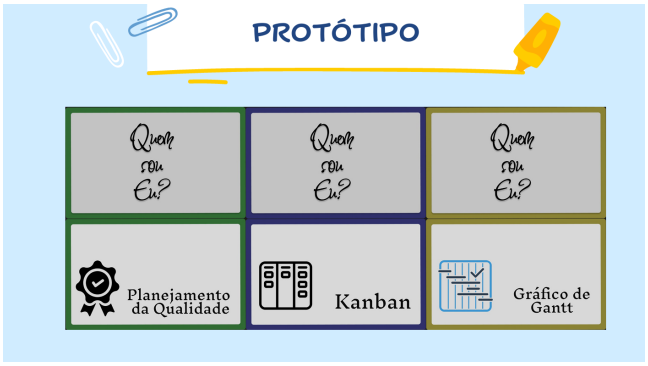

Figure 5: Prototype of the cards from the game Who am I? about Software Project Management

5 Discussion of Results

This section presents and discusses the results achieved through the application of the Design Thinking methodology by the students. We organized it into three subsections: overview of participants, quantitative analysis of Likert-Scale survey data, and qualitative analysis of open-ended student feedback.

5.1 Overview of Participants

A total of 39 students voluntarily participated in the activity, divided into six groups. The students themselves picked their groups, since we gave them a maximum number of 6 people per team. Most participants were enrolled in the Information Systems program, followed by students from Computer Science and a few from other programs such as Business Administration, Internet Systems, and Control and Automation Engineering. The students were distributed between the third and eighth semesters of their respective programs, with the majority in the fourth semester. It indicates a certain level of maturity in the field of Software Project Management, as most students had already taken courses such as Software Engineering and People Management. The distribution of the students in their respective semesters and programs can be visualized in the graphics from Figures 8 and 7.

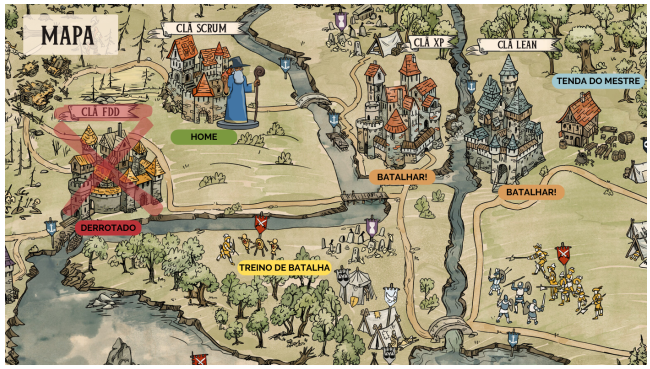

Figure 6: Prototype of the map from the Medieval RPG about Agile Methods

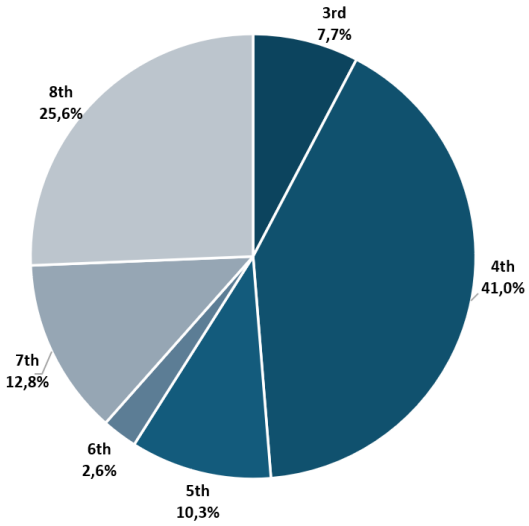

Figure 7: Distribution of students for each semester

Regarding the themes chosen for the educational games, participants selected topics related to Agile Methodologies—such as Scrum, XP, and Kanban—as well as knowledge areas from the PMBOK (Project Management Body of Knowledge). The games varied in format and platform, including both physical and digital games, RPGs, trivia games, and card games.

At the end of the activity, a vote was taken to determine the most creative game. The top three selected were "RPG Medieval," "Método Truker," and "Who Am I?".

