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The Effectiveness of Technology-Project-based Learning (TPBL) Module in Fostering Children's Creative Thinking Skills Through Science Education

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Early science learning has the potential to enhance children's creative thinking skills through quality learning, but this requires well-structured activities and a supportive learning environment. The purpose of this study is to evaluate the effectiveness of the Technological-Project-based Learning (TPBL) Module in early childhood education to enhance the creative thinking skills of children. This study employed a mixed-methods design, where qualitative data was collected using interview instruments and quantitative data was gathered using pre and post-tests. The study involved 2 preschool teachers and 50 preschool children. After an 8-week intervention, the findings revealed a significant positive change in the mean score of children's thinking skills in the treatment group, with the average pre-test score of M = 32.60 and a post-test score of M = 55.16. Additionally, the results indicated a significant difference between the treatment and control groups based on the post-test, with $p < 0.05 = 0.001$. A p-value below 0.001 signifies that this outcome is exceedingly improbable to have arisen by chance. Furthermore, interview data indicated that participants found the TPBL module to be a highly impactful initiative in enhancing their creative thinking skills, as it involved engaging projects and allowed them to make decisions collaboratively with peers. These implications encourage schools to provide technological learning materials to ensure quality science education, in line with 21st-century education standards.

Keywords: early science; preschool; project-based learning; technological-based learning

Research on the pedagogy and acquisition of understanding of science in preschoolers has become an acknowledged discipline over the past twenty years (Trundle & Saçkes, 2024). The cumulative evidence from an expanding corpus of literature indicates that the introduction of science in developmentally suitable manners may facilitate young children's sensory discovery of their environment and establish essential knowledge and skills for enduring science education, alongside fostering a profound appreciation for nature (Trundle, 2015; Trundle & Saçkes, 2012). Early science education is essential for cultivating curiosity (Bjerknes et al., 2024), enhancing problem-solving abilities (Dewi et al., 2024), and developing fundamental skills (Sjöström, 2021) that children can leverage in their future academic pursuits. It offers young children the chance to investigate their surroundings through experiential activities, inquiry-driven learning, and interdisciplinary methods that combine science with other disciplines (Alan & Mumcu, 2024).

A fundamental component of early science education is project-based learning (PBL), which has demonstrated enhancements in children's cognitive abilities, motivation, and collaboration skills. This methodology enables youngsters to immerse themselves in scientific principles through the execution of real-world projects, fostering collaboration and enhancing practical problem-solving skills. The adaptability of PBL allows it to be utilized in diverse educational environments, integrating science concepts with collaborative learning, inquiry-based instruction, and digital resources to enhance the educational experience (Howitt et al., 2020; Chen et al., 2023). Additionally, early science education is essential for the cultivation of communication skills, enabling children to articulate ideas, disseminate discoveries, and cooperate with peers. Research indicates that including STEM (Science, Technology, Engineering, and Mathematics) activities in preschool can markedly improve creativity, problem-solving abilities, and general academic preparedness (Vongkulluksn et al., 2018; Aldemir & Kermani, 2017).

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These initiatives seek to enhance children's current education while equipping them for a future in which science literacy and problem-solving skills are essential for success in various fields. To gain a comprehensive understanding of the significance of early science education, you may examine the complete publications and studies cited, including those by Howitt et al., (2020) and Chen et al., (2023). The significance of science education (Foti, 2021) in preschool is highlighted by its capacity to cultivate curiosity, problem-solving abilities, and critical thinking from a young age. Taşdemir and Yıldız (2024) emphasize that science activities in preschool address children's educational requirements while also igniting their inherent curiosity about the world. Early science education establishes fundamental abilities crucial to lifelong learning and a profound comprehension of science concepts.

According to research by Kalogiannakis et al., (2021), science education for children is characterized as an interactive and engaging process that employs gamification to improve learning experiences. Behnamni et al., (2020) investigated technology-based learning (TBL) for young children, emphasizing the potential of well-designed games to foster creativity. These games offer organized yet flexible settings that encourage children to make decisions, enhancing critical thinking and creativity. TBL can function as an interactive platform for cultivating cognitive flexibility, essential for creativity. More profoundly, a thorough literature analysis conducted by Naimah (2022) revealed that the utilization of technological resources, such as educational videos, in science teaching enhances students' comprehension and academic performance. Some science topics are challenging for children to comprehend; nevertheless, guidance, exploration, simulation, and visualization through educational videos can enhance their conceptual knowledge (Berg et al., 2019; Shui et al., 2019; Ugwuanyi et al., 2020; Wu et al., 2021). Therefore, the integration of PBL and TBL, referred to as Technology-Project-Based Learning (TPBL), can be implemented through blended learning. Irwanto and Setyo Rini (2024) assert that blended learning can significantly enhance learners' motivation in science-related education. This finding aligns with Yıldız Taşdemir and Gürler Yıldız's (2024) study, which emphasizes that children should be given opportunities to explore topics through engaging activities, such as incorporating technological materials in classroom learning activities (Yıldız & Selvi, 2015).

