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Exploring Skills Enhancement in Student Teacher Through Implementation of Design Thinking in Unplugged Game Creation

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Abstract: Design thinking provides a comprehensive framework that encourages collaboration, empathy and experimentation, which aligns well with the goals of modern education. While design thinking is recognised as an effective approach in education, previous research has focused primarily on its application in digital materials or project design tasks. This study addresses this gap by exploring the skills enhanced by student teachers through the implementation of design thinking in the creation of unplugged educational games. Using a qualitative case study design, a total of six groups with total 22 student teachers were selected through the purposive sampling technique to participate in a series of workshops focused on unplugged educational game design. Data was collected through focus group discussions, document analysis of design artefacts, weekly reflective e-portfolios and participant observation during the game creation process. The findings revealed significant improvements in the student teachers' problem-solving, creativity and communication skills as they engaged in design thinking. Through collaborative problem solving, iterative prototyping and creative ideation, the student teachers have improved their ability to communicate ideas clearly, and were able to tackle complex challenges and generate innovative solutions. These findings highlight the transformative potential of design thinking in teacher education and demonstrate its effectiveness in preparing future educators for the complexities of 21st century teaching and learning. Future research may examine design thinking's impact on teachers of different experience levels, use experimental designs for validation, and compare it with other instructional models to identify effective strategies.

Keywords: Design thinking, Unplugged Educational Game, Student Teacher, Skills Enhancement

1. Introduction

The field of teacher education has undergone a notable transformation, driven by the necessity to enhance the professional competencies of educators in order to meet the demands of 21st-century education (Senin et al., 2021; Pushpanadham, 2020). As the educational landscape shifts towards more interactive, student-centred approaches, there has been a heightened focus on developing essential skills such as creativity, critical thinking, problem-solving, and adaptability. In order to meet these demands, Pushpanadham (2020) proposed that there is a growing need for professional skills development among teachers in order to assist teachers in acquiring the professional competencies and experience necessary for practical activity.

One innovative approach that aligns with these contemporary educational needs is design thinking. Initially introduced by Peter G. Rowe in 1987 and further developed by scholars like Richard Buchanan, Tim Brown, and David Kelley, design thinking is a problem-solving methodology characterised by user-centred design, iterative prototyping, and a focus

on creative and practical solutions (Brown, 2009), emphasising human or user needs (Diefenthaler et al., 2017). The process of design thinking emphasizes empathy, creativity, and iterative testing to address complex challenges (Canfield, 2021). The general process of design thinking involves five phases: empathy, define, ideate, prototype, and test. Although it originated in the fields of design and business, design thinking has been increasingly adopted in education as a means to promote innovation, collaboration, and personalized learning experiences (Panke, 2020). By encouraging teachers to think like designers, this approach empowers them to develop more engaging and effective teaching strategies that meet the diverse needs of their students (Umutlu, 2022; Cain & Henriksen, 2022; Novak & Mulvey, 2020).

The implementation of design thinking in education has shown promise in fostering key 21st-century skills such as creativity, critical thinking, and problem-solving. These skills are essential for both teachers and students as they navigate the complexities of modern education. Professional skills, including effective communication, collaborative problem-solving, and innovative thinking, are crucial for educators to effectively engage and inspire students. However, while there is substantial research on the application of design thinking in developing digital educational tools and curriculum, there has been limited exploration of its impact on the development of professional skills in teachers, particularly in non-digital contexts such as unplugged game creation. This gap in the literature highlights the need for further investigation into how design thinking can be leveraged to enhance teacher competencies in diverse educational settings.

This study seeks to address these gaps by exploring the potential of design thinking to develop and enhance specific professional skills among student teachers through the creation of unplugged educational games. The rationale for focusing on unplugged games lies in their proven benefits as highlighted in recent studies. For instance, research by Wu et al. (2023), Wen et al. (2023), Kalkan et al. (2022), and Chen et al. (2021) has shown that unplugged games are effective in developing 21st-century skills, improving learning and retention, and increasing engagement and motivation among learners. Additionally, unplugged games offer a versatile and accessible approach that aligns with the current teaching and learning environment without the reliance on digital technology. By focusing on the use of non-digital tools, this research aims to provide insights into the processes and experiences that contribute to skills development in a more accessible and flexible educational environment.

