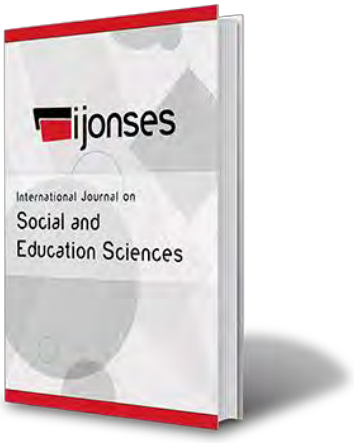

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Abstract

This study aims to enhance teamwork skills among lower secondary school science students through a Learning Activity Package (LAP) using the design thinking process. The research evaluates the experiences of science teachers and students to identify areas for improvement in teamwork skills, which is achieved through interviews and observations in the Empathise & Define phase. Insights from this phase are used in the Ideate & Prototype phase to develop and refine collaborative learning activities, focusing on communication, collaboration, and problem-solving. Rooted in cooperative learning theory and utilising a design thinking framework, the study employs a user-centred approach with tools like personas and user journey maps. The project, through expert evaluations and an iterative design process, aims to contribute significantly to the development of teamwork skills, preparing students for future workforce demands.

Introduction

Recent surveys on technology adoption between 2023 and 2027, focusing on business transformation and organisational recruitment, reveal that over 85% of respondents believe technology will be fundamental in shaping the future of business operations and employment within the next five years. This era of technological progress, characterised by the rise of new technologies, is redefining human-machine interactions. It is altering our work environments and job specifications, necessitating novel skill sets. Currently, it is estimated that machines undertake 34% of business-related tasks, with humans handling the remaining 66%. Despite technological advancements, the indispensability of human labour persists due to the irreplaceability of certain tasks and skills, highlighting the workforce's continued reliance on human expertise (World Economic Forum, 2023).

In addressing the forthcoming challenges, the imperative lies in early skill development at the basic education level, escalating these skills through higher education. This approach aims to stay abreast of industry shifts and fosters a culture of lifelong learning. In the evolving labour market, where industries and work conditions are in constant flux, skills development becomes crucial (World Economic Forum, 2023).

Emphasising teamwork skills, noted for enhancing employability, underscores their significance as among the most transferable and in-demand competencies across job markets. The utility of teamwork skills extends beyond specific job applications, facilitating effective collaboration, leadership, listening, and communication. These

competencies are invaluable in both personal and professional realms, making them highly sought after by employers (Doyle, 2022; Kurtuy, 2023).

As teachers, we must promote the development of skills that enable our students to function effectively in the workplace, such as working well in teams (Benavides, 2022). The ways to help develop teamwork skills encompass a multitude of emotional intelligence skills that can aid in enhancing your ability to work effectively as a team. These include communication, responsibility, honesty, active listening, empathy, collaboration, and self-awareness (Keiling, 2023). Knowing how to work as part of a team is an essential component of almost all jobs and tasks. But, very often, this important skill is taken for granted. Effective teamwork rarely just 'happens'; it is honed and developed using a combination of skills, attitudes, and careful leadership to make a very real and measured impact in the workplace (Dalley, 2021). The development of skills helps adolescents and children improve their lives, family life, and communities. They can create new opportunities and take necessary actions when needed. Currently, many countries are working on this issue by enhancing potential and providing opportunities for the improved development of skills for youth (Axen, 2023; Ozturk, 2023). By developing these essential skills early on, students will be prepared to collaborate successfully with others, both in the classroom and in the workplace. This preparation ultimately leads to increased productivity and positive relationships (Grzimek et al., 2020).

To cultivate these essential teamwork skills, a series of collaborative learning activities have been developed, incorporating cooperative learning teaching methods known for maximising student engagement and effectiveness. Cooperative learning, which encourages concept mastery through group instructional work, unites students towards shared objectives, leveraging group dynamics for enhanced learning outcomes (Johnson & Johnson, 2015; Johnson et al., 2014; Tran, 2014). This pedagogical approach is distinguished by the interdependence of group member roles and the emphasis on student interaction in a face-to-face learning environment, fostering personal responsibility, teamwork, social skills, and collective problem-solving (Johnson & Johnson, 1999; Schul, 2011). This research explores the development of a learning activity package aimed at improving teamwork skills among students, drawing on cooperative learning theories to design a prototype that aligns with the educational imperative of nurturing 21st-century skills.

Learning Activity Package

The Learning Activity Package (LAP) is designed to achieve its objectives through the preparation of hands-on learning media. According to Arseneau et al. (1994), the effectiveness of LAP is grounded in active engagement with these materials. Duke (1975) introduced this as an innovative teaching approach that emphasises the active participation of students in classroom learning activities. Further, Cardarelli, as cited by Ezeano (2013), describes the LAP as a teaching strategy that prioritises active and student-centred learning. In this model, the teacher acts as a facilitator, guiding students through activities and problems that contribute to their development and enhance learning effectiveness.

The role of teachers in this process is to facilitate the learning experience by guiding students through various

problem-solving activities, thereby helping them to achieve the learning objectives. The LAP emphasises learning activities as the core of the educational process, where the teacher, as a facilitator, steers students through diverse activities and challenges, potentially elevating their success to a higher level (Njoku and Akamobi, 2015). Akpokiniovo (2020) highlights the LAP as an approach that centres on the learners, aiming to facilitate teaching and offering students a variety of options to meet behavioural objectives. This methodology fosters diversity in learning outcomes, allowing students to select paths that align with their learning styles and preferences.

Udu (2018) underscores that a series of teaching activities can significantly enhance students' retention of scientific knowledge through active participation in the learning process. Ward and Williams (1976) also emphasise the importance of the characteristics of the learning activities incorporated within the LAP. They outline a general concept that specifies the content to be studied, the specific skills to be acquired, and multimedia guidelines for practising and obtaining those skills.

Teamwork Skills

The essence of teamwork skills lies in their ability to foster strong interpersonal connections, facilitate effective communication, and enable collaborative efforts toward shared objectives. Aggarwal (2019) conceptualises teamwork as a collaborative endeavour of two or more individuals aimed at a unified goal, emphasising the pivotal role of teamwork skills in achieving high-quality outcomes and promoting continuous improvement through the integration of individual members' ideas and expertise.

Expanding on this notion, Hanna (2023) identifies teamwork skills as a combination of qualities and abilities that enhance collaboration and communication during interactive processes. This perspective highlights the necessity of proficient communication, active listening, and a sense of responsibility as foundational elements contributing to an individual's effectiveness within a team. Supporting these views, Coursera (2023) delineates teamwork skills as crucial for successful collaboration, including competencies such as communication, collaboration, and negotiation, underscoring their relevance in both personal and professional domains.

From an educational standpoint, Zhang et al. (2021) emphasise the importance of teaching social skills to motivate autonomous learning and nurture leadership, communication, and collaborative capabilities. This aligns with Boon et al. (2013) and Sales et al. (2015), who assert that the development of teamwork skills is an adaptive process integrating cognitive, emotional, and behavioural dimensions among team members, thereby facilitating effective interactions toward achieving common goals.

Cooperative Learning Theory

Cooperative Learning Theory emerges as a pivotal conceptual framework within the realm of educational psychology, focusing on the learning dynamics that unfold through the collective efforts of individuals engaged in educational or training settings. Originating from the foundational work of Johnson and Johnson (2009), this theory underscores the importance of stimulating learning via communication, knowledge exchange, and

cooperative work among participants in a group or team setting. Barkley, Cross, and Major (2014) further elucidate that Cooperative Learning Theory advocates for an instructional strategy aimed at fostering environments where students can learn collaboratively. This approach not only facilitates knowledge sharing among learners but also cultivates a nurturing atmosphere rich in relationships and mutual support, thereby promoting the acquisition of critical skills necessary for problem-solving, teamwork, and leadership.