Interestingly, both TBL and PBL approaches in early science education offer numerous benefits for children's development (Rahmawati et al., 2020). Wong (2019) demonstrated that the amalgamation of these two approaches is essential for augmenting children's involvement and cultivating abilities such as problem-solving and collaboration. It facilitates a more personalized, dynamic, and contextually relevant learning experience. Effective integration necessitates the utilizations of familiar tools that resonate with children and guarantees that technology is congruent with educational objectives. It fosters creativity and critical thinking, rendering the learning experience more dynamic and relevant to future employment (Jabbar & Halim, 2024). The selection of PBL-TBL in school environment constitutes an effective strategy for maximizing its application in education, leveraging contemporary communication methods, and addressing the requirements of modern learners, particularly concerning e-learning and smartphone utilization (Munawaroh et al., 2022). The emergence of fourth-generation technological tools profoundly influences education as a whole and project-based learning in particular (Al-Mawlid, 2019), while also equipping teachers and learners with cutting-edge tools to investigate, experiment, and understand the complexities of the natural world (Doyan et al., 2021).

Literature Review

Learning Module in Early Science Education

The implementation of learning modules is crucial in the instruction of science (Khabibah et al., 2017), particularly within early childhood education environments (Letchumanan & Aidah, 2024; Rasdi et al., 2021; Mashudi et al., 2024). Numerous studies over the past five years emphasize the significance of science education in preschool through the utilization of modules for children (Ghazali et al., 2024; Ghazali et al., 2021). Learning modules often promote active learning, wherein children with educational content via experimentation, investigation, and discourse. This method enables children to engage more actively in the learning process and enhances their comprehension of science concepts by allowing them to personally experience exploration and problem-solving. The outcomes of a study by Hsin and Wu (2023) illustrate the significance of systematic concept acquisition in enabling preschool children to acquire foundational science skills while also fostering their creative abilities in executing science-related tasks. The findings indicate that indigenous children utilizing the science learning module enhance their creative thinking skills more rapidly (Hsin & Wu., 2023) than those employing a standard science learning strategy (Cooper et al., 2020). To investigate the significance of employing science learning modules for preschoolers, the findings of Dongjin and Ashari (2024) through systematic analysis indicate that the implementation of activities utilizing these modules, particularly in early science, can enhance children's critical thinking skills. This empowerment enhances their creativity in executing the assigned tasks through the activity. Thus, ensuring the quality of education through the implementation of learning modules in schools necessitates that teachers play a pivotal role. They must create a responsive environment and introduce science content actively, as such content does not emerge autonomously (Henriksson et al., 2023).

Enhancing the quality of learning through learning science modules requires alignment between the teacher's proficiency in conveying the module content and the varying capacities of children to comprehend that content (Suwartiningsih, 2021). In the classroom, it is inappropriate to offer individual learning modules that alone foster creativity, innovation, and student autonomy in the educational process (Fadhli, 2022). Therefore, it is imperative to develop learning modules designed for personalized instruction for all students (Rahmawati et al., 2023), as this will facilitate the comprehension of specific concepts and foster motivation and a positive desire to learn (Rohaizad et al., 2017).

TPBL in Education

Science teachers assert that science classes ought to be more relevant to real-world contexts to help learners comprehend the essential role of science in daily life (Oxford University Press, 2024). However, the pedagogical approach to science in schools has faced longstanding criticism for its disconnection from other crucial educational objectives, including inquiry and problem-solving abilities, civic engagement, agency, and a commitment to addressing future challenges (Alzen et al., 2023; Schwartz et al., 2023; Thomas & Boon, 2023). The issue of diminishing leaners interest in the field of science is increasingly concerning and frequently addressed in contemporary discourse (Shanmugam & Balakrishnan, 2018). This presents a challenge for teachers to devise a solution that engages and motivates learners to study science subjects. Consequently, it is imperative to diversity instructional methods to prevent leaners ennui and, crucially, to engage their interest in the subject matter (Mahamod & Mustapha, 2007). International reforms in science education recognize the necessity for significant changes in pedagogy, curricular resources, and evaluation methods (Penuel et al., 2022). Over the past decade, numerous studies have examined the integration of Project-Based Learning (PBL) with technology (Haataine & Aksela, 2021; Jabbar & Halim, 2024; Rahmawati et al., 2020) within the educational context. From the standpoint of early childhood education, the promotion of science education through the integration of these two techniques, operationally referred to as TPBL, effectively stimulates children's creative thinking skills. The study by Parwoto et al. (2024) revealed that children in the treatment group engaged in TPBL activities exhibited a higher level of creative thinking skills compared to those in the control group utilizing conventional learning methods and indirectly it proves that TPBL-focused activities can stimulate children's creative expression during science activities (Chen et al., 2024; Meyer & Crawford, 2011).

This study implements TPBL activities in early science education by adopting the PBL Model presented by Pekins (2008) (See Figure 1.0). The figure depicts a research framework highlighting the interaction between the teacher and children through five organized steps. The main keyword in this study is the mediation process defined by Vygotsky. The foundation of Vygotsky's sociocultural framework is his mediation theory, which uses language as a key mediating tool to investigate how social interaction impacts human cognitive development. According to Vygotsky, mediation entails the use of cultural instruments and symbols, particularly language, to cultivate advanced cognitive functions that surpass inherent capabilities. Through the utilisation of these tools in social settings, individuals assimilate cognitive processes, altering their comprehension and interaction with the world (Ghassemi & Asgarzadeh, 2017).