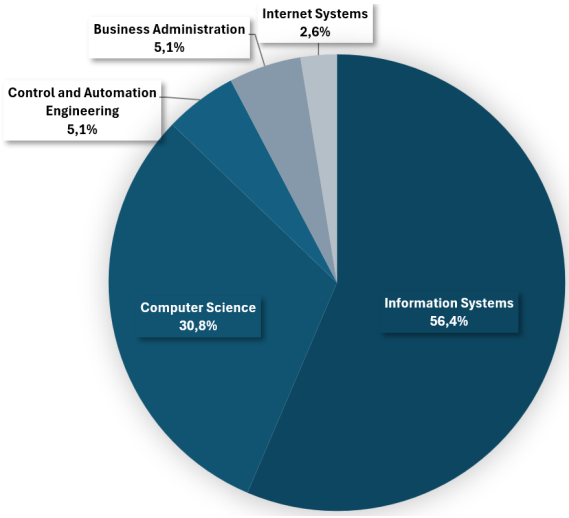

Figure 8: Distribution of students from each program

- **RPG Medieval** is an online role-playing game in which players choose a class representing an agile methodology. Students participate in missions to learn more about their class (i.e., Scrum, XP, etc.) and compete with peers from other classes through knowledge-based challenges.
- **Método Truker** is a hybrid between poker and the Brazilian card game truco, where students answer questions about the course content by placing bets using a chip-based mechanic.
- **Who Am I?** is a question-and-answer game in which each student receives a card with a project management-related role or concept (e.g., Scrum Master). Without seeing their own card, they must ask yes-or-no questions to peers until they guess what is on their card.

5.2 Quantitative Analysis of Likert-Scale Survey Data

It is important to note that, among the 39 participants, 29 reported having no prior knowledge of Design Thinking before the classroom activity. Therefore, most students responded based on their first and only impression of the method.

Figure 9 presents the distribution of student responses to the 10 questions, offering insight into their perceptions of the activity.

Based on the chart, it can be observed that, overall, participants agreed with all ten statements. Questions Q01 and Q02 assessed students' conceptual understanding of Design Thinking, aiming to verify whether the content presented beforehand and reinforced during the activity had been effectively absorbed. The high percentage of students who agreed with these statements suggests that the introductory session on Design Thinking was both clear and comprehensive, successfully preparing them to engage with the activity.

Questions Q03 and Q07 focused on students' perceptions regarding collaborative work, aiming to determine whether the exercise helped them recognize the importance of active participation. The large number of students who agreed with these statements indicates a favorable view of the method, suggesting they were able to contribute meaningfully to their group's ideas—an essential element for the activity's success.

Questions Q05 and Q08 aimed to evaluate whether Design Thinking encouraged students to be more creative and to develop innovative solutions that might not have emerged without the application of the method. These items also sought to understand whether students saw potential for innovation through Design Thinking in the field of Computing. The students' agreement with these statements reflects the method's potential to foster creativity and idea generation. However, Q05 received a few neutral and disagreeing responses, indicating that while students viewed the method positively in the context of educational solutions, they were somewhat more hesitant about its direct application in their own field of study.

In this context, Q04 and Q06 aimed to assess students' confidence in applying Design Thinking to future projects and the perceived applicability of the technique. Despite receiving relatively few disagreeing responses, Q06 was the most contested statement on the form—a result that can be expected, considering the short timeframe of the activity. Nevertheless, a significant number of students still agreed with these items, reinforcing both the potential of the method and its usefulness in enabling students to approach problem-solving through the Design Thinking framework.

Finally, Q09 and Q10 addressed more specific aspects of the structural process of Design Thinking, particularly its emphasis on testing. The students' agreement with these statements validates their experience with the method and indicates an understanding of the importance of following its procedures to ensure effective implementation. Notably, Q09 received the highest number of "strongly agree" responses among all questions, suggesting that students recognized the value of prototyping and testing as integral components of the methodology. This is further supported by the quality of the prototypes presented by the groups.

5.3 Qualitative Analysis of Open-Ended Student Feedback

In addition to the scaled questions, two open-ended questions were included in the form. The first asked students to briefly describe their experience with Design Thinking, while the second provided a space for suggestions to improve the activity and its implementation.

Regarding the first question, students reported finding the process both challenging and productive, highlighting teamwork, creative freedom, and the structured stages offered by Design Thinking. Some students mentioned initial confusion when starting the activity; however, as the exercise progressed, they came to understand the method's stages and were able to contribute positively to the development of the game idea.

Furthermore, the second question proved useful for gathering suggestions to improve the activity. The main concern raised by students was related to time constraints, as they felt that two class sessions were insufficient to fully understand and apply the method. They suggested extending the duration of the activity to allow for better development of the game, potentially enabling the complete implementation of each group's ideas.