2. Research Objective and Questions

The main objective of this study is to explore the enhancement of professional skills among student teachers through the implementation of design thinking in the creation of unplugged educational game.

i. What professional skills are enhanced among student teachers through the implementation of design thinking in the creation of unplugged educational games?
ii. How does the design thinking process facilitate the enhancement of these skills in student teachers during the creation of unplugged educational games?

3. Methodology

This study employed an exploratory qualitative research design to investigate the potential of design thinking in enhancing specific professional skills among student teachers through the creation of unplugged educational games. The case study method was chosen for this research, enabling an in-depth examination of contemporary phenomena within real-life contexts (Yin, 2018). This study explored the experiences of different groups of student teachers implementing design thinking for educational unplugged game creation. The research focused on six groups of student teachers, each composed of three to four students

enrolled in a 14-week Educational Technology course. These students were tasked with using design thinking to complete an unplugged educational game design project during their three-hour practical class. The purposive sampling technique was employed to select participants from two programs, namely Physical Education and Malay Language Education to ensure a diverse range of perspectives. All selected groups scored an A on the project and fully attended practical classes, which were used as criteria to identify participants who were fully engaged and demonstrated high competency in applying design thinking. Their consistent participation increased the depth and breadth of the data collection, providing richer insights into the design thinking process.

Data were collected throughout the design thinking process, namely from initial discussions to the final production of the unplugged games. Data collection methods included focus group discussions, participant observations, and document analysis. A total of 18 focus group discussions were conducted over 14 weeks, with three discussions for each group conducted after completing the final product to allow participants to reflect on their design thinking process and skills development. Document analysis involved examining weekly e-portfolio reports on the Padlet platform, mind maps, sketches, prototypes, and final game products. Over the 14-week task, participant observation has allowed the researcher to engage with student teachers, capturing detailed field notes and multimedia data.

The data analysis process involved thematic analysis. Data from focus group discussions, participant observation and document analysis, including e-portfolios, mind maps and prototypes, were coded and analysed to identify patterns and relationships. Triangulation was achieved by cross-referencing findings from different data sources to ensure consistency and validity. This approach strengthened the credibility of the findings by confirming that the findings were consistent across the different data collection methods and provided a comprehensive understanding of how design thinking contributed to the development of student teachers' skills.

4. Results and Findings

To better understand how design thinking enhances the professional skills of the student teachers, the findings were categorised into three main skill areas, namely problem-solving, creativity and communication. These categories were derived from the core competencies that are widely recognised as essential in both the field of education and the design thinking process (Brown, 2009; Cain & Henriksen, 2022). Each of these competencies plays a critical role in enabling teachers to address classroom challenges, foster innovation, and engage effectively with students. The subsequent sections will elaborate on how these skills were developed through the implementation of design thinking in the creation of unplugged educational games

4.1 Problem-solving Skills

The data revealed that student teachers significantly enhanced their problem-solving abilities through the systematic and iterative process of design thinking. This enhancement was evident across all participants groups, who reported that adhering to a structured, step-by-step approach was essential in addressing the complexities associated with the development of unplugged educational tabletop games. By focusing on user needs, the student teachers learned to empathise with their target audience, ensuring that the final product was both relevant and effective. The design thinking process also emphasized the importance of strategic planning, as the participants developed a deeper understanding of the need to organise their work effectively and anticipate potential obstacles. This is shown in the following excerpts of focus group discussions:

> "The step-by-step guide taught us how to plan effectively and be organized before tackling a complex problem. This has made us become more organized

and systematic when trying to overcome a problem, because we know exactly what need to do for the next step." (Student E, FGD2/S2/156-159)

"Design thinking has enabled us to overcome the problem by first empathising and identifying the needs of teachers, and then finding ideas to overcome the problem. We have become more systematic in solving problems." (Student G, FGD3/S3/250-254)

"Design thinking has enabled us to solve problems in a structured, clearer and effective manner. We refined our approach by iterating the planning, brainstorming ideas, testing and getting feedback until we have identified the optimal solution. Our problem-solving skills have improved significantly compared to our previous method." (Student U, FGD6/S2/242-246)