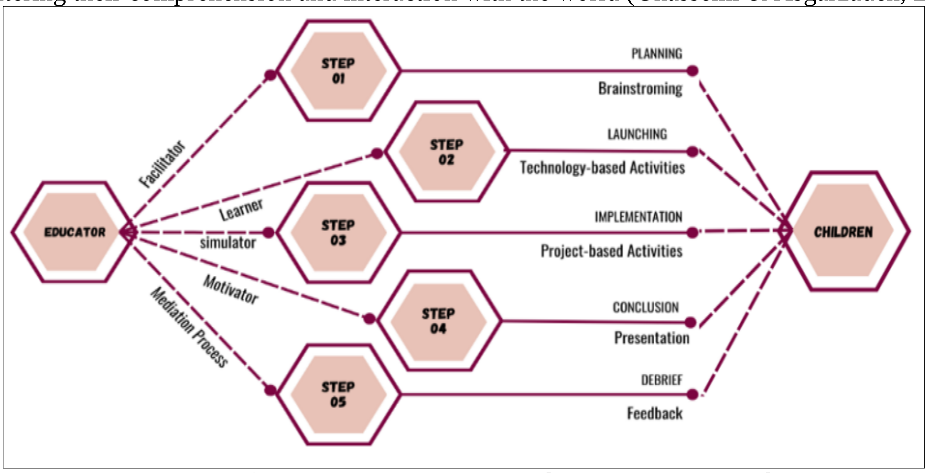

Figure 1.0: TPBL Framework in Current Research

In this study, teachers serve as mediators in the learning and facilitating process (Vygotsky, 1978). They act as facilitators, guiding children through the Zone of Proximal Development (ZPD)—the gap between what a child can do independently and what they can achieve with assistance (Wertsch, 1985). At the same time, teachers employ instructional strategies such as scaffolding (Woods et al., 2020; Yawilong, 2022) to provide essential support for children's learning, systematically withdrawing this assistance as their competence increases. In addition, children play the role of active learners (Bodrova, 2019; Smolucha & Smolucha, 2021). They are not passive consumers of knowledge; rather, they are active participants in the learning process. The mediation process promotes participation in activities that require creativity, critical thinking, and problem-solving skills. Children internalize their interactions with teachers, peers, and structured learning modules, thereby transforming their cognitive functioning. On the other hand, learning modules serve as instruments for mediation (Kozulin & Presseisen, 1995). Early science learning modules, crafted with specific cultural and cognitive tools such as language, symbols, or interactive activities, are crucial in shaping children's engagement with knowledge. These modules offer children the opportunity to practice and implement new abilities within their ZPD. Language-based learning modules enable children to enhance their linguistic and cognitive abilities by interpreting and generating meaning through content interaction and teacher assistance.

Based on Figure 1.0, it illustrates that the teacher plays multiple roles throughout the learning process: as a facilitator, learner simulator, motivator, and mediator. These roles are crucial as they guide and support the children at each stage of the project-based learning process as below:

- Step 1 - Planning (Brainstorming): This step involves initial planning, where both the teacher and the children brainstorm ideas to define the project's goals. It sets the foundation by identifying key themes or questions.
- Step 2 - Launching (Technology-based Activities): In this phase, when the project is launched, the teacher becomes a leaner to learn with children through TBL ativity. This could include research, exploring resources, or introducing tools they will use in the project.
- Step 3 - Implementation (Project-based Activities): This is the core of the TPBL framework, where children actively engage in hands-on, PBL tasks. The teacher acts as a facilitator, guiding children as they explore, experiment, and build their project.
- Step 4 - Conclusion (Presentation): At this stage, children present their project or findings. This presentation phase allows them to demonstrate their understanding and what they have accomplished. Additionally, the teacher acts as a motivator, encouraging children to be brave in sharing what they have successfully produced.
- Step 5 - Debrief (Feedback): Finally, the process concludes with feedback. Here, the teacher and children reflect on the project, discuss what went well, and identify areas for improvement. Feedback is essential to reinforce learning and ensure a clear understanding.

In summary, this TBPL framework highlights an interactive and iterative approach. Within this framework, the teacher plays a pivotal role in facilitating the learning experience, fostering an environment where children feel encouraged to undertake independent project work. The teacher supports children in reaching well-informed conclusions, thereby enhancing their engagement and comprehension through structured feedback.

Measurement of Children's Creative Thinking Skills

The exploration of creative thinking in school-aged children generates significant interest among researchers and teachers regarding the potential for conventional classroom learning activities, when conducted in a supportive environment, to enhance cognitive and creative abilities (Wang, 2012). This inquiry is particularly significant as research on children's learning and education increasingly substantiates the notion that creative thinking—encompassing skills such as idea generation or divergent thinking—does not occur in isolation from learning activities, but rather through them (Dijksterhuis & Ritter, 2019; Kim et al., 2019). Recently, teachers increasingly recognize the need of cultivating children's creative thinking (Kim & Park, 2020). Reviewing from this perspective, the enhancement of children's creative thinking skills at the educational center will transpire through cooperative learning, wherein innovative solutions to learning challenges are collaboratively devised with peers (Segundo Marcos et al., 2024). Another insightful finding from past research is children do exhibit enhanced creativity in task execution when had the opportunity to engage in a sustained intense program (Gu et al., 2019). Although previous literature (Treffinger & Isaksen, 2013) supports that creativity is essential for preparing new generations of learners for an uncertain future, there is a lack of practical guides for teachers to help students identify their creative talents and enhance their creative thinking skills (Abdulla & Cramond, 2017). Consequently, to facilitate the continuous evaluation and interpretation of children's creativity development, it is essential for teachers or researchers to be familiar with the most effective ways obtainable. The utilization of suitable measurements to assess an individual's creative development is crucial within the context of learning.

