



# Designing and Development of a Structured Game-Based Project-Based Learning Module

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**Abstract.** Contemporary education increasingly emphasizes learner-centred pedagogies, however the implementation of the Home Science curriculum in Malaysia remains predominantly teacher-centred, limiting students' engagement and opportunities to develop higher-order thinking and real-world application skills. Despite the proven potential of game-based learning and project-based learning, their integrated application within structured, curriculum-aligned instructional modules remains limited, highlighting a critical need for systematically designed learning resources to support effective classroom implementation. This study aims to develop a structured game-based module grounded in project-based learning for the Form 4 Home Science subject, specifically for the topic of Food and Nutrition. The development of this module is intended to support the requirements of 21st-century teaching and learning, which emphasize active, collaborative, and student-centred learning in alignment with the Home Science Curriculum and Assessment Standard Document (DSKP). This study adopts a Design and Development Research (DDR) approach by integrating the ADDIE model and the Universal Design and Agile Development (UDin) model as the framework for module development. The design and development process encompasses the phases of analysis, design, development, implementation, and evaluation, and is supported by expert validation through two stages of usability testing to ensure the quality, usability, and suitability of the module within authentic classroom contexts. The developed module fulfils several key criteria, as it is designed in the form of a user-friendly website with printable features, complemented by a learning kit to support the implementation of module activities, and accompanied by a comprehensive teacher's manual. In terms of content, the module comprises eight structured game-based activities that support project-based learning and incorporate elements of exploration, problem-solving, and the application of knowledge in authentic situations. In addition, the module systematically integrates Classroom-Based Assessment (PBD) aligned with the mastery levels (TP) of the Form 4 Home Science DSKP, provides suggested lesson plans for teachers, and includes complete instructional materials for both teachers and students. The findings indicate that the structured game-based module developed has the potential to serve as a practical, flexible, and effective instructional support tool in enhancing student engagement and facilitating teachers in implementing project-based learning in a well-structured and meaningful manner for the topic of Food and Nutrition.

**Keywords:** Structured game-based learning, Project-based learning, Design and Development Research, Home Science, Food and Nutrition Keyword

## 1 Introduction

Education in the twenty-first century places a greater emphasis on learner-centered pedagogies that encourage active involvement, collaboration, critical thinking, and knowledge building. Conventional teacher-centered systems that focus largely on lectures and rote memorization are frequently deemed unsuitable for educating students for the abilities expected in modern society. As a result, global educational reforms have promoted the use of novel pedagogical practices that facilitate active and immersive learning environments, such as project-based learning, game-based learning, and technology-enhanced instruction.

In the Malaysian educational framework, the Home Science (Sains Rumah Tangga) curriculum is crucial in cultivating students' practical life skills, especially in food preparation, nutrition, family management, and overall well-being. The Curriculum and Assessment Standard Document (DSKP) for Form 4 Home Science underscores the amalgamation of information, practical competencies, and values via genuine learning experiences. However, classroom implementation is frequently teacher-centered and content-focused, restricting opportunities for students to actively apply information in real-world circumstances. Consequently, students may encounter diminished engagement and restricted possibilities to cultivate higher-order thinking skills, collaborative capabilities, and problem-solving proficiencies.

To tackle these issues, numerous studies have emphasized the promise of game-based learning (GBL) as a novel pedagogical approach to augment student engagement and motivation. Game-based learning incorporates features like competition, challenges, feedback, and interaction into educational settings, therefore fostering significant and fun learning experiences. Prior research has shown that game-based learning can markedly enhance student engagement, motivation, and cognitive growth across diverse educational settings (Nadeem et al., 2023; Serrano, 2019). Empirical evidence suggests that game-based learning environments facilitate the development of problem-solving skills, collaborative learning behaviors, and enhanced conceptual comprehension through interactive and immersive activities.

Systematic evaluations of educational gamification and game-based learning indicate that integrating game aspects into instructional techniques can enhance student engagement, motivation, and academic achievement (Baah et al., 2024; Alotaibi, 2024). These results indicate that games offer significant contexts for learning by integrating enjoyment and challenge with organized educational tasks, thereby motivating students to stay actively engaged in learning activities.

In addition to game-based learning, project-based learning (PBL) has gained popularity as an effective educational strategy for facilitating meaningful learning. Project-based learning promotes student engagement with real-world issues, facilitates investigative research, fosters collaboration among peers, and results in genuine outputs. Thomas (2000) asserts that project-based learning facilitates knowledge construction for students through inquiry-driven activities necessitating the integration of knowledge

across several disciplines. Likewise, Bell (2010) underscores that project-based learning fosters the cultivation of critical thinking, communication, and teamwork skills, which are vital competencies for twenty-first-century learners.

The amalgamation of game-based learning with project-based learning presents considerable promise for fostering more engaging and substantive educational settings. Game features can augment student motivation and engagement, while project-based learning frameworks facilitate profound research, knowledge application, and real-world problem-solving. This integration enables students to engage in learning as an interactive process, actively constructing knowledge instead of passively receiving information. Nonetheless, despite the increasing interest in both pedagogical methods, their integrated application within structured instructional modules remains comparatively restricted in several educational environments.