Design Thinking

Design Thinking (DT), rooted in "Design Science" since the 1960s, embodies a comprehensive, iterative, and user-centred approach to innovation and problem-solving. It emphasises understanding users' needs through empathy, thereby enabling the development of solutions that are deeply connected to real-world applications. Characterised by continuous cycles of visualisation, prototyping, experimentation, and feedback, DT promotes an adaptable and flexible design process. This approach integrates analytical and intuitive thinking, fostering a dynamic synergy that bolsters creativity and logical problem-solving.

The integration of Design Thinking principles into the development of Learning Activity Packages offers a promising approach to enhancing teamwork skills among students. By employing the empathy-driven, iterative process of Design Thinking, educators can create learning activities that not only address the core objectives of teamwork skill development but also ensure that these activities resonate with students' needs and experiences. This user-centred approach aligns well with the collaborative nature of teamwork skills, potentially leading to more engaging and effective learning outcomes.

Research Questions

RQ1. What are the experiences and essential needs to promote teamwork skills among science teachers and lower secondary school students?
RQ2. How can a collaborative learning activity package be designed to foster teamwork skills?

Objectives

-To analyse the experiences and essential needs for promoting teamwork skills among science teachers and lower secondary school students, providing a foundational understanding that informs the design of educational interventions.
-To develop a series of collaborative learning activity packages aimed at enhancing the teamwork skills of lower secondary school students, utilising insights gained from objective one to guide development.

Method

This study employs a design research methodology, leveraging the design thinking process (Brown, 2009) across its five stages: Empathise, Define, Ideate, Prototype, and Test. This approach underlies the development of a

cooperative learning activity package tailored to improve teamwork skills among lower secondary school students.

Empathise & Define (Phase 1): This phase directly addresses the first objective by engaging with science teachers and lower secondary students to understand their experiences and needs concerning teamwork skills. It involves detailed interviews and observations, aiming to empathise deeply with the participants and accurately define the core challenges and requirements in promoting teamwork skills.

Ideate & Prototype (Phase 2): This phase focuses on the second objective by designing and developing collaborative learning activity packages based on the defined needs and challenges. It translates insights from Phase 1 into tangible learning interventions, conceptualising and prototyping collaborative activities that aim to enhance teamwork skills.

From Empathy to Prototyping: The study ensures a seamless transition from understanding user experiences (Empathise, Define) to creating solutions (Ideate, Prototype), maintaining a user-centred approach throughout. Each phase is iteratively linked, ensuring that the insights gained from understanding users' experiences directly influence the design and development of the learning interventions.

Integrating Collaborative Learning Principles: The study utilises the principles of collaborative learning (Johnson & Johnson, 1998) as a theoretical and practical framework to ensure that the design of the learning activity package is pedagogically sound and aligns with best practices in fostering teamwork skills. All details are shown in Table 1.

Table 1. Procedures and Operations, Design and Development of a Prototype Series of Collaborative Learning Activities Package to Promote Teamwork Skills of Lower Secondary School Students

Distance	Phase 1: Analysis of User Experience and Requirements.	Phase 2: Designing and developing.
Research	1. Analysis of science learning management experiences to enhance teamwork skills of teachers in large schools. 2. Learning experience analysis is managed by learning science to enhance the teamwork skills of Lower Secondary School students in large schools.	1. Simulator Appearance Design 2. Designing the user experience simulation to bring in the interference design. 3. Defining theory and creating predictive maps for design. 4. Set the principles for designing a cooperative learning activity package to promote teamwork skills. 5. Defining the composition of innovation. 6. Innovative prototyping. 7. Expert evaluation of innovative prototype
Productivity	1. Analysis results, management experience, science learning to promote skills, working as a team of teachers in	1. Simulation User Experience. 2. Interference Appearance. 3. Cooperative learning activity package Design

Distance	Phase 1: Analysis of User Experience and Requirements.	Phase 2: Designing and developing.
	large schools. 2. The results of the learning experience analysis were managed by science learning to enhance the teamwork skills of Lower Secondary School students in larger schools.	Concept Framework 4. Principles of Innovative Design. 5. Expert Evaluation of Innovative Prototypes.
Target Group	1. Lower Secondary School science teacher 7 people 2. Lower Secondary School students 50 people	1. Lower Secondary School science teacher 7 people 2. Lower Secondary School students 50 people 3. The research team. 4. Three experts, including a game expert, an innovation expert, and a design expert."
Research duration	1 month from May 15th to June 15th, 2023	3 months from June 16th to September 29th, 2023
Data collection	Interviews and observations	Use in-depth interview methods and prioritize comments using cards. (Allabarton, 2019) Use the theory of collaborative learning with the principles of (Johnson & Johnson 1998) to design.
Data Analysis	Domain Analysis	Domain Analysis
Research tools	• In-depth interview. • Persona and User Typology	• In-depth interview. • Insight experience persona and User journey maps • Insight mind! value proposition canvas

Addressing the "Test" Phase Limit: While the "Test" phase has not been executed due to potential constraints, it is integral for validating the effectiveness of the designed interventions. Planning for this phase involves outlining a strategy for user testing with students and teachers, assessing the usability, engagement, and impact of the learning activity package on teamwork skills. Feedback from this phase will inform refinements to the interventions, ensuring they meet the identified needs effectively.

Results and Discussion

This study is centered on the creation and formulation of a cooperative learning activity package, specifically designed to augment teamwork skills in lower secondary school students. The research is structured around two principal objectives. To achieve the objectives, the study employs the design thinking process as delineated by Brown (2009), highlighting the critical role of comprehending the perspectives of both instructors and students. This approach underscores the significance of a user-centered methodology in the development of activities

focused on improving teamwork skills, ensuring that the designed interventions are both effective and tailored to the unique context of lower secondary science education.

Phase 1: Analysis of User Experience and Requirements

From interviewing teachers and students through in-depth interviews, we gathered data on their experiences and needs across five dimensions: roles, emotions, attitudes, behaviours, and opinions. This information was used to create personas, as illustrated in Table 2.

Table 2. Analysis of User Experience Needs and Requirements

Interview	Needs
Students	Roles: Students in grades 1-3 with a GPA of 3.00-4.00 are predominantly involved in cleaning the school area, performing daily duties in the classrooms, and serving as class leaders, assistant leaders, and members of the classroom. Emotions: Can apply the knowledge in daily life. Some content is still not understood, making it boring and confusing. There is a lot of note-taking. Desires to actively participate in activities and enjoy the learning process. Attitude: Making science learning enjoyable by incorporating engaging activities, including game-based learning, and hands-on practical experiences. The activities involve physical movement, allowing the acquired knowledge to be applicable in daily life. Behaviour: Things that stimulate a desire to learn in a fun and enjoyable way. Opinions: The additional components to enhance learning include tools that support multimedia learning and various learning activities. Roles: Teaching science for ages 0-20 years involves responsibilities as an academic subject teacher, personal development teacher, and budgetary affairs teacher. Teaching science for ages 21-30 years and above involves responsibilities as an academic subject teacher, personal development teacher, and general administrative affairs teacher. Emotions: Emphasizing the learner as the core and aligning with the learners' needs, it is a hands-on approach to learning where students actively engage in practical application, and science is something closely applicable to daily life in various ways. It supplements various skills. Attitude: Learning management that focuses on students as the core and aligns with their needs aims to establish interactions and mutual support among students, creating a learning environment where students actively engage in real-life practices. The teacher acts as a facilitator, providing guidance, while assessments and evaluations should take on diverse formats to accommodate individual differences. What is deemed unnecessary is the addition of excessive homework or an overwhelming amount of content. Behaviour: Observing that students do not enjoy taking notes, prefer playing games, and desire to engage in activities outside the classroom, there is an interesting learning process integrated with technology and media to generate greater interest in learning. The

Interview	Needs
Teacher	expectation is for students to be able to analyze scientific knowledge and apply it in their daily lives, thereby enhancing essential skills for the present. Opinions: Wishing to enhance hands-on learning management in science, I aim for students to actively engage in practical activities, listen attentively to others' opinions during collaborative work, and provide a variety of activities to foster diverse learning experiences.