From observations and analysis of their weekly e-portfolios, it was evident that all student teachers were effectively demonstrating the development of problem-solving skills. They were deeply immersed in a structured process that involved idea generation, prototyping, and iterative testing. Throughout the 14-week design task, the student teachers engaged actively in collaborative discussions and feedback-seeking sessions. The participants also conducted in-depth analysis to understand the root causes and specific needs of their target group. They carefully planned and brainstormed potential solutions, systematically determining how to resolve the identified problems. This involved generating a range of ideas and rigorously evaluating them through testing, while gathering feedback from both their instructors and classmates.

Figure 1: The student teachers organizing their thoughts using visual aids

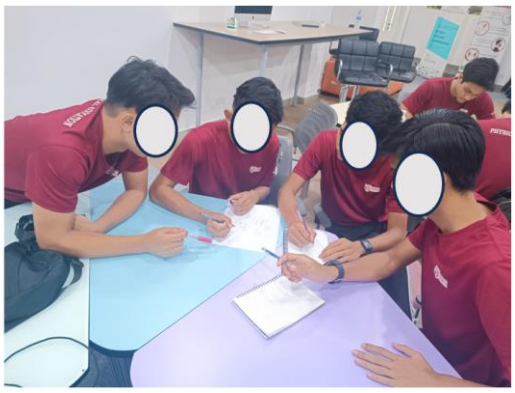

Figure 2: The student teachers actively brainstorming using note-taking tools

4.2 Creativity Skills

Creativity skill is another prominent theme that emerged from the data. The implementation of design thinking in the creation of unplugged game encouraged student teachers to think creatively and fostered an environment where innovative ideas were highly valued. Throughout the creation of unplugged games, student teachers were encouraged to seek unconventional solutions and adopt a creative mindset towards design challenges. This process involved not only the generation of original ideas but also the adaptation of existing concepts to create new and enhanced versions. The iterative nature of design thinking enabled them to experiment with various approaches, refine their ideas, and foster a mindset that prioritizes creativity as a fundamental aspect of educational innovation. As a result, they grew more confident in their ability to generate ideas. This is shown in the following excerpts of focus group discussions:

"We have come up with a simple, interactive, and easy-to-use idea. We think outside the box to generate ideas that align with the students' objectives and interests and can solve the problems they face." (Student G, FGD2/S2/197-199)

“We've become more creative because we've learned so much through trial and error. We also didn't expect to be able to turn first aid into a fun game, but we did it! We modified and combined some existing ideas until we got the final product.” (Student J, FGD3/S3/75-78)

“We often come together to brainstorm the best idea. Then we give existing products a new lease of life to create new unplugged games that fit our objectives.” (Student U, FGD5/S2/292-294)

The results from observations and document analysis further reinforce these findings, illustrating how student teachers creatively combined and modified existing ideas to develop new products that effectively achieved their educational objectives. The participants demonstrated a high level of skills in adapting and tailoring these innovations to suit the classroom context and align with the teaching content. This resulted in the creation of educational games that were highly praised by lecturers for their novelty, effective implementation, and appealing design. Throughout the process, the participants gained valuable experience and continuously refined their ideas through testing and gathering feedback from instructors and classmates. This iterative approach allowed them to enhance their concepts, making improvements based on constructive feedback. As a result, the student teachers became more confident in generating new ideas and presenting them, demonstrating increased creativity and innovation in their approach to educational design.

Figure 3: ‘Mini Football', the final product designed by student teachers to address the venue issues identified by the group.

Figure 4: The ‘muscle game’ incorporates various educational elements designed by the student teachers, demonstrating their ability to create interactive tools.