Moreover, the successful execution of novel teaching methods necessitates structured instructional design frameworks to guarantee that learning activities are pedagogically valid and linked with curriculum goals. Instructional design models offer systematic frameworks for converting learning theories and pedagogical principles into effective instructional resources. The ADDIE model, a prevalent instructional design framework, comprises five phases: analysis, design, development, implementation, and evaluation. The ADDIE model provides a methodical framework for creating instructional materials that correspond to learning objectives and learner requirements.

In Malaysia, instructional design frameworks have been broadened to include comprehensive educational principles that amalgamate knowledge, values, and significant learning experiences. The Universal Design and Agile Development (UDin) model is a framework designed to facilitate comprehensive and iterative instructional design processes that incorporate content knowledge, pedagogy, technology, and values in educational products (Din, 2016; Din, 2017). The UDin model prioritizes ongoing enhancement and iterative development to guarantee that educational materials are accessible, flexible, and attuned to the requirements of learners and instructors.

Furthermore, Malaysian educational perspectives emphasize the significance of incorporating information, skills, language, and values into the teaching and learning process to generate holistic learners capable of applying knowledge responsibly in real-life circumstances. Integrative techniques facilitate the creation of significant learning experiences that encompass not just cognitive knowledge but also ethical ideals and practical skills essential for daily life.

Notwithstanding the expanding corpus of research on game-based learning and project-based learning, numerous research gaps persist. Many research on game-based learning predominantly emphasize digital games or gamification features, rather than structured instructional modules that integrate game-based activities with curriculum-aligned project-based learning assignments. Secondly, current research frequently investigates game-based learning in isolation, failing to properly integrate it with project-based learning frameworks that foster deeper learning and genuine knowledge application. Third, research is sparse on the creation of structured instructional modules that specifically incorporate these techniques inside the Home Science curriculum, especially concerning Food and Nutrition at the secondary school level.

Moreover, prior research often prioritizes the use of teaching practices above the systematic design and creation of instructional modules that offer practical assistance for educators in classroom settings. Teachers frequently experience difficulties in implementing innovative pedagogies because to inadequate instructional resources, a lack of structured learning materials, and insufficient advice on how to incorporate games and projects into curricular requirements. Consequently, it is essential to create instructional modules that offer extensive learning activities, instructional instructions, and evaluation strategies to assist teachers in efficiently using novel pedagogical methods. This study seeks to provide a structured game-based project learning module for the Form 4 Home Science curriculum, focusing on the topic of Food and Nutrition. The module is constructed with a Design and Development Research (DDR) methodology, incorporating the ADDIE model and the UDin model as the instructional design framework. The design and development process includes analysis, design, development, implementation, and assessment, bolstered by expert validation and usability testing to guarantee the module's quality, usability, and appropriateness in real classroom settings.

The designed module comprises an intuitive web-based platform featuring printable educational resources, supplemented by a learning kit and an extensive teacher's manual. The module comprises eight organized game-based activities aimed at facilitating project-based learning that promotes discovery, teamwork, and problem-solving. The module incorporates classroom-based assessment that aligns with the competency levels of the Form 4 Home Science curriculum to promote significant learning and efficient instructional execution.

This study enhances the creation of creative instructional resources that facilitate meaningful learning experiences through the integration of game-based learning, project-based learning, and systematic instructional design frameworks. This study's conclusions aim to offer practical insights for educators, instructional designers, and curriculum developers in creating interesting and successful learning modules that match with the objectives of twenty-first-century education.

## **2 Conceptual Framework**

This study's conceptual framework integrates many theoretical and methodological approaches to guide the design and development of a structured game-based project-based learning module for the Form 4 Home Science subject. The framework amalgamates components from game-based learning, project-based learning, and instructional design frameworks, encompassing the ADDIE model and the Universal Design and Agile Development (UDin) model, inside a Design and Development Research (DDR) methodology. This integration establishes a comprehensive framework that links learning theories, instructional design principles, and systematic research methodologies to develop an effective educational module.

## **2.1 Game-Based Learning as a Method to Engage Individuals.**

Game-based learning (GBL) has gained prominence as an instructional method that fosters student engagement and motivation in the classroom. Integrating game elements such as challenges, competition, incentives, and feedback can cultivate interactive learning experiences that augment students' cognitive engagement and participation. Research demonstrates that game-based learning significantly enhances students' motivation, engagement, and academic performance across many educational contexts (Nadeem et al., 2023; Serrano, 2019).

Alotaibi's (2024) comprehensive review demonstrates that game-based learning enhances student engagement and retention by creating relevant learning environments that promote active interaction with the subject. Baah et al. (2024) assert that gamification elements can enhance student engagement and reduce cognitive load when learning activities are structured appropriately. The results demonstrate that integrating gamification into instructional design enhances student engagement and fosters deeper learning experiences.

Game-based learning activities in the Home Science curriculum can augment experiential learning by enabling students to explore food and nutrition principles through interactive tasks. Structured games enable students to hone essential competencies for twenty-first-century education, such as problem-solving, decision-making, and collaborative learning.