Over the past decade, numerous studies have demonstrated the significance of employing the Torrance Tests of Creative Thinking (TTCT) in social science research (Abdulla Alabbasi et al., 2022; Humble et al., 2016; Krumm et al., 2018; Soh et al., 2021). TTCT is utilized by a large number of individuals, and it can be utilized for testing purposes by individuals of varying ages (Zhao et al., 2019). Particularly, the test is mostly utilized for the purpose of evaluating the individuals' capacity for divergent thinking. According to Theoharopoulou et al., (20200), the predominant factors that determine a subject's score are their level of fluency, adaptability, originality, and elaboration in their responses. Torrens believed that divergent thinking (Mumford et al., 2001) was the basis of creativity, and he developed tests that placed an emphasis on evaluating different types of thinking. Among all creative tests, the TTCT is the one that has been around the longest, has been the subject of the most extensive study, and is the one that is utilized in educational settings the most frequently (Theoharopoulou et al., 2020). Therefore, Wang and Ismail @ Kamal (2023) suggested that TTCT is not only capable of evaluating individual thinking based on a variety of factors, but it is also useful for teachers in terms of how they interact with their learners.

Aim and research questions

We undertook a study aimed at elucidating the effects of a TPBL Learning Module, termed MyPreScience Learning Module, on children's creative thinking abilities (assessed via the TTCT test) and the nature of specific educational inquiries, characterized by their divergent skills (Guilford, 1950). This was executed in reaction to the previously identified research need. To achieve this purpose, we considered the following research questions (RQs):

- RQ1: What is the mean score of the treatment group before and after they used the MyPreScience Module to evaluate their progress using the TCTT measurement?
- RQ2: Is there a significant difference in the mean score of creative thinking skills between the treatment and control groups following an 8-week intervention measured by TCTT??
- RQ3: Is the MyPreScience Learning Module effective in preschool for enhancing children's creative thinking skills through independent interviews?

Method

Design

Context

This research employed a mixed-methods design (Zainudin et al., 2021). This design is a research methodology that integrates quantitative and qualitative components inside a single study. The objective is to achieve a more thorough comprehension of a study subject by using the benefits of both methodologies. This study employs a sequential explanatory design (Ivankova et al., 2006). This design is a category within mixed methods research. This category involves the initial collection and analysis of quantitative data (quasi-experimental), succeeded by qualitative data (interviews). The objective of the use of this design category is to elucidate or augment the outcomes of quantitative research using qualitative insights. This study was executed over a duration of 10 weeks, with the initial week allocated for pre-tests. Monitored the period from the second week to the ninth to execute the research intervention. The tenth week comprises post-tests and independent interviews with an teacher from the treatment group.

Participants

A total of 50 children were selected as participants for this study. All of the participants originated from two separate preschools located in a remote area of a Malaysian state. The ages of the participants range from 5 to 6 years ($M = 6$). Preschool A was assigned as the experimental group, whilst group B was assigned as the control group. They were divided into two separate groups. Furthermore, two teachers participated in this study, each representing a distinct group. Both teachers possess a bachelor's degree in Preschool Education and have over 15 years of experience in teaching preschool children. Both teachers are female.

Instruments

a. MyPreScience Learning Module (Translated from Malay Language as *Modul MyPreScience*)

Prior to the utilization of this learning module in the study, it underwent a developmental process. Ten experts were recruited to assess the usability of this module in preschool education. The study's findings indicate a solid consensus that the module is suitable for children aged 5-6 years, achieving a value of 1 ($k = 1$) in agreement. Upon completion of this learning module (refer to *Figure 1*), it will be utilized during the 8-week intervention by teacher and children from the treatment group. Out of the 10 developed projects, only eight projects were chosen (refer to *Figure 2*) by the teacher for the implementation of activities in early science education. Teachers were allotted one week to identify the necessary tools for their instructional methods in preschool. Conversely, teachers in the treatment group were permitted to employ any instructional methods during the eight instructional sessions.