Employ the data presented in Table 2 as a basis for designing the visuals depicted in Figures 2 and 3. Additionally, leverage this information to construct a journey map, as exemplified in Tables 3 and 4, to comprehensively illustrate the process.

Persona and User Typology

The project involves four personas, each with distinct appearances. The following details provide an overview of their unique characteristics (see Figure 3).

Figure 2. Persona and User Typology

Students and the science teacher both advocate for a shift towards a dynamic, interactive educational approach. Students prefer engaging, technology-enhanced, collaborative learning experiences that apply knowledge practically. The teacher supports a student-centred methodology, emphasizing real-life connections, interactive activities, and hands-on learning over traditional lectures. She envisions a learning environment that promotes individualized, technology-integrated education to spark interest and develop essential skills. For subsequent research to address research question 2, how can a collaboratively learning activity package be designed to foster

teamwork skills? details are as follows:

Insight Experience: Persona and User Journey Maps

The essence of student and teacher feedback emphasizes a shift towards a student-centred teaching approach. This method prioritizes engaging, interactive activities and games to spark interest and participation at the start of lessons, moving away from traditional lectures and memorization. It encourages hands-on learning, collaboration, and the application of knowledge through games and group tasks, aiming to make learning more enjoyable and effective. This approach fosters a dynamic, participatory classroom environment where students can practice teamwork, and reflect on their learning.

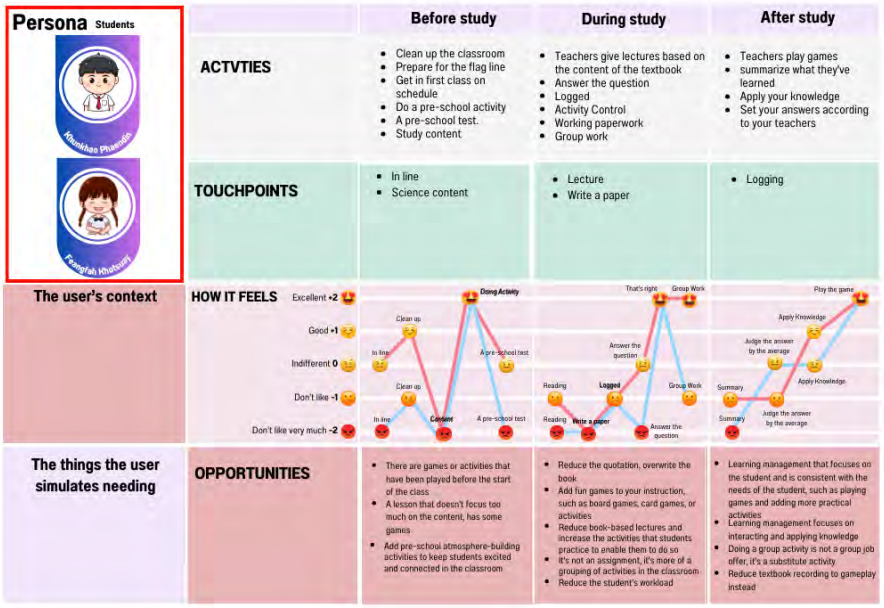


Figure 3. Persona and User Journey Maps

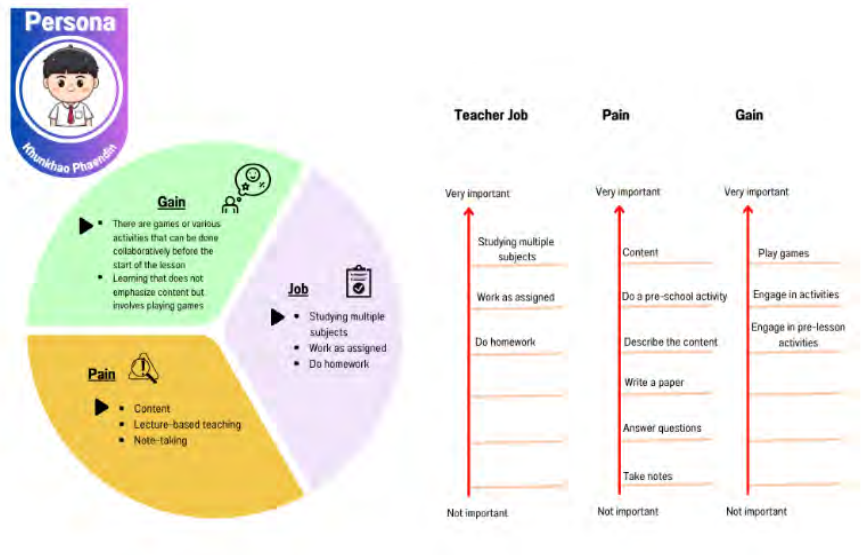
The comparison between the perspectives of persona and user typology and Insight experience persona and user journey maps. Similarities:

1. Student-Centred Approach: Both texts advocate for a shift from traditional lecture-based teaching to a more student-centred approach. This focus is on making the learning experience more engaging and interactive for students.
2. Engagement and Interaction: Each text highlights the importance of engaging and interactive activities. There's a clear preference for learning experiences that involve collaboration, hands-on activities, and the practical application of knowledge.
3. Technology Integration: The first text explicitly mentions the integration of technology as part of the educational approach, while the essence of technology-enhanced learning can be inferred in the second text through references to engaging and interactive activities.
4. Real-Life Connections: Both texts value the importance of connecting learning to real-life situations. The first text explicitly mentions this, while the second implies it through the emphasis on the practical application of knowledge. After obtaining user data as shown in (see Figure 3), the user requirements and issues are rearranged once again in (see Figure 4). The details are as follows:

Insight Mind! Value Proposition Canvas

1. Customer (Segment) Profile

The summary highlights a pedagogical shift towards integrating collaborative games and activities before conventional lessons, promoting a more engaging and interactive learning environment over traditional content-heavy methods. It underscores the importance of learning through play and advocates for a departure from lecture-based instruction towards activities that evaluate learning outcomes and stimulate reflection. The goal is to develop teamwork skills through practical engagement rather than simple task completion. It also suggests preparing worksheets and devising activities that boost student involvement, using enjoyable teaching techniques alongside standard lectures. This innovative approach aims to enhance the educational journey by merging traditional teaching with modern, interactive strategies.