## **2.2 Project-Based Learning for Significant Education.**

Project-based learning (PBL) is a recognized pedagogical approach that engages students in authentic problem-solving and tangible tasks to facilitate meaningful learning. Thomas (2000) contends that project-based learning enhances students' understanding by involving them in the investigation of complex subjects or issues through inquiry and collaborative learning activities.

According to Bell (2010), project-based learning facilitates the development of critical thinking, communication, collaboration, and creativity as essential abilities for twenty-first-century students. Project-based learning empowers students to assume responsibility for their education through planning, researching, and producing significant outcomes that demonstrate their understanding of a subject.

Project-based learning is crucial in Home Science education since it emphasizes the practical application of knowledge related to cooking, nutrition, and everyday skills in real-life contexts. Students can apply their classroom knowledge to real-world scenarios and acquire practical skills through projects focused on food and nutrition. The integration of game-based learning with project-based learning establishes an innovative educational approach, wherein game elements maintain student engagement and project activities facilitate deeper understanding and application of knowledge.

### 2.3 ADDIE and UDin Models for Instructional Design Framework.

To create effective teaching materials, one must adhere to a systematic design strategy that ensures alignment among learning objectives, instructional activities, and assessment systems. Instructional design approaches provide a systematic approach to transform learning theories into effective educational resources. The ADDIE model is a widely recognized paradigm for instructional design. It consists of five essential phases: analysis, design, development, implementation, and evaluation. The ADDIE model provides a systematic approach for designing and developing instructional resources that fulfill learner requirements and comply with curriculum criteria.

This study utilizes the Universal Design and Agile Development (UDin) model in conjunction with ADDIE, emphasizing a cohesive and iterative approach to instructional design. The UDin model underscores the importance of integrating learning theories, pedagogical methods, technology, and values in the development of educational products (Din, 2016, 2017). The UDin technique ensures that instructional materials remain adaptable, user-friendly, and aligned with the needs of learners and educators through iterative cycles of production and evaluation. Intergration of ADDIE with UDin, facilitating a structured yet adaptable approach to module development. ADDIE provides a systematic approach to development, while UDin facilitates continuous improvement and incremental adjustments throughout the development phases.

### 2.4 Fundamentals of Research Design.

This study is grounded in the Design and Development Research (DDR) strategy, a systematic approach for the creation, development, and evaluation of educational goods. Individuals that specialize in educational technology and instructional design frequently utilize DDR to develop beneficial and efficient learning methods for pupils. The study design is crucial for ensuring that the development process is conducted systematically and scientifically. Creswell & Creswell (2018) contend that a theoretical framework provides a foundation that unifies research questions, variables, and methodological approaches within a cohesive structure.

Sekaran and Bougie (2020) emphasize that a meticulously constructed theoretical framework facilitates the comprehension of the interrelationships among various variables and aids researchers in formulating hypotheses and methodologies for data collection. Saunders, Lewis, and Thornhill (2023) assert that research frameworks provide researchers with a coherent structure to organize and execute their work, ensuring alignment among their objectives, design, and data collection methods. A rigorous research methodology is essential for producing credible and meaningful study results. Aguinis (2025) asserts that systematic study design and methodological rigor are crucial for ensuring the validity and reliability of research outcomes. Multivariate analytical techniques are commonly employed in educational research to investigate the interactions among diverse elements and to evaluate the effectiveness of existing models. Hair et al. (2019) assert that multivariate analytical tools allow researchers to examine complex relationships across constructs within study models. These methodological principles

support the implementation of DDR in this study to systematically develop and evaluate the structured learning module.

2.5 The Conceptual Framework of the Study.

This study's conceptual framework posits that structured game-based learning activities serve as the primary method of instruction inside a project-based learning environment. The instructional approaches were developed using the ADDIE and UDin frameworks within the broader Design and Development Research methodology. The paradigm asserts that the integration of game-based learning and project-based learning can enhance students' engagement, motivation, and meaningful learning experiences. Students are expected to acquire knowledge about food and nutrition through structured learning activities and collaborative exercises. The systematic design process informed by ADDIE and UDin ensures that the module is pedagogically robust, user-friendly, and aligned with curricular requirements. The DDR technique provides a definitive method to evaluate the utility, practicality, and efficacy of the curriculum in actual classroom environments. The conceptual framework provides a theoretical and methodological foundation for the design and development of the structured game-based project-based learning module for the Form 4 Home Science subject as per shown in the figure 1 below.