Figure 1: Front Page of MyPreScience Learning Module

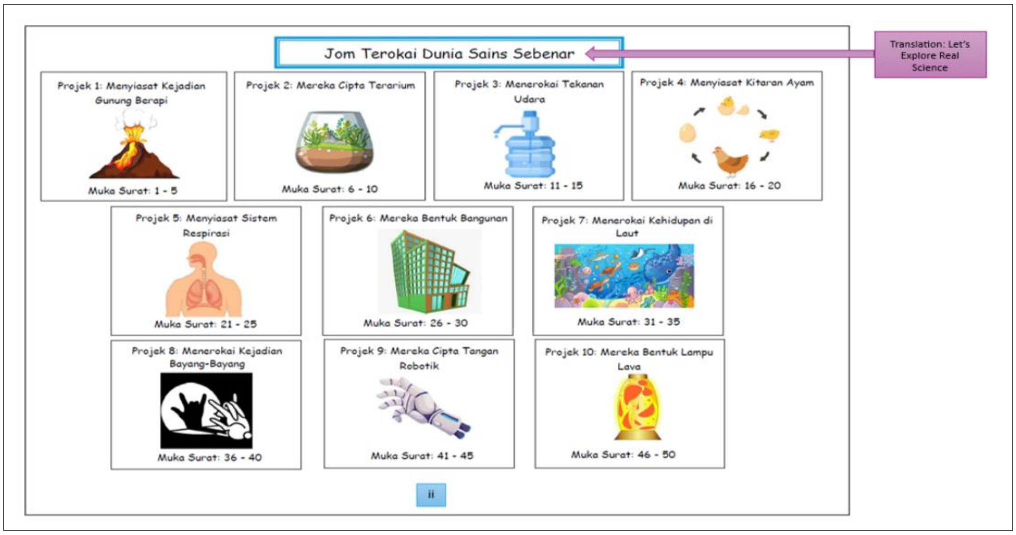

Figure 2: Ten projects developed in MyPreScience Learning Module

According to the data presented in Table 1 below, only eight of these ten projects were utilized by teachers:

Table 1
Eight Projects Selected in Eight-Week Intervention

Project	Intervention Week	Selection	
		Yes	**No**
1. Exploration of volcano eruption	1	✓	
2. Design of terrarium	2	✓	
3. Exploration of air pressure			×
4. Exploration of chicken cycle	3	✓	
5. Exploration of respiratory system	4	✓	
6. Design of building	5	✓	
7. Exploration of ocean animals	6	✓	
8. Exploration of shadow			×
9. Design of robotic arm	7	✓	
10. Design of lava lamp	8	✓	

b. Creative Thinking Skills Assessment (CTSA)

CTSA assesses an individual's capacity to conceive, assess, and enhance ideas in innovative and practical manners. It generally entails duties that necessitate innovative thinking, creative problem-solving, and the generation of original solutions. These evaluations can be utilized in educational environments to cultivate and analyze students' creative thinking capabilities, which are increasingly acknowledged as vital competencies for success in the 21st century. This assessment was adapted from the TTCT test by Ernawati and Muhaimin (2019), and it comprises a series of pre-tests and a series of post-tests. Due to the children's limited comprehension of the questions posed, each test was answered by teachers from both groups.

To enable teachers to assess the development of children's creativity from many viewpoints, current researchers have concentrated on the constructs and 12 items utilized in this exam, as illustrated in *Table 2*. It summarizes constructs and items related to CSTA. It categorizes the skills into four main constructs, each with associated items that reflect specific aspects of creative thinking

Table 2

Constructs and Items in CSTA

No.	Construct	No.	Item
1.	Fluency	1.	Sparking ideas
		2.	Give suggestions
		3.	Active attitude
2.	Flexibility	4.	Generate ideas
		5.	Identify the problem
		6.	Present ideas
3.	Originality	7.	Give ideas
		8.	Empowering ideas
		9.	Adding ideas
4.	Elaboration	10.	Determine the truth
		11.	Develop ideas
		12.	Reaching Decisions together

Prior to the use of CTSA in an actual study, pilot experiment was conducted in a different preschool, revealing that 25 children demonstrated a notable mean (m) score disparity between the pre-test and post-test, changing from $m = 32.32$ to $m = 51.48$. Consequently, following the implementation of one of the ten projects outlined in the MyPreScience Module, positive results regarding creative thinking were observed among the children.

c. Interview Form: Learning Module Effectivenes (LME)

The LME is crucial for assessing the effectiveness of the learning module since it facilitates comprehensive data collecting from participants. This instrument is utilized for many different purposes, including assessing user experience, evaluating comprehension and effectiveness, identifying strengths and weaknesses, understanding the context of use, gathering qualitative data for module enhancement, and measuring student engagement. The establishment of this LME enables contemporary researchers to gather more pertinent and precise data, enhancing the significance and efficacy of the study.

In this instrument, three constructs and three items (refer to Table 3) were employed to evaluate the effectiveness of the MyPreScience Learning Module.

Table 3

Constructs and Items in LME

No.	Construct	Item
1.	Experience	Appropriateness
2.	Insights	Effectiveness
3.	Evaluation	Usability

After the researchers completed the post-test study between the two groups of children, the interview session was conducted with a teacher from the treatment group. In order to ensure that the interview session was conducted well, the researchers used a semi-structured interview where the participants freely gave their views on the questions asked.

Procedure

The study consisted of four parts: pre-test week, intervention weeks, post-test week, and interview session

Pre-Test Week

The methodology for executing a pre-test study at two distinct preschools encompassed numerous essential steps to ensure the dependability of the data obtained. Prior to the deployment of the CTSA instrument in the actual study, it underwent validation by a subject matter expert. Subsequent to the review, the researchers sought consent from the State Education Office, the District Education Office, and the Preschool Headmaster to conduct this study. Upon receiving approval, the researchers initiated the study by disseminating the research instrument to the respondents (teachers from both groups) for completion. To guarantee the precision of the recorded data, the researchers convened a discussion with the study participants to elucidate each component of the produced instrument. On the other hand, children's names were not used to protect their data and privacy. Instead, their names were represented by certain codes, such as numbers, based on their list of names. The test was conducted in two preschools on separate dates and days. Data obtained from the CTSA was documented and preserved for analysis.