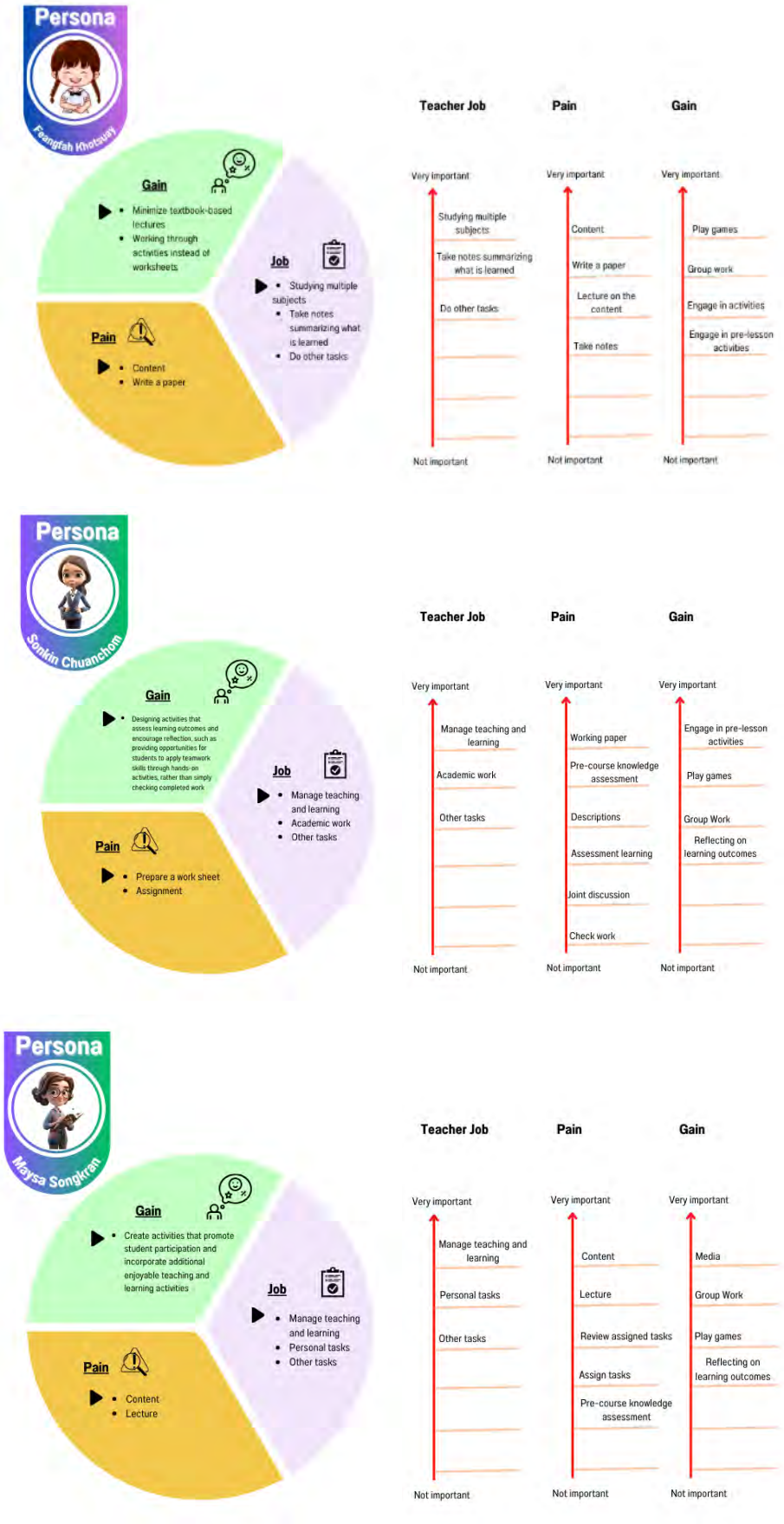
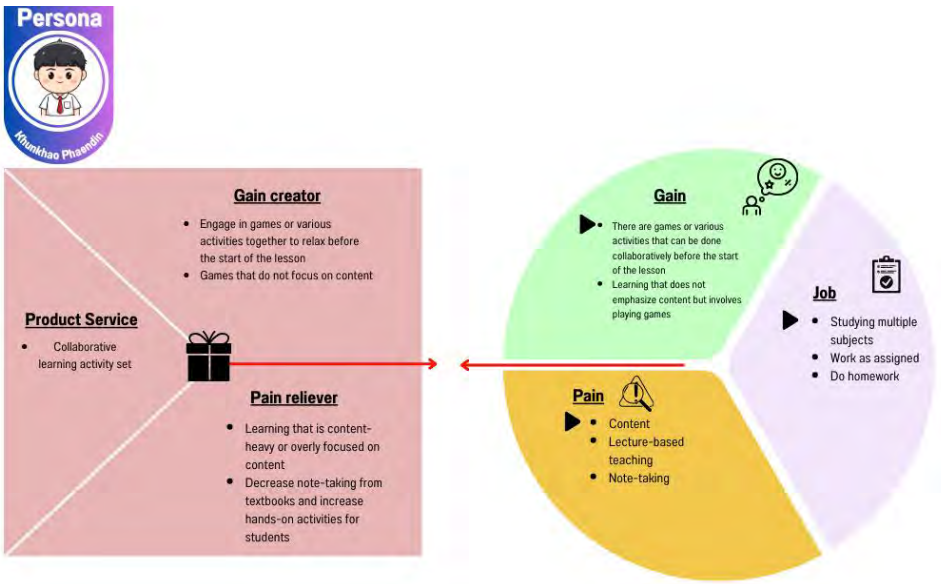


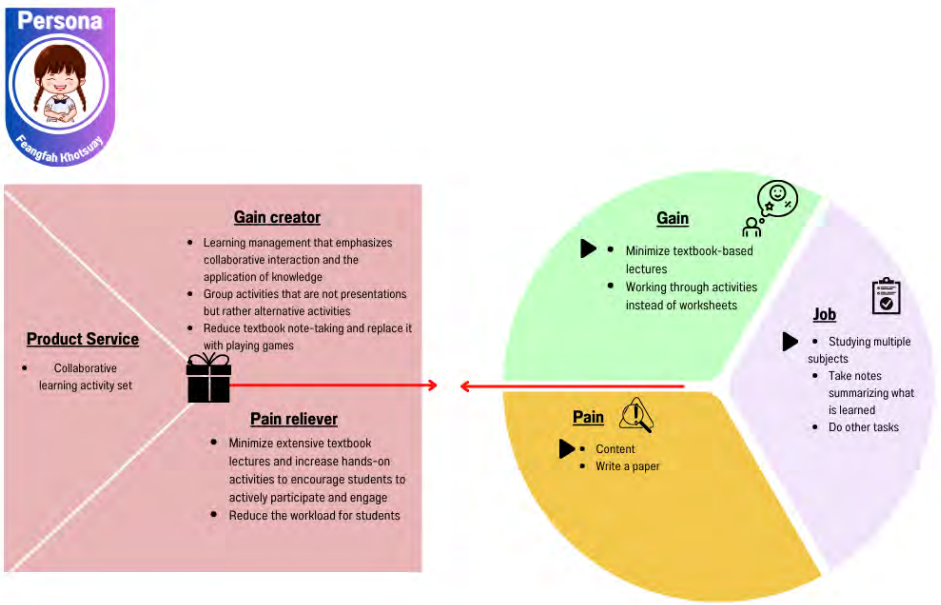
Figure 4. Customer (segment) profile

After obtaining the problem and understanding the user's needs (Figure 4) led to a user problem fix (Figure 5). The details are as follows:

2. Value (proposition) map

The primary problem identified revolves around the traditional, content-heavy learning approach that relies heavily on textbook lectures and note-taking. This method is criticized for not fostering sufficient student engagement or active participation. The suggested solution is a significant shift towards hands-on activities that not only reduce the students' workload but also promote collaborative learning and self-reflection. The goal is to minimize extensive lectures and replace them with engaging group activities that encourage the practical application of knowledge, thus moving away from heavy content-based teaching.