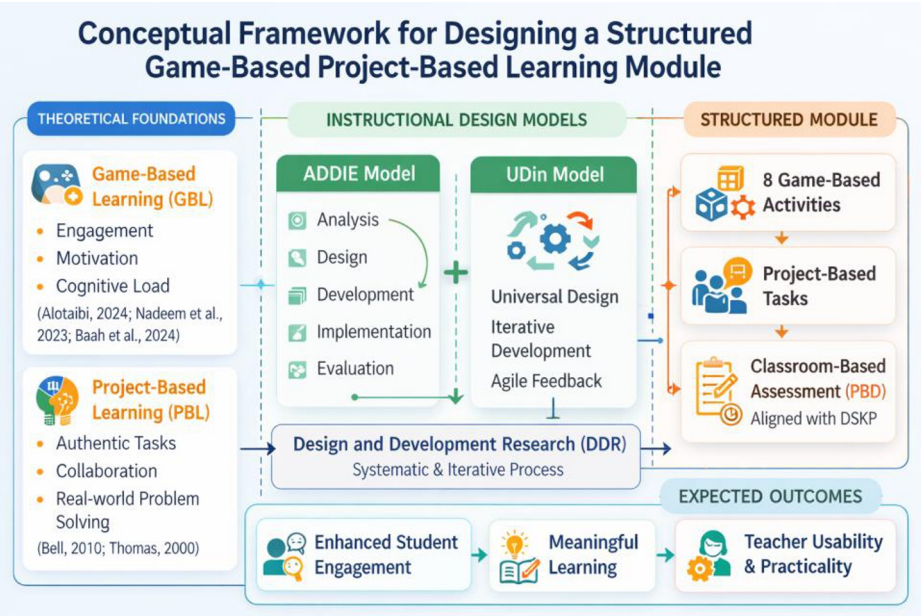


Fig. 1. Conceptual framework of the study

### 3 Methodology

Research Design. This study employed the Design and Development Research (DDR) methodology to design a structured game-based project-based learning module for the Form 4 Home Science curriculum, concentrating on the subject of Food and Nutrition. In educational technology and instructional design, Design and Development Research is often used to methodically make and test educational products including digital learning aids, learning systems, and instructional modules. DDR stresses the careful planning, building, and testing of educational interventions to make sure they work, are possible, and can be used in real-life learning situations. Creswell & Creswell (2018) contend that a rigorously structured study design ensures coherence among research objectives, theoretical frameworks, and scientific methodologies in educational research. Saunders, Lewis, and Thornhill (2023) contend that research design serves as a framework that guides the whole research process, including data collection, analysis, and interpretation, so ensuring the systematic attainment of study objectives. Aguinis (2025) asserts that a comprehensive research design and methodological transparency are essential for producing credible and meaningful research outcomes. The DDR technique was employed in this study as it enables researchers to develop instructional items using systematic design methodologies while simultaneously evaluating their practicality and usability.

#### 3.1 Methodology.

The ADDIE instructional design approach was used to create this study's module. It comprises five main steps: analysis, design, development, implementation, and assessment. The ADDIE model provides a structured methodology for creating instructional materials that align with educational goals and learner needs. The Universal Design and Agile Development (UDin) model adds to the ADDIE model by putting iterative design, ongoing improvement, and the use of teaching methods, learning theories, and technology into the process of making educational products (Din, 2016; Din, 2017). The combination of ADDIE and UDin makes the development process both systematic and iterative, making sure that the final module is pedagogically sound, user-centered, and useful in the classroom. The research technique consists of three fundamental phases of DDR:

##### Phase 1: Analysis

The first step is to figure out what the students need to learn and what factors in their environment are important for teaching and learning Food and Nutrition in Form 4 Home Science. This stage involves looking at the curriculum needs, the learning goals set out in the Home Science DSKP, and the problems teachers have while trying to make learning activities fun. A literature analysis on game-based learning and project-based learning was performed to identify effective instructional strategies that could enhance student engagement and provide meaningful learning experiences.



### **Phase 2: Planning and Building**

The second half is about designing and building the structured game-based project-based learning module. Based on the results of the analysis phase, the module was created with eight structured game-based activities that help with project-based learning. The module was made to be:

- a website for learning
- resources for learning that can be downloaded
- a kit for learning activities
- a guide for teachers

The lessons were set up to encourage students to learn about food and nutrition by discovering, working together, and solving problems. Elements of classroom-based assessment (PBD) associated with the proficiency levels of the Home Science curriculum were included to enhance formative assessment.

### **Phase 3: Evaluation**

The final step is all about checking how useful and usable the module is. The review included expert validation and usability testing to make sure that the module meets the standards for quality of education, usability, and alignment with the curriculum. Expert validation is essential in the development of instructional goods as it ensures that the products are pedagogically sound and aligned with educational objectives. Sekaran and Bougie (2020) say that expert validation makes research instruments and results more reliable and valid. There were two parts to the usability evaluation to see if the module would work for teachers and students in the classroom.

## **3.2 Examination of Data**

We used the right statistical approaches to look at the data we got from expert validation and usability testing. Descriptive statistics were used to look at the quantitative data to see how much agreement there was among experts and users about how useful and practical the module was. Hair et al. (2019) contend that statistical analysis is essential for examining correlations among variables and evaluating research models in educational research. The analytical results were used to improve and fine-tune the module before it was finally put into action.

## **3.3 Procedure for Module Fabrication: Production of the MPB-SRTT4 Module**

The structured game-based project-based learning module developed in this study is designated as MPB-SRTT4 (Modul Pembelajaran Berstruktur Sains Rumah Tangga Tingkatan 4). The module was specifically designed for the Food and Nutrition topic within the Form 4 Home Science syllabus. The objective is to facilitate enjoyable and significant learning experiences for students. MPB-SRTT4 integrates game-based learning with project-based learning. The framework is founded on the ADDIE model

and the Universal Design and Agile Development (UDin) methodology (Din, 2016, 2017). The module is designed to provide educators with a structured instructional tool that facilitates the implementation of student-centered learning in accordance with the curricular requirements of the Home Science topic. The module is accessible via an online platform that offers structured learning activities, instructional resources, and pedagogical tools to assist both educators and learners in effectively engaging with the content. The MPB-SRTT4 module platform includes interactive learning tools, printed resources, and activity guidelines that assist educators in organizing game-based project learning activities within the classroom (MPB-SRTT4, 2024).