Intervention Weeks

The intervention week in the study denotes a designated timeframe during which a planned program, activity, or technique (intervention) is executed on the target group as part of the research. This phase is crucial as it seeks to assess the direct or indirect impacts of the intervention on the study variables. The duration of this trial was 8 weeks, during which the treatment group engaged in science education utilizing the MyPreScience Learning Module. Conversely, the control group employed autonomous ways for science learning and was not constrained by traditional approaches. Continuous monitoring was implemented to guarantee both groups could effectively perform the tasks. The participants' development was rigorously documented in order to assure the intervention was executed as intended. Electronic resources, such as cameras, were employed to keep track of the learning process and facilitation carried out by both groups. The the timeline of intervention weeks can be referred to *Table 4*.

Table 4

The Timeline of Intervention Weeks

Week		Date	Time		Date	Time
1		16/7/2024	9.00 am – 10.00 am		19/7/2024	9.00 am – 10.00 am
2		23/7/2024	9.00 am – 10.00 am		25/7/2024	9.00 am – 10.00 am
3		30/7/2024	9.00 am – 10.00 am		2/7/2024	9.00 am – 10.00 am
4	**Control Group**	6/8/2024	9.00 am – 10.00 am	**Control Group**	8/8/2024	9.00 am – 10.00 am
5		13/8/2024	9.00 am – 10.00 am		15/8/2024	9.00 am – 10.00 am
6		20/8/2024	9.00 am – 10.00 am		22/8/2024	9.00 am – 10.00 am
7		27/8/2024	9.00 am – 10.00 am		29/8/2024	9.00 am – 10.00 am
8		3/9/2024	9.00 am – 10.00 am		5/9/2024	9.00 am – 10.00 am

Post-Test Week

Administering a post-test in the study was a crucial measure to assess the impact of the implemented intervention. Researchers executed this investigation one week subsequent to the successful implementation of intervention weeks for both groups. The researchers employed a uniform research instrument, specifically the CTSA. The researchers underscored the necessity of elucidating the post-test's aim to the study participants, which was to assess the program's or intervention's efficacy, rather than to evaluate them personally. A coding system instead of naming system was implemented to ensure meticulous data collection and maintain continuity between pre- and post-tests. After the data was meticulously collected and documented, researchers compared the post-test findings with the pre-test to discern any alterations.

Analysis

IBM SPSS Statistics

IBM SPSS Statistics was used to evaluate quantitative data to answer research questions RQ1 and RQ2. The Paired t-Test and the Independent Samples t-Test were the two primary statistical tests utilized. The Paired t-Test enabled researchers to determine whether there was a significant difference between two sets of related data, such as pre-test and post-test scores obtained by the same group, addressing the first research question. Analyzing the results of the Paired t-Test made it possible to identify significant differences between pre-test and post-test scores. For answering RQ2, the Independent Samples t-Test was employed. This test assessed whether there was a statistically significant difference in the post-test scores of two distinct groups. The results of the Independent Samples t-Test determined if there was a significant difference in post-test scores between the two groups.

ATLAS.ti 9

Researchers used ATLAS.ti9 software to address RS3. This software enabled users to systematically organize, analyze, visualize, and present qualitative data results effectively. Researchers employed thematic analysis as a method to uncover, analyze, and report patterns (themes) within qualitative data. This strategy was advantageous in qualitative research for organizing and interpreting intricate material by deconstructing it into significant themes. This analysis was adaptable and applicable to several forms of qualitative research, including interviews. It enabled researchers to acquire a profound understanding of the subject matter and to articulate the findings of the investigation in a coherent and systematic manners.

Results

The mean score of treatment group before and after the use of MyPreScience Learning Module (RQ1)

The study employed a Paired t-Test to compare the mean scores of the pre-test and post-test within the same group. Before conducting the test, researchers documented the test scores for each participant, with scores ranging from 1 to 5. A score of 1 indicated that the child's creative thinking skills were severely restricted and required the teacher's assistance to address a problem. A score of 2 indicated that the child's creative thinking skills were somewhat open yet needed the teacher's supervision in problem-solving. A score of 3 indicated that the child's creative thinking skills were somewhat open; however, they required some encouragement from the teacher while addressing challenges. A score of 4 indicated that the child's creative thinking skills were much advanced and required no teacher assistance when addressing problems. A score of 5 indicated that the child's creative thinking skills were highly critical and did not require the teacher's motivation when addressing any topic. *Table 5* and *Table 6* illustrate the difference in scores between the two groups. *Table 5* provides a detailed comparison of the pre-test scores, while Table 6 presents the post-test scores. The analysis of these tables demonstrated any significant changes in the scores following the intervention, highlighting the effectiveness of the program in enhancing the creative thinking abilities of the children in the study.