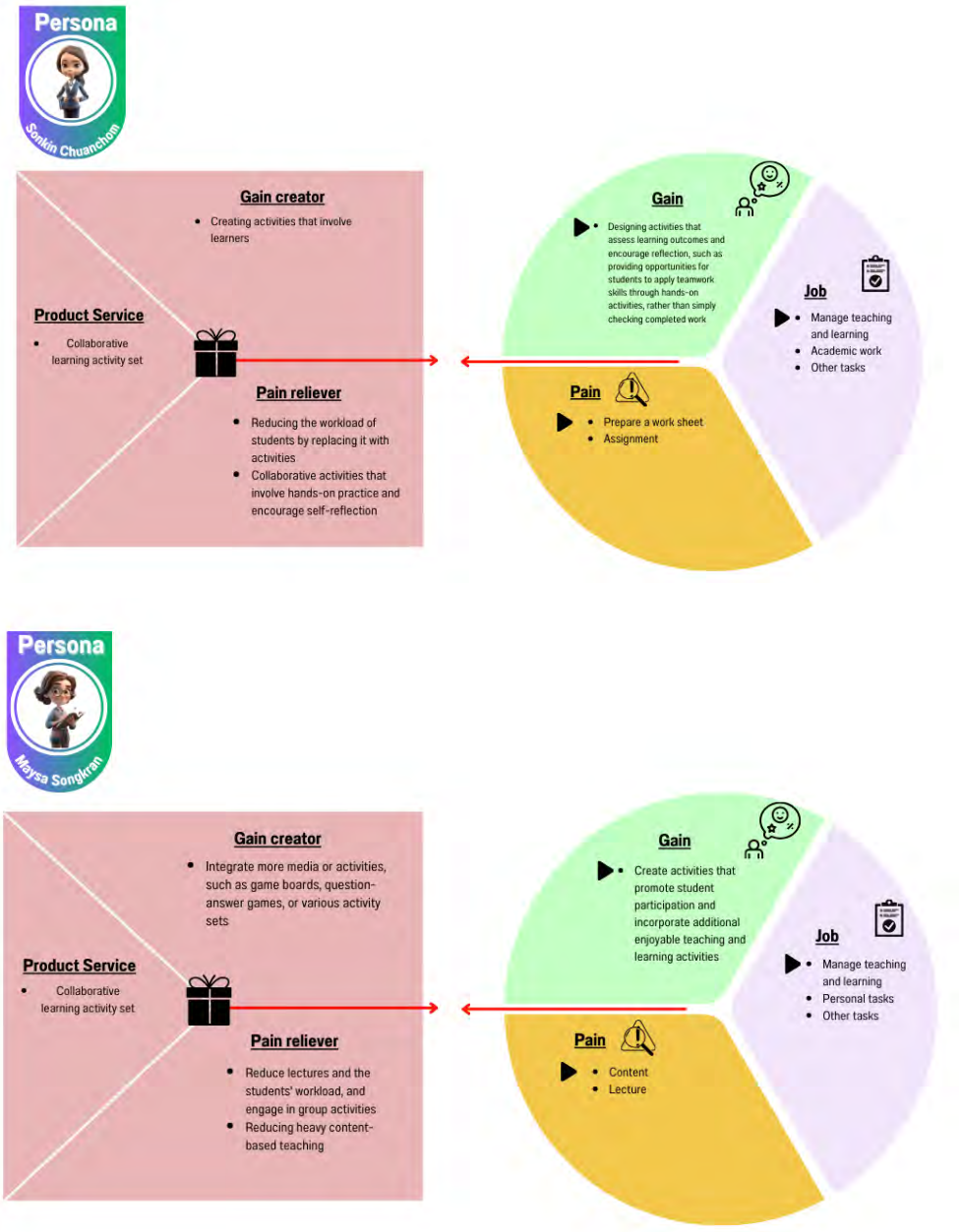


Figure 5. Value (Proposition) Map

To improve consistency and clarity in the presented points, here are the corrections and refinements:

1. Content-Heavy Learning:
    - Original: Learning that is content-heavy or overly focused on content.
    - Consistency: Shift away from overly content-heavy learning towards more interactive and engaging approaches.
2. Note-Taking and Textbook Lectures:
    - Original: Decrease note-taking from textbooks increase hands-on activities for students minimize extensive textbook lectures and increase hands-on activities to encourage students to actively participate and engage.
    - Consistency: Minimize note-taking from textbooks and extensive lectures, and increase hands-on

activities to enhance active participation and engagement among students.

3. Workload Management:
    - Original: Reduce the workload for students and reduce the workload of students by replacing it with activities.
    - Consistency: Reduce students' workload by integrating more collaborative and reflective activities in place of traditional assignments.
4. Collaborative and Hands-on Activities:
    - Original: Collaborative activities that involve hands-on practice and encourage self-reflection to reduce lectures and the students' workload and engage in group activities.
    - Consistency: Encourage collaborative and hands-on activities that foster practical learning and self-reflection, reducing the emphasis on lectures and overall student workload.
5. Content-Based Teaching:
    - Original: Reducing heavy content-based teaching.
    - Consistency: Transition from heavy content-based teaching to methodologies that prioritize experiential learning and student collaboration.

This led to the design of a series of collaborative learning activities to adapt to the needs of the user:

2) The objective is to design collaborative learning activities that enhance teamwork skills in lower secondary school students, based on insights from experience analysis. This involves a Design Thinking process as detailed by Brown, (2009). The second phase focuses on designing and developing a prototype series of these activities, aimed specifically at improving teamwork skills among these students.

Phase 2: Design and develop a prototype series of collaborative learning activity package to promote working skills as a team of lower secondary school students.

Intervening Characteristics

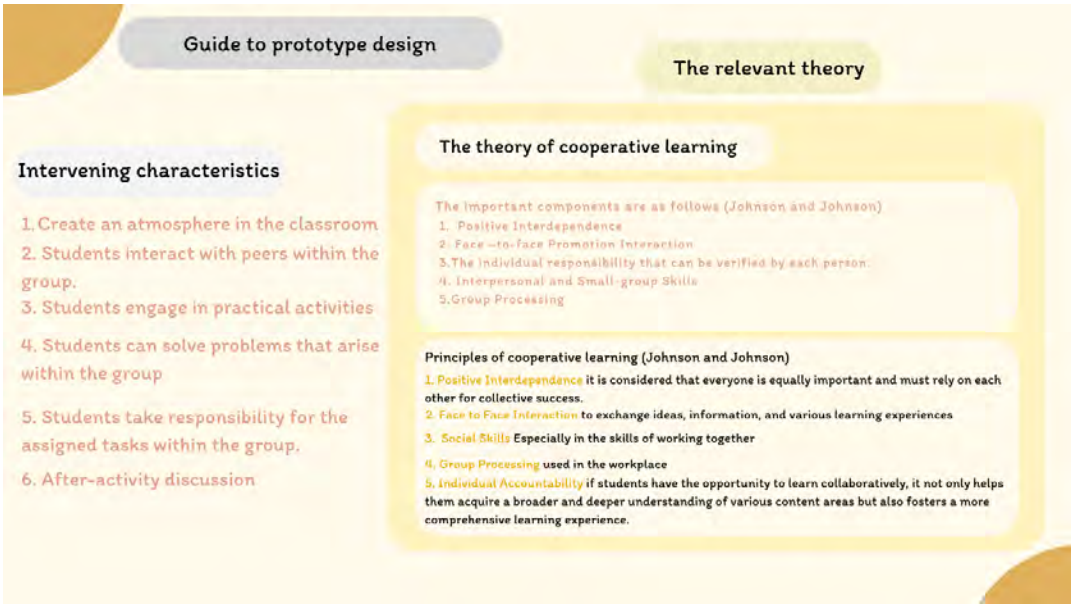


Figure 6. Intervening Characteristics

Then take the Intervening characteristics to the prototype. Details are as follows:

Designing Low-Fidelity Prototype

This Low-Fidelity Prototype wireframe is a design of the box sets in the form of a rough sketch, stemming from user needs, with a focus on engaging activities within the classroom. It emphasizes activities that are fun and interactive, moving beyond mere paperwork. The design encourages peer interaction and hands-on practical experiences. It is outlined briefly for the activity set to address user requirements. As in the Figure 7.