Furthermore, the module's creation considers the integration of both practical and theoretical knowledge within Home Science education. Home Science seeks to improve students' comprehension and practical skills in food preparation, nutrition, and daily life competencies (Zakaria & Md Piah, 2021). This aligns with the overarching objective of the Home Science curriculum, which emphasizes the instruction of practical life skills and the integration of several disciplines, including science, nutrition, and daily living (Azizi & Hashim, n.d.). The objective of developing MPB-SRTT4 is to bridge classroom learning with real-life applications through significant educational activities.

### **3.4 The Structure of the MPB-SRTT4 Module.**

The MPB-SRTT4 module comprises several essential components that assist educators in implementing game-based project-based learning within the classroom. The principal components of the module are:

1. MPB website for digital education
2. Organized educational programs that incorporate games
3. Printable educational resources
4. Learning activity established
5. A pedagogical manual for instruction
6. Regulations for Classroom-Based Assessment (PBD)

The digital learning platform serves as the primary conduit for educators and learners to access educational resources and activity guidelines. The website features an organized navigation system that assists users in locating the module's learning activities, project guidelines, and assessment components (MPB-SRTT4, 2024). Educators may utilize the downloadable resources inside the module to conduct learning activities employing concrete educational tools such as cards, worksheets, and activity guides. These products are designed to facilitate interactive learning activities, thereby assisting students in collaboration, exploration, and problem-solving.

Prior research has highlighted the importance of instructional modules and teaching aids in enhancing successful pedagogy and learning in Home Science education. For instance, the development of interactive multimedia modules has been shown to enhance students' comprehension and utilization of learning materials in Home Science programs. Similarly, innovative educational methods such as augmented reality learn-

ing materials have demonstrated efficacy in enhancing students' understanding of culinary practices and increasing their engagement in Home Science courses. The results demonstrate that well-organized instructional modules serve as effective tools for promoting practical and experiential learning.

### **3.5 Establishment of Game-Based Learning Activities.**

The MPB-SRTT4 module comprises eight structured game-based learning activities designed to facilitate project-based learning. Each activity aims to educate youngsters about food and nutrition via practical, collaborative projects. The activities emphasize several key methods of learning:

- exploring concepts
- collaborating to resolve issues
- applying knowledge to real-life scenarios
- reflecting and discussing it
- executing the project

These activities motivate students to actively construct knowledge rather than only absorb information. Active learning methodologies, such as cooperative and collaborative learning, have been shown to significantly enhance students' communication and higher-order thinking abilities in Home Science courses. Moreover, technology-enhanced educational materials, such as instructional films and digital platforms, have demonstrated the ability to improve students' academic performance and understanding of complex topics in Home Science education. The integration of game-based learning and project-based learning within the MPB-SRTT4 module fosters an organized educational environment that promotes engagement, collaboration, and substantive learning.

### **3.6 Integrating Classroom-Based Assessment (PBD).**

A crucial component of the MPB-SRTT4 module is the implementation of Classroom-Based Assessment (PBD), which aligns with the competency levels of the Form 4 Home Science curriculum. The module includes integrated assessment tasks that enable educators to monitor student learning progress during project activities. These evaluative activities encompass formative tasks such as group discussions, observations, reflections, and project presentations. Incorporating assessment into learning activities is essential to ensure that learning outcomes align with curricular requirements and facilitate the monitoring of students' progress.

## 4 Research Gap

Even while more and more people are interested in new ways to teach, like game-based learning and project-based learning, there are still big gaps in how they are used in Home Science education. Previous studies have demonstrated that game-based learning improves student motivation, engagement, and learning outcomes when integrated into instructional activities (Alotaibi, 2024; Nadeem et al., 2023; Serrano, 2019). Project-based learning is recognized as an effective approach for cultivating critical thinking, collaboration, and practical problem-solving abilities in students (Bell, 2010; Thomas, 2000).

Nonetheless, most current research focuses on assessing the effectiveness of game-based learning or project-based learning in isolation, rather than integrating both techniques into a unified instructional framework. Research in Home Science education has underscored the imperative of developing appropriate teaching resources and modules to enhance effective teaching and learning processes. A prior study has highlighted the imperative for instructional modules and multimedia teaching materials to augment students' understanding and engagement in Home Science education (Mat Nashir et al., 2022). Moreover, research on Home Science education indicates that innovative instructional strategies and teaching resources are essential for promoting significant learning experiences and deepening students' comprehension of complex topics such as food and nutrition (Sukiran et al., 2018).