Table 5

Pre-Test Scores for the Treatment Group

Code	IT1	IT2	IT3	IT4	IT5	IT6	IT7	IT8	IT9	IT10	IT11	IT12	Total
1	2	2	3	3	2	2	3	3	3	3	2	2	30
2	3	3	3	3	2	3	2	3	3	3	3	2	33
3	3	3	3	3	2	3	2	3	3	3	3	2	33
4	3	3	3	3	2	3	3	3	3	3	3	2	34
5	3	3	3	3	3	3	2	3	3	3	3	2	34
6	3	3	3	3	2	3	2	3	3	3	3	2	33
7	3	3	3	2	2	3	2	3	3	3	3	2	32
8	3	3	3	3	2	3	2	3	3	3	3	2	33
9	3	3	3	2	3	2	3	3	3	3	2	2	32
10	2	2	3	3	2	3	2	3	3	3	2	2	30
11	3	3	3	3	2	3	2	3	3	3	3	3	34
12	3	3	3	3	2	3	3	3	3	3	3	2	34
13	3	2	3	2	3	3	3	3	3	3	2	2	32
14	3	3	3	3	2	3	2	3	3	3	3	2	33
15	2	2	3	3	2	2	3	3	3	3	2	2	30
16	2	2	3	3	2	2	3	3	3	3	2	2	30
17	3	3	3	3	2	3	3	3	3	3	2	2	33
18	3	3	3	3	2	3	2	2	3	3	3	2	32
19	3	3	3	3	2	3	2	3	3	3	3	2	33
20	3	3	3	3	2	3	2	3	3	3	3	3	34
21	3	3	3	3	3	3	3	3	3	3	3	2	35
22	3	3	3	3	2	3	2	3	4	3	3	3	35
23	3	3	3	3	3	3	3	3	3	3	2	2	34
24	3	3	3	3	2	3	2	2	3	3	3	2	32
25	3	3	3	3	2	3	2	3	3	3	3	2	33

Table 6

Post-Test Scores for the Treatment Group

Code	IT1	IT2	IT3	IT4	IT5	IT6	IT7	IT8	IT9	IT10	IT11	IT12	Total
1	5	5	5	5	5	5	5	5	4	3	3	5	55
2	5	5	5	5	5	4	5	5	4	3	3	5	54
3	5	5	5	5	3	5	5	5	4	3	5	5	55
4	5	5	5	5	5	5	5	5	5	5	3	5	58
5	5	5	5	5	5	5	5	5	5	3	3	5	56
6	5	5	5	5	5	5	5	5	4	5	3	5	57
7	5	5	5	5	5	5	5	5	4	3	3	5	55
8	5	5	5	5	5	5	5	5	5	3	5	5	58
9	5	4	5	4	5	5	5	5	4	3	3	4	52
10	5	5	5	5	5	5	5	5	4	3	3	3	53
11	5	5	4	5	5	5	5	5	4	3	3	5	54
12	5	5	5	5	5	5	5	5	4	3	3	5	55
13	4	5	5	5	5	5	5	5	4	3	3	4	53
14	5	5	5	5	5	5	5	5	4	4	5	5	58
15	5	5	5	5	5	5	5	5	5	4	5	5	59
16	5	5	5	5	5	5	5	5	4	3	3	4	54
17	5	5	5	5	5	5	5	5	4	3	3	5	55
18	5	5	5	5	5	5	5	5	4	3	4	5	56
19	4	5	4	5	5	5	4	4	4	3	3	4	50
20	5	5	5	5	5	5	5	5	4	3	3	5	55
21	5	5	5	5	5	5	5	5	5	3	5	5	58
22	5	5	5	5	5	5	5	5	4	4	5	5	58
23	5	5	3	5	5	5	5	5	4	3	3	5	53
24	5	5	5	5	5	5	5	5	4	3	3	4	54
25	5	5	4	5	5	5	5	5	4	3	3	5	54

After the intervention period, researchers analyzed the mean scores of both the pre-test and post-test. Table 7 illustrates the mean difference between the pre-test and post-test scores for the treatment group, highlighting the impact of the intervention on the participants' performance.

Table 7
The Difference Between Mean Scores of Pre-Post Tests

Item	Question	Mean	
		Pre-Test	Post-Test
1.	Children can generate ideas to solve problems in science activities in preschool.	2.84	4.92
2.	Children can propose various actions during science activities.	2.80	4.96
3.	Children show an active attitude in solving problems related to science concepts.	3.00	4.80
4.	Children can come up with ideas to answer various questions related to science activities.	2.88	4.96
5.	Children can identify problems from different perspectives during science activities.	2.20	4.92
6.	Children can present their ideas in different ways during science activities.	2.84	4.96
7.	Children can provide new ideas in solving problems during science tasks.	2.40	4.96
8.	Children can empower others' ideas during science activities.	2.92	4.96
9.	Children can add or refine ideas to improve the quality of their thoughts.	3.04	4.20
10.	Children can determine the truth in solving problems during science activities.	3.00	3.28
11.	Children can develop creative ideas to implement science activities.	2.68	3.52
12.	Children have the potential to be trusted to achieve consensus during science activities.	2.12	4.72

Table 6 presents the pre-test and post-test mean scores evaluating children’s problem-solving abilities and creativity in science activities during preschool. The analysis reveals clear improvements in these competencies, attributable to the intervention. Based on general observations, all items show increases in mean scores, indicating that the intervention positively influenced children's problem-solving, creativity, and ability to contribute during science activities. Many items, such as proposing various actions, answering questions, and empowering others' ideas, reached a mean of 4.96, signifying a near-universal enhancement in these skills.