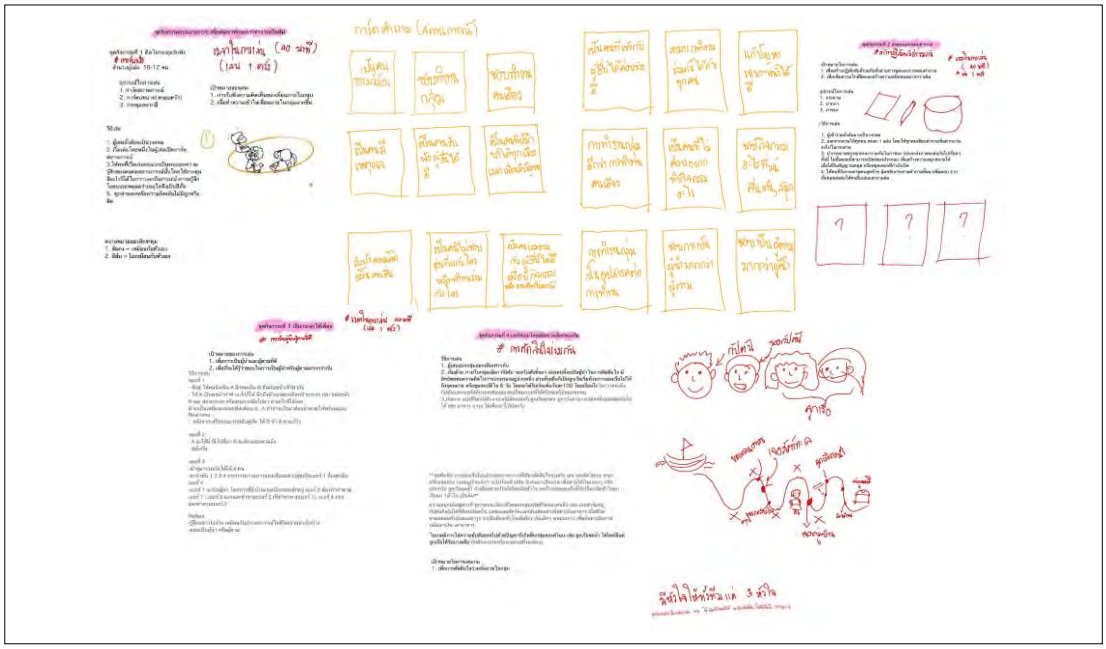


Figure 7. Low-fidelity Prototype

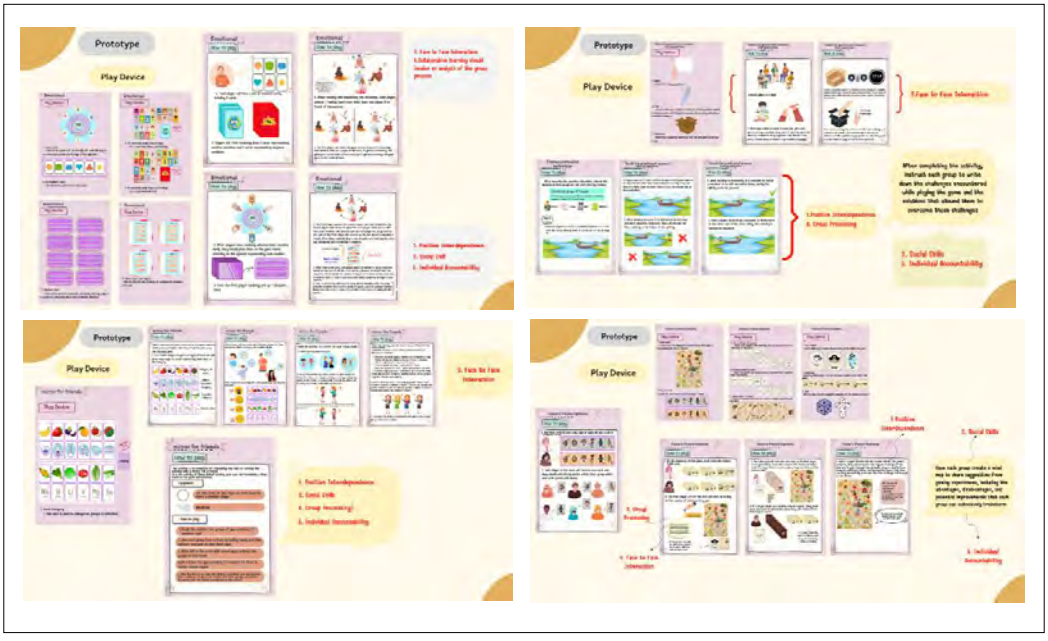


Figure 8. Designing Low-fidelity Prototype

After initially drafting the collaborative learning activity set, subsequent refinement and design enhancements are evident. There is an increase in the number of activities, a more polished design, and the incorporation of learning theory principles into the activity set. This is in response to expert feedback and evaluation, suggesting the need for certain elements in the activity set to enhance credibility and theoretical foundation. As a result, adjustments have been made as depicted in Figure 8.

The development process included a brainstorming session and evaluations conducted by professionals in the field, specifically game experts, innovation experts, and design experts. The details of the assessment results provided by the game expert are as follows:

Table 2. Presents the Outcomes from Interviews with a Game Expert regarding the Prototype Design

Feedback Category	Summary of Responses
Attractiveness	Responses vary, indicating a need for understanding the specific age group's interests.
Implementation Challenges	Concerns about the detail level in activities and the appropriateness of questions in games.
Adjustments Needed	Recommendations include adding more competitive and diverse activities to increase excitement.
Promotion of Teamwork	Positive feedback on the potential to enhance teamwork through collaborative activities.
Additional Suggestions	Suggestions for improving gameplay, adjusting the number of players, and ensuring content appropriateness through teacher screening.

Summarize the findings from Table 2 to develop a game activity emphasizing hands-on practice. Incorporate a series of real-life activities, ensuring careful planning and integration of game elements to enhance engagement. This approach will not only allow players to acquire knowledge and experience through enjoyable gameplay but also enrich the fun factor by offering a variety of devices for gameplay, thereby increasing responsiveness and engagement.

Table 3. Presents the Outcomes from Interviews with an Innovation Expert regarding the Prototype Design

What might the future implications be if we were to encounter this situation?	**Provide an overview, connect the prototype with its impact, and relate it to the theoretical principles applied to ensure our design is both effective and principled.**
Do you have any additional suggestions or insights?	The sentence can be revised for clarity and grammatical accuracy as follows: "The theoretical framework underpinning the activity set demonstrates that it incorporates all the principles we designed into the activities.

To clarify, Table 3 demonstrates how teamwork is a result of prototype designs incorporating interactive features. Innovation, driven by activities that promote teamwork, results in changes in patterns of interaction. This link between prototype designs and the concept of collaborative learning indicates that future designs are likely to inherently incorporate these principles.

Table 4. Presents the Outcomes from Interviews with a Media and Design Expert regarding the Prototype Design

Aspect	Current Issue	Suggested Adjustments	Additional Notes
Colour Scheme	The card colour in the activity kit is too dark.	Adjust colours to be more playful and brighter, focusing on pastel shades. Adjust the board and player card colours for excitement.	Ensuring the colour intensity and allocation are balanced.
Equipment Durability	Equipment may be damaged or lost during play.	Implement durable materials for all equipment. Consider adding chains or ropes to keep parts connected.	Critical to address this to maintain the quality of the set.
Game Board	The board's design does not engage students.	Make the game board A3 size. Adapt the board design to be more engaging and visually appealing.	Enhancing the visual appeal and interaction.
Book Design	The book's layout and size are not engaging.	Try a book with an attractive header and appealing pictures. Adjust book size and number for better handling.	Focusing on making the book more user-friendly and engaging.

In summary, Table 4 advocates for designing activity sets suitable for specific age groups, enriched with carefully selected colors to boost their attractiveness and playfulness. The selection of colors and materials plays a crucial role in enhancing the appeal of these activities. Therefore, it is essential to customize these elements according to the target age group, while also paying attention to various design details. Moreover, the introduction of extra accessories can simplify gameplay and provide a range of design choices.