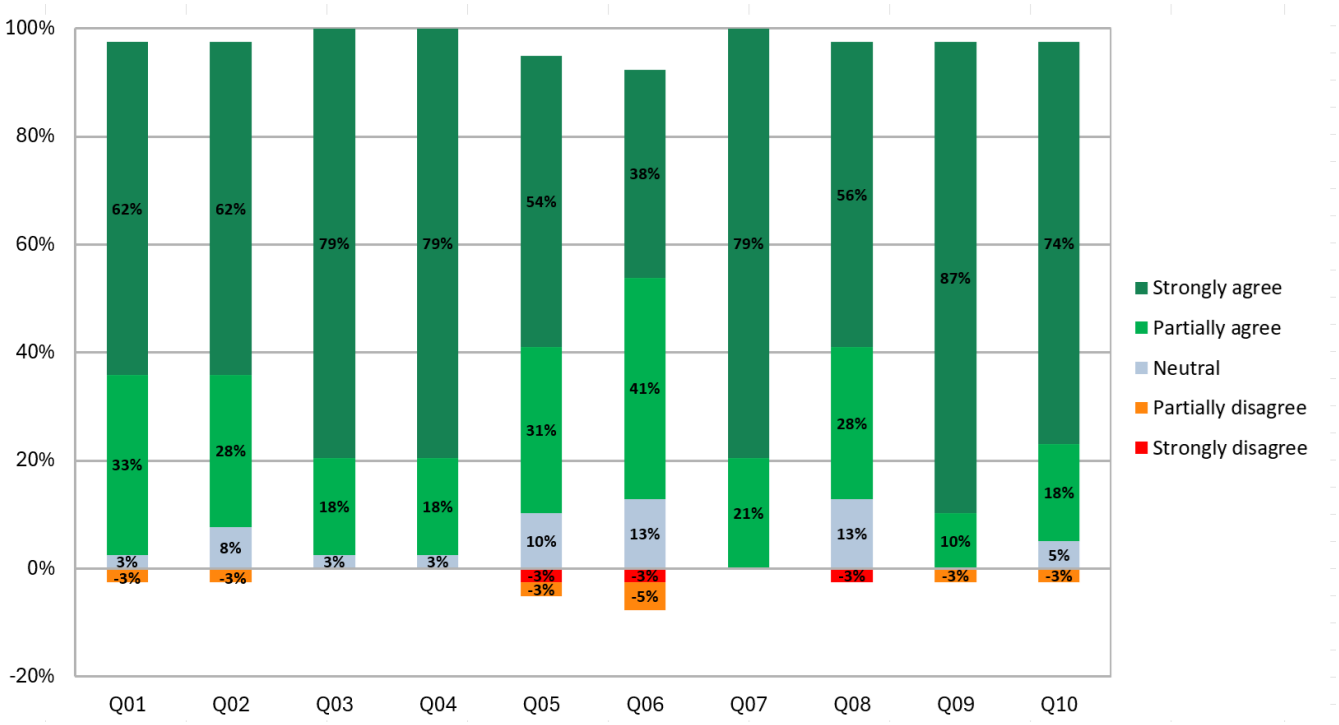

Figure 9: Distribution of Student Responses About the Use of Design Thinking

6 Conclusion

Based on the results discussed, the implementation of the Design Thinking activity within the Software Project Management course positively influenced the students' learning experience. The activity provided an opportunity to apply a methodology valued in industry to an academic setting, enabling students to generate relevant and creative ideas for educational games in computing. A key outcome of this study was the successful adaptation of the Design Thinking methodology to the context of higher education in Software Engineering. This adaptation proved effective in engaging students, supporting collaborative learning, and fostering creativity—essential skills in project management education. The students' feedback confirms the method's pedagogical value, indicating that it helped them better understand both the course content and the relevance of user-centered approaches. Given these outcomes, the approach shows strong potential for replication in similar educational contexts, expanding its reach and further integrating active learning strategies in software-related courses. Enhancements such as extending the activity duration and incorporating real-world examples in the preparatory materials could increase its educational impact. Finally, the educational game concepts proposed by the students also demonstrate notable development potential, offering promising directions for future research focused on designing innovative teaching tools for computing education.

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Finally, the educational game concepts proposed by the students also demonstrate notable development potential, offering promising directions for future research focused on designing innovative teaching tools for computing education. In terms of future work and broader applications, this methodology holds great promise for the field of Software Quality. By integrating a human-centered approach from the early stages of a project, this method can be used to identify and prevent potential usability and functional issues. Future research could investigate how applying Design Thinking to the requirements and design phases impacts the final software quality metrics, such as defect density and user satisfaction scores.

This approach would allow for the proactive identification of quality attributes, like reliability and maintainability, ensuring they are addressed from the outset, rather than being reactive fixes. The principles learned here could be adapted to train students on how to build quality into a product from day one, rather than merely testing for it at the end.

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