The intervention yielded significant improvements in critical thinking and collaborative skills among children. This is evidenced by the substantial increase in scores for identifying problems from different perspectives (Item 5), which rose from 2.20 to 4.92, and trust to achieve consensus (Item 12), which jumped from 2.12 to 4.72. Consistently high post-test scores in proposing actions (Item 2), presenting ideas (Item 6), and empowering others’ ideas (Item 8), all reaching a maximum of 4.96, highlight the intervention's success in promoting diverse and dynamic thinking. However, there was only marginal improvement in determining the truth in problem-solving (Item 10), from 3.00 to 3.28, and moderate progress in developing creative ideas (Item 11), from 2.68 to 3.52. This underscores the need for additional focus on fostering analytical reasoning and higher-level creativity.

In addition, based on *Table 8*, the data highlights a marked improvement in performance from the pre-test to the post-test. This suggests that an intervention conducted between the two tests may have positively influenced the participants' outcomes. The relatively low standard error values indicate reliable estimates of the population mean. Specifically, the average score for the pre-test is 32.60, while for the post-test, it is 55.16.

Table 8
Cumulative Mean Score for 12 Items in Pre-Post Tests

Test	N	Mean	Std. Error Mean
Pre-Test	25	32.60	0.316
Post-Test	25	55.16	0.442

In conclusion, the intervention significantly enhanced the holistic development of ideas among children. This is reflected in substantial gains in their ability to present ideas in different ways and add or refine ideas, demonstrating improved creativity and flexibility in thought. Additionally, notable advancements in consensus-building and empowering others' ideas indicate a marked increase in social and teamwork skills, fostering collaboration and empowerment. However, while creativity-related aspects showed robust improvements, areas such as determining truth and creative implementation require further emphasis to strengthen critical thinking and higher-order creative capabilities.

The difference in the mean score of creative thinking skills between the treatment and control groups (RQ2)

Figure 5.13 below presents the "Independent Samples Test," which demonstrates that the difference in post-test scores between the control and treatment groups was evaluated using the t-test for Equality of Means. The t-value, assuming equal variances, is -33.659 with degrees of freedom (df) = 48. The p-value (Sig. 2-tailed) is less than 0.001, indicating high significance. The disparity in post-test scores between the control and treatment groups is statistically significant. Given that the p-value is substantially below 0.05, we reject the null hypothesis, determining that the treatment group exerted a significant influence on the scores. The average difference between the control and treatment groups is -21.230. This signifies that the treatment group's post-test results exceed those of the control group by an average of 21.23 points.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means							
						Significance				95% Confidence Interval of the Difference	
		F	Sig.	t	df	One-Sided p	Two-Sided p	Mean Difference	Std. Error Difference	Lower	Upper
Posttest_Score_2	Equal variances assumed	.086	.770	-33.659	48	<.001	<.001	-21.320	.633	-22.594	-20.046
	Equal variances not assumed			-33.659	47.970	<.001	<.001	-21.320	.633	-22.594	-20.046

Figure 2: Independent Sample T-Test Result for Creative Thinking Skills

The findings indicate a statistically significant disparity between the post-test scores of the control and treatment groups. The treatment group exhibited a mean score that exceeded 21.23 points. Levene's test validates the equal variances assumption, thereby confirming that the treatment significantly enhanced performance. A p-value below 0.001 signifies that this outcome is exceedingly improbable to have arisen by chance.

In conclusion, one reason for the elevated creativity developments of children in the treatment group compared to the control group after 8 weeks of intervention is the greater variety of resources utilized in the MyPreScience Module activities. The treatment group had access to many learning materials, including natural items, scientific instruments, and digital resources, which may have afforded them greater possibilities to investigate diverse methods and solutions. Innovative thinking frequently emerges when individuals utilize various instruments to investigate novel ideas.

The effectiveness of MyPreScience Learning Module (RQ3)

To address this RQ3, only an teacher from the treatment group (E2) were interviewed. *Figure 3* is a flowchart illustrating the relationships between different aspects of the effectiveness of the MyPreScience module. The flowchart includes elements such as "Appropriateness," "Effectiveness," and "Usability," connected by causal links indicating that appropriateness, effectiveness, and usability contribute to the overall effectiveness of the MyPreScience Learning Module.

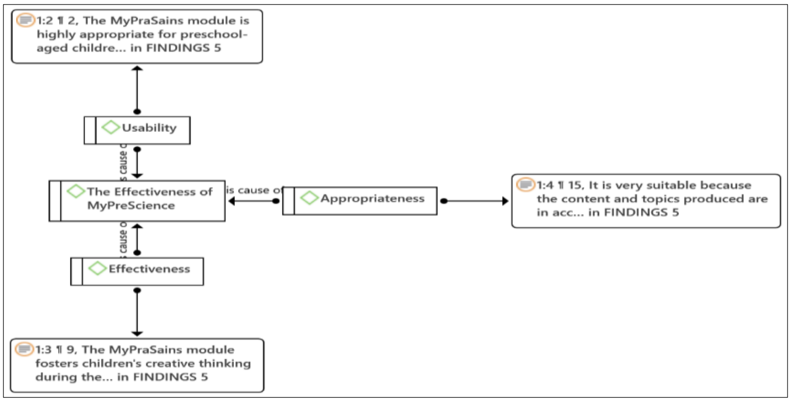