Additionally, research demonstrates that effective pedagogical approaches must integrate experiential learning activities with conceptual understanding to enhance students' ability to apply knowledge in practical contexts (Azizi & Hashim, n.d.). A lot of research has been done on technology-based learning tools, cooperative learning strategies, and new ways to teach Home Science. However, not much research has been done on making structured game-based project-based learning modules that fit with the Form 4 Home Science curriculum and classroom assessment standards. Previous studies often focus on evaluating the effectiveness of a certain teaching method rather than developing a whole instructional module that systematically integrates learning techniques, instructional design frameworks, and curriculum requirements. This highlights the need for a structured educational framework that combines game-based and project-based learning methods to help teachers create interesting and meaningful learning experiences.

The goal of this study is to fill a vacuum in research by developing a structured game-based project learning module for the Form 4 Home Science curriculum, with a focus on Food and Nutrition. The module integrates game-based learning activities inside project-based assignments and is developed using a systematic instructional design framework based on the ADDIE model and the UDin model. The module is designed to be a useful instructional tool that gets students more involved, helps them learn in a meaningful way, and makes it easier to use in the classroom.

**Table 1.** Structure of the MPB-SRTT4 Game-Based Activities

| Activity   | Game-Based Learning Element    | Project-Based Learning Task                            | Learning Focus (Food & Nutrition)         | Expected Learning Outcome                                            |
|------------|--------------------------------|--------------------------------------------------------|-------------------------------------------|----------------------------------------------------------------------|
| Activity 1 | Concept exploration game       | Identifying food groups through interactive activities | Basic nutrition concepts                  | Students identify major food groups and nutrient functions           |
| Activity 2 | Card-based nutrition challenge | Classifying nutrients and their functions              | Nutrients and balanced diet               | Students explain the roles of nutrients in human health              |
| Activity 3 | Problem-solving board game     | Analysing daily meal plans                             | Balanced diet planning                    | Students design a balanced meal plan                                 |
| Activity 4 | Scenario-based game            | Solving nutrition-related problems                     | Healthy food choices                      | Students evaluate healthy and unhealthy food choices                 |
| Activity 5 | Collaborative game task        | Investigating food preparation methods                 | Cooking methods and nutrient preservation | Students explain the effects of cooking methods on nutrients         |
| Activity 6 | Simulation game                | Designing a healthy meal project                       | Meal planning                             | Students design a nutritious meal menu                               |
| Activity 7 | Strategy-based group game      | Creating nutrition awareness campaigns                 | Food and nutrition awareness              | Students develop communication skills related to nutrition education |
| Activity 8 | Final project game challenge   | Presentation of food and nutrition project             | Application of nutrition knowledge        | Students present project outcomes based on learned concepts          |

**4.1 Integration with the MPB-SRTT4 Module Platform.**

The aforementioned activities are executed via the MPB-SRTT4 learning platform, which offers organized instructions, educational resources, printed materials, and activity guidelines for educators and learners. The platform facilitates module implementation by structuring learning activities into stages that direct students through discovery, collaboration, and project development (MPB-SRTT4, 2024). The incorporation of planned learning activities into a digital learning platform enables educators to execute project-based learning systematically and methodically. The module combines

classroom-based assessment components matched with the Home Science curriculum to facilitate the monitoring of students' learning progress throughout the educational process.

## 5 Discussion

The objective of this study was to develop a structured game-based project learning module for Form 4 Home Science, concentrating on Food and Nutrition. The findings of this study indicate that integrating game-based learning with project-based learning in a meticulously designed educational module may enhance meaningful learning and increase student engagement. The integration of game-based learning elements into the module establishes a dynamic teaching environment that promotes active participation and sustained engagement among students. Previous research has consistently highlighted the advantageous impact of game-based learning on student motivation, engagement, and academic performance (Alotaibi, 2024; Nadeem et al., 2023; Serrano, 2019). The MPB-SRTT4 module encompasses game characteristics such as challenges, collaboration, and problem-solving activities that enable students to actively interact with the content rather than merely absorbing information.

Moreover, project-based learning activities allow students to apply theoretical knowledge in practical circumstances related to food and nutrition. Project-based learning fosters inquiry, problem-solving, and collaborative learning, essential for developing twenty-first century competencies such as critical thinking and communication skills (Bell, 2010; Thomas, 2000). The module's structured activities enable students to investigate real-world issues related to dietary selections, meal planning for nutrition, and maintaining a healthy lifestyle. The results demonstrate the significance of developing instructional modules that facilitate effective learning and teaching for students. Previous studies demonstrate that well-organized teaching modules and instructional resources can enhance students' understanding of Home Science concepts and improve the effectiveness of classroom education (Mat Nashir et al., 2022).

The integration of innovative instructional resources, including technology-enhanced learning materials and practical instruments, has shown effective in improving students' understanding and engagement in Home Science educational activities (Sukiran et al., 2018). The results indicate that Home Science education must incorporate information from several different disciplines. Home Science education often integrates scientific principles, practical skills, and real-world applications. Previous research has shown that Home Science education includes various scientific fields, such as chemistry, biology, and nutrition, which improve students' understanding of food and health (Azizi & Hashim, n.d.). Through the implementation of game-based and project-based learning approaches in the MPB-SRTT4 module, students may effectively connect classroom knowledge with real-world applications. This integration facilitates a profound understanding of concepts for students and compels them to use their knowledge in practical scenarios.