Designing High-Fidelity Prototype

In this phase, modifications are implemented based on the guidance provided by media and design experts, as detailed in Table 3. The project consists of four distinct box sets, each designed with a specific focus:

1. Package 1: Emotional Intelligence Development (Figure 9)
2. Package 2: Logistics and Question-Answering Skills (Figure 10)
3. Package 3: Reflective Practices for Peer Support (Figure 11)
4. Package 4: Strategic Team building through ‘Pirate Options’ (Figure 12)

Each package incorporates elements of collaborative learning, adhering to cooperative learning principles and integrating features highlighted in Figure 6. The aim is to create a conducive environment that encourages interaction, enhances problem-solving skills, and fosters a sense of responsibility among participants. Following

the completion of each activity, a debriefing session is conducted to reflect on experiences and learnings.

The design of every activity within these sets is carefully crafted to embed these user requirements, with the goal of strengthening teamwork abilities to fulfil user expectations, as outlined below.

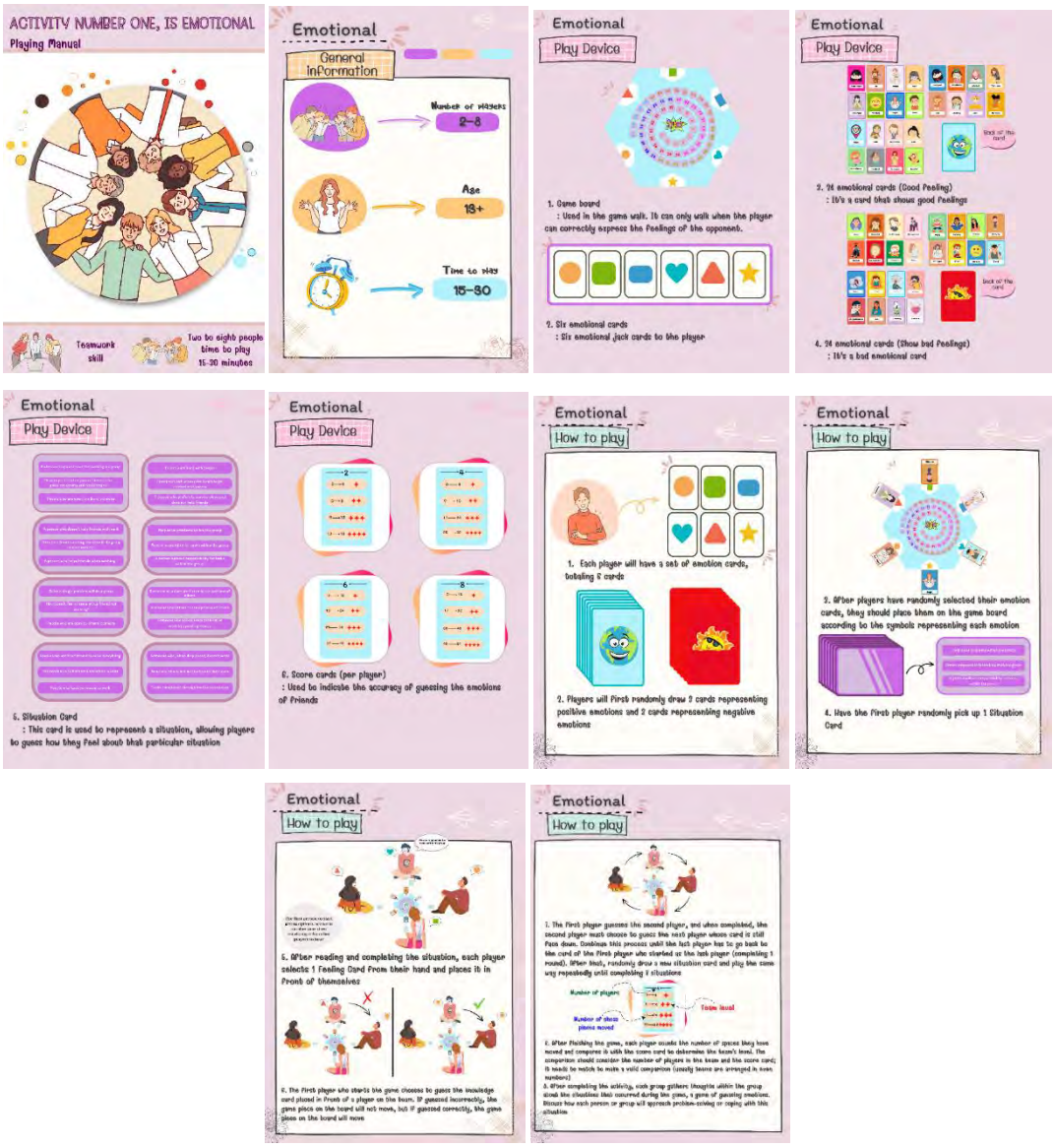


Figure 9. Package 1: Emotional Intelligence Development

Package 1 is an activity where learners guess the feelings of their peers who are participating in the activity. There is an exchange of opinions on why each person feels a certain way. This activity aims to create an atmosphere of understanding and to get to know each other better. It helps improve relationships between individuals and encourages them to engage in conversations to enhance mutual understanding among learners in the classroom.

Package 2, there is an activity written on what we want to know about friends, and in the writing, there is a scope for writing so that there are no inappropriate questions. The teacher is the one who reviews asking those questions before asking. For students to be more interactive than in the 1st activity, with inserted insertion activities, students

will be able to solve problems by helping each other while teams are planning to help each other and, most importantly, by relying on each other in the team.