4.3 Communication Skills

The third theme identified from the data is communication skills. Throughout the process, the student teachers engaged in extensive discussions and brainstorming sessions, enabling the exchange of ideas and fostering collaborative problem-solving. They learned how to deliver and gather clear and accurate messages aligned with their objectives, particularly during interview sessions and when collecting feedbacks. The student teachers also developed the ability to share their opinions openly while actively listening to feedback from others, using this input to refine their ideas and prototypes. This experience not only enhanced their ability to communicate their ideas clearly and persuasively but also taught them to respect differing opinions, which contributed to the improvement of their designs. This is shown in the following excerpts of focus group discussions:

"From the start, we've been training our communication skills. From interviewing teachers to identify what we need, discussing ideas with each other, designing products, getting feedback from friends and instructors, and finally presenting our ideas to everyone." (Student D, FGD1/S3/90-94)

“We had the great opportunity to interview a targeted group and get their valuable feedback. We also had the chance to discuss ideas with our group. We learned how to communicate in a positive way and deliver the message clearly.” (Student N, FGD4/S3/93-95)

“We've learned a lot about how to communicate effectively. We had a great chat with the teacher we interviewed, discussed solutions among group members, tested our prototype, and asked for feedback to improve our prototype. It's been a great opportunity to build our confidence in communicating.” (Student X, FGD6/S3/92-97)

The observation and e-portfolio data further supported these findings. The observation and e-portfolio data provided further evidence to support these findings. The data demonstrated that the student teachers consistently practised their communication skills throughout the entire design thinking process. Their discussions during the empathy, define, and ideation phases were particularly focused on generating solutions and ideas, while the testing phase emphasized improving and refining these ideas based on feedback. Throughout each phase, the student teachers enhanced their ability to communicate more effectively and with greater clarity. The participants demonstrated proficiency at delivering their ideas clearly and confidently, explaining their concepts in a way that resonated with their peers and instructors. Their discussions were increasingly focused, and they were able to articulate their thoughts and rationale with precision, which significantly contributed to the refinement of their final products.

Figure 5: The student teachers actively involved in continuous interaction and brainstorming idea through the process

Figure 6: The student teachers actively seeking feedback in the phase of prototyping and testing

5. Discussion

The results of this study demonstrate the significant impact of design thinking on the enhancement of skills in student teachers, particularly in the aspects of problem solving, creativity and communication. These findings are consistent with the existing literature that highlights the transformative potential of design thinking in educational contexts (Noh & Karim, 2021; Razali et al., 2022; Al-Yahya et al., 2021; Strakhovich, 2021; Charosky et al., 2022; Mahajan et al., 2021). The structured approach of design thinking enabled the student teachers to improve their problem-solving skills. By breaking down complex educational

challenges into more manageable tasks, the student teachers were able to systematically address the root causes of problems, in line with the views of Brown (2009) and Wasyluk & Kucner (2021), who highlight the iterative nature of design thinking as a powerful tool for methodical problem solving.

The study also found that design thinking significantly enhanced the creativity of the student teachers. Engaging in brainstorming sessions and collaborative discussions encouraged them to think outside the box and develop innovative solutions tailored to the needs of their students. This finding is in line with Avsec & Savec (2022) and Kim (2022) who emphasise the role of design thinking in fostering creativity. In addition, the iterative feedback loops allowed the student teachers to revisit and refine their ideas, highlighting the importance of resilience and adaptability in the creative process. Furthermore, the implementation of design thinking facilitated the enhancement of communication skills among the student teachers. Through extensive discussions, brainstorming sessions and feedback exchanges, student teachers improved their ability to articulate and share ideas effectively. This is in line with the findings of Cain & Henriksen (2022) and Henriksen et al. (2018), who emphasised the importance of communication in a collaborative educational setting.

6. Conclusion and Recommendations

The results of this study demonstrate the significant impact of design thinking on improving the problem-solving, creativity and communication skills of student teachers. The iterative and collaborative nature of design thinking enabled the participants to systematically address complex educational challenges, generate innovative solutions, and communicate effectively with their peers, targeted users, and instructors. These findings highlight the transformative potential of design thinking in preparing future teachers for the demands of 21st century teaching and learning.

Based on the findings of this study, it is recommended that future research expand to include both experienced and novice teachers to explore how design thinking benefits teachers at different career stages. An experimental design, incorporating control and experimental groups, would further validate the effectiveness of design thinking in enhancing professional skills. Additionally, comparing design thinking with instructional models like ADDIE, ASSURE, and the Dick and Carey Model, as well as examining the differences between digital and non-digital game creation, would provide a more comprehensive understanding of the most effective strategies for various educational contexts.

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