Furthermore, employing a structured instructional design framework, particularly the integration of the ADDIE model and the UDin model, facilitates the module's systematic development. Instructional design models provide a structured methodology for developing instructional materials encompassing learning objectives, pedagogical strategies, and assessment methodologies (Din, 2016, 2017). The module developed through this systematic design process ensures the alignment of curricular requirements, learning activities, and assessment components. Incorporating Classroom-Based Assessment (PBD) into the module enhances the instructional design by enabling educators to monitor student learning progress during project activities. This integration ensures that evaluation is regarded as an essential component of the learning process, rather than a distinct duty. This study's findings demonstrate that the MPB-SRTT4 module is an effective instructional tool that aids educators in implementing new teaching approaches, hence enhancing student engagement and learning experiences in the Home Science classroom.

## 6 Contribution to Knowledge

This study significantly advances the domain of educational research, particularly in Home Science pedagogy and instructional design. The study initially contributes to the amalgamation of game-based learning and project-based learning inside a structured educational framework. Although previous studies have explored the effectiveness of game-based learning and project-based learning separately, there is a lack of research on the integration of both approaches within a cohesive instructional framework. The MPB-SRTT4 module integrates these two pedagogical approaches to establish a structured learning environment that fosters engagement, collaboration, and the acquisition of valuable knowledge concurrently. This study facilitates the development of teaching modules specifically designed for Home Science education. Many studies have examined the use of multimedia learning resources and innovative teaching aids in Home Science classrooms (Mat Nashir et al., 2022; Sukiran et al., 2018); however, there remains a lack of structured modules that integrate diverse pedagogical approaches within a unified instructional design framework. The MPB-SRTT4 module addresses this deficiency by providing a comprehensive array of instructional resources, encompassing learning activities, teaching materials, and assessment components.

This study contributes to the application of instructional design frameworks in module development. The integration of the ADDIE model with the UDin model demonstrates the application of systematic instructional design methodologies in the development of new educational modules. This integration illustrates the significance of amalgamating theoretical foundations, pedagogical strategies, and technology to create effective learning environments (Din, 2016, 2017). The study assists educators in creating effective instructional materials. The MPB-SRTT4 module is a comprehensive educational system that includes a digital learning platform, printable instructional materials, organized exercises, and guidance for educators. These components provide educators with valuable resources to implement student-centered learning methodologies in the

classroom. Ultimately, this study promotes pertinent learning in Home Science courses. The module fosters active knowledge construction, practical application of concepts, and the cultivation of vital 21st-century skills, like problem-solving, cooperation, and critical thinking, by integrating game-based and project-based learning activities. The MPB-SRTT4 module is a novel approach to education that integrates pedagogical techniques, instructional design principles, and curriculum standards to facilitate engaging and pertinent student learning.

## **7 Implications for Practice, Policy, and Future Research: Implications for Educational Practice**

The results of this study offer significant implications for pedagogical approaches in Home Science education. The creation of the MPB-SRTT4 module illustrates how structured instructional frameworks that combine game-based and project-based learning can facilitate student-centered pedagogical methods in the classroom. The incorporation of game-based learning activities into project-based learning tasks offers educators a potent method to augment student engagement and participation throughout the educational process. Prior research has demonstrated that interactive learning methodologies, including game-based learning, can markedly enhance student motivation and engagement in classroom activities (Alotaibi, 2024; Nadeem et al., 2023; Serrano, 2019). By incorporating gaming aspects into formal learning activities, educators may foster more interactive and interesting learning environments for students.

Secondly, the MPB-SRTT4 module offers educators systematic instructional support that aids in the execution of project-based learning. Project-based learning promotes student exploration of real-world issues, peer collaboration, and the application of knowledge in genuine contexts (Bell, 2010; Thomas, 2000). The organized activities in the module allow educators to direct students through project tasks methodically, assuring the attainment of learning objectives. The module offers practical teaching resources, including printable learning materials, activity guides, and assessment tools to facilitate classroom application. The accessibility of these instructional tools is crucial for enhancing instructors' capacity to adopt new pedagogical practices effectively. Prior research indicates that instructional modules and multimedia teaching aids can markedly enhance the efficacy of teaching and learning in Home Science classes (Mat Nashir et al., 2022). Likewise, the application of novel educational materials and technology-enhanced learning tools has been shown to boost students' comprehension of practical tasks in Home Science disciplines (Sukiran et al., 2018). Consequently, the MPB-SRTT4 module possesses the capability to function as an effective instructional support resource that aids educators in executing engaging and significant learning activities.



### **7.1 Consequences for Educational Policy.**

This study's findings have significance for curriculum development and educational policy, especially on the enhancement of creative teaching methods in the Home Science curriculum. The creation of structured instructional modules that fit with curricular standards can facilitate the adoption of student-centered learning methods highlighted in modern educational reforms. The Home Science curriculum seeks to enhance students' knowledge, abilities, and values via practical and experiential learning activities. The MPB-SRTT4 module facilitates these objectives by incorporating organized learning activities that link theoretical knowledge to practical applications.