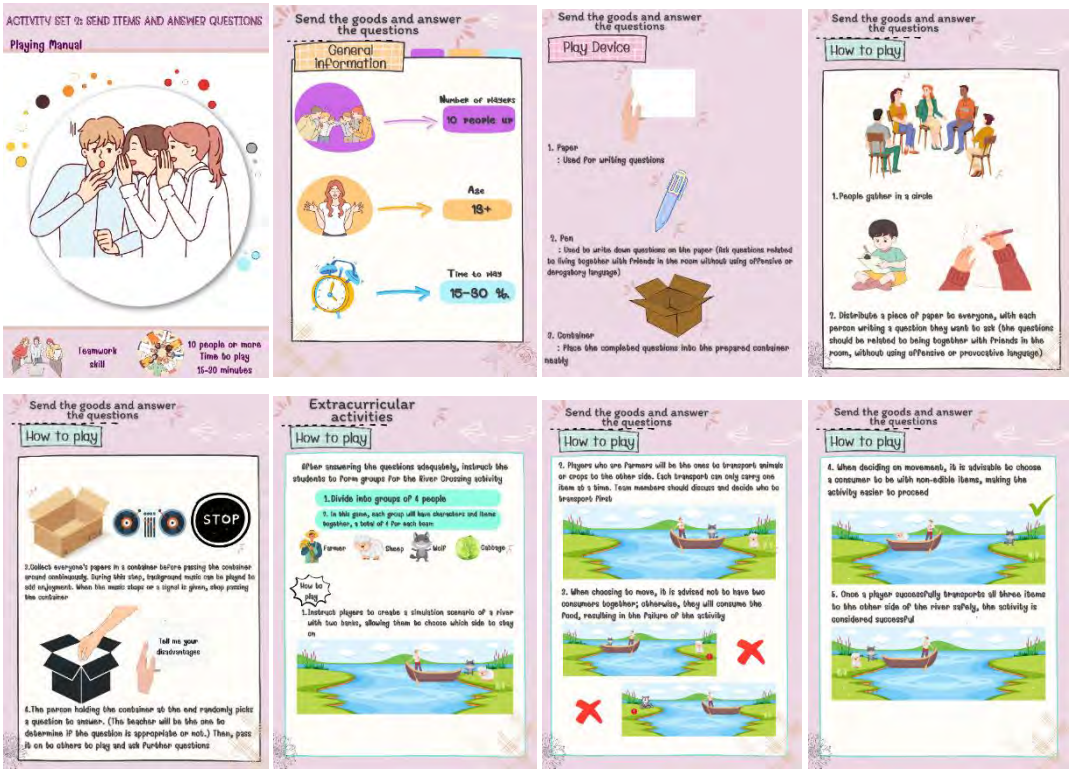


Figure 10. Package 2: Logistics and Question-answering Skills

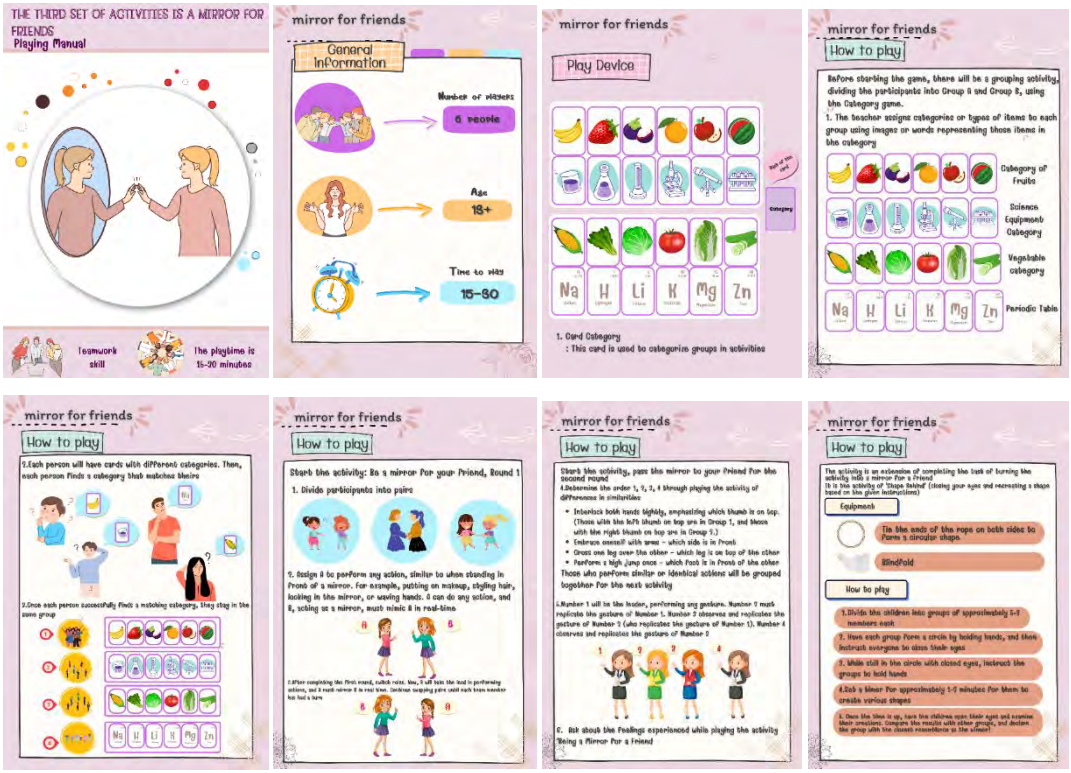


Figure 11. Package 3: Reflective Practices for Peer Support

Package 3, It's an activity where the teacher gives the student a process of thinking, an activity that involves both interaction and fun, and some activities are inserted into it. The students help each other work out and plan, accept, and listen to each other's opinions.

Figure 12. Package 4: Strategic Team Building through 'Pirate Options'

The final activity involves teamwork assistance, where there will be game boards and cards for various interactive plays that allow learners to collaborate in decision-making and share opinions to help the team progress. After completing the activity, there will be a discussion about the insights gained collectively.

Conclusion

This research embarked on a comprehensive journey to address the pressing need for enhanced teamwork skills among lower secondary school science students, a competency increasingly vital in the evolving landscape of technology and employment as outlined in the introduction. The rapid technological advancements between 2023

and 2027, as highlighted by recent surveys, underscore the importance of developing such skills from an early educational level to prepare students for future business operations and organizational roles. With teamwork skills identified as pivotal for employability and effective workplace collaboration, our study aimed to systematically analyze and foster these competencies through the lens of cooperative learning.

In answering our research questions, we first explored the experiences and essential needs for promoting teamwork skills among science teachers and lower secondary school students (RQ1). This inquiry led to a deeper understanding of the current educational challenges and opportunities, as well as the specific requirements for effective teamwork skill development. Subsequently, our focus shifted to designing collaborative learning activity package that could nurture these skills among students (RQ2), leveraging the insights gained to create impactful educational interventions.

Aligned with our objectives, the study proceeded through a design research methodology, inspired by the design thinking process. The empathize and define stages (Phase 1) provided a solid foundation for understanding the critical needs and challenges in teamwork skill development. This understanding informed the ideate and prototype stages (Phase 2), where innovative collaborative learning activities were conceptualized and developed. These activities, grounded in the principles of cooperative learning theory, emphasized positive interdependence, face-to-face interaction, social skills, group processing, and individual accountability—each designed to address specific teamwork skill gaps identified in Phase 1.

The transition from empathy to prototyping ensured a user-centred approach throughout the study, with each phase iteratively building on the insights gained from the previous one. This seamless integration of collaborative learning principles into the design of the learning activity package not only adhered to pedagogical best practices but also aligned with the educational imperative of nurturing 21st-century skills.

Reflecting on the broader implications of our findings, it is evident that the development of teamwork skills is not only crucial for individual student success but also for the collective advancement of educational and professional communities. By embedding these skills early in education, we prepare students to navigate the complexities of the modern workforce and contribute positively to society. Our study contributes to the ongoing dialogue on education reform, advocating for a proactive approach to skill development that anticipates the demands of future employment landscapes.

In conclusion, the research presented in this article underscores the significance of integrating cooperative learning strategies into the educational curriculum to enhance teamwork skills among lower secondary school students. By doing so, we not only address the immediate needs of students and educators but also contribute to building a resilient, skilled workforce capable of adapting to the rapid changes in technology and employment. As we move forward, it remains imperative for educational researchers, policymakers, and practitioners to continue exploring and implementing innovative approaches to skill development, ensuring that students are well-equipped to thrive in the 21st-century workplace.

Future Research

Building on the foundation established for enhancing teamwork skills among lower secondary school students through cooperative learning, future research can extend in multiple directions to deepen and broaden the understanding of effective educational strategies. Key areas include implementing and longitudinally studying the collaborative learning activity package in classroom settings to assess the durability of teamwork skill development over time. Comparative analyses could empirically evaluate these interactive learning methods against conventional pedagogical approaches, highlighting their efficacy.

Exploring cross-cultural contexts can shed light on the adaptability of cooperative learning strategies, considering diverse educational traditions and values. The integration of emerging technologies into these learning activities presents an opportunity to modernize and enhance the engagement and effectiveness of teamwork skill development. Investigating the role of teacher training in successfully deploying these strategies could identify essential professional development pathways.

Further research is warranted to refine these educational interventions based on feedback from the "Test" phase, ensuring they are responsive to student and teacher needs. Developing specialized assessment tools for teamwork skills and examining the impact of cooperative learning on a broader range of 21st-century competencies could offer insights into the holistic benefits of such educational approaches.

Challenges and barriers to the implementation of cooperative learning warrant examination to provide actionable solutions for educators. Additionally, an economic analysis could clarify the cost-effectiveness of these innovative teaching methods, balancing resource investment against potential benefits in student skill acquisition and preparedness for the workforce.

Through these avenues, future studies can enrich the pedagogical toolkit for fostering teamwork skills, contributing to the preparation of students for the challenges and opportunities of the 21st-century workplace.

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