The incorporation of interdisciplinary knowledge within the curriculum underscores the significance of linking Home Science education with other domains, including science and nutrition. Prior studies indicate that Home Science education encompasses multidisciplinary knowledge, synthesizing aspects of chemistry, biology, and practical applications concerning food and nutrition (Azizi & Hashim, n.d.). Thirdly, The creation of instructional modules like MPB-SRTT4 facilitates the execution of classroom-based assessment methodologies. By integrating assessment elements into learning activities, educators can more effectively track students' academic progress while assuring conformity with curriculum requirements. These findings indicate that educational institutions and curriculum makers ought to promote the creation and implementation of organized instructional modules that facilitate novel teaching methodologies and significant learning experiences.

### **7.2 Consequences for Subsequent Investigations.**

This study advances the creation of a structured game-based project-based learning module, however various avenues for future research are discernible. Future research may investigate the efficacy of the MPB-SRTT4 module in enhancing students' learning outcomes, including information acquisition, critical thinking abilities, and collaborative learning skills. Empirical studies utilizing experimental or quasi-experimental study techniques could yield additional evidence concerning the module's effect on student learning performance.

Secondly, subsequent study may investigate the application of the module in other educational settings, encompassing schools with heterogeneous student demographics and learning environments. Such investigations may yield insights regarding the module's flexibility and scalability across various teaching environments.

Third, subsequent research may explore the incorporation of digital technologies in game-based project-based learning settings. The swift advancement of educational technologies creates chances for improving interactive learning environments via digital platforms, simulations, and immersive learning tools.

Fourth, future study may investigate the enduring effects of structured game-based learning modules on students' perceptions of Home Science education. Comprehending students' opinions and attitudes toward innovative instructional methods can yield significant insights for enhancing teaching tactics and curriculum development.

Future research may examine the incorporation of interdisciplinary learning methodologies in Home Science education, including the relationship between nutrition education, health education, and scientific learning. Such investigations could enhance the significance of Home Science education in fostering comprehensive student development.

## 8 Conclusion

This study aimed to develop a structured game-based project learning module for the Form 4 Home Science curriculum, concentrating on the subject of Food and Nutrition. The Design and production Research (DDR) strategy guided the module's production. It used the ADDIE instructional design model and the Universal Design and Agile Development (UDin) paradigm as the main framework for the design and development process.

The findings indicate that the MPB-SRTT4 module provides a structured educational resource that integrates game-based learning and project-based learning within a coherent instructional design framework. Incorporating game elements like interactive challenges, group exercises, and problem-solving activities into lessons creates engaging learning experiences that encourage students to participate. Previous studies have demonstrated that game-based learning can enhance students' motivation, involvement, and academic achievement when properly integrated into classroom activities (Alotaibi, 2024; Nadeem et al., 2023; Serrano, 2019).

By doing project-based learning activities, students can use what they learn in class in real-life situations related to food and nutrition. Many people agree that project-based learning is a great way to help students develop their ability to think critically, work together, and solve problems in the real world (Bell, 2010; Thomas, 2000). Through structured project activities, students can explore nutritional concepts, assess real-world food-related issues, and devise pragmatic solutions.

This study highlights the importance of carefully designed instructional modules in promoting effective teaching and learning within Home Science education. Instructional modules and resources improve students' understanding and involvement in learning complex concepts (Mat Nashir et al., 2022). Using new teaching methods, such technology-enhanced learning materials, can help students comprehend how to do things in Home Science classes (Sukiran et al., 2018).

Integrating interdisciplinary knowledge into Home Science education enables students to connect scientific principles with practical applications related to food, nutrition, and health (Azizi & Hashim, n.d.). The MPB-SRTT4 module provides a practical and creative way to teach that keeps students interested, encourages meaningful learning, and makes it easy to use in the classroom. The integration of game-based learning and project-based learning within a structured instructional design framework demonstrates the efficacy of innovative pedagogical approaches in enhancing Home Science education.

## 9 Limitations of the Study

Despite the merits of this work, significant limits must be acknowledged. The study primarily focuses on the design and development of the teaching module, rather than doing an extensive empirical assessment of its effectiveness. Although usability evaluation and expert validation provide valuable insights into the module's practicality and suitability, more empirical research is necessary to evaluate the module's impact on students' learning outcomes, motivation, and engagement.

The module was specifically tailored for the Form 4 Home Science topic of Food and Nutrition, which may limit its relevance to other courses within the Home Science curriculum. The pedagogical framework utilized in this study may be transferable to different subjects; however, additional research is required to evaluate its applicability across other subject areas.

The implementation of the module may depend on several contextual factors, such as teachers' pedagogical readiness, resource accessibility, and classroom environment. Previous research has shown that the effectiveness of instructional innovations often depends on teachers' understanding and ability to effectively implement new teaching methods (Zakaria & Md Piah, 2021).

Ultimately, although the module integrates digital learning resources through an online platform, the effectiveness of digital learning environments may also depend on factors such as technological accessibility and students' skill in digital literacy. Future research should examine the influence of these contextual factors on the successful implementation of the module.

Despite these limitations, the study provides valuable insights into the development of structured instructional modules that integrate innovative pedagogical approaches in Home Science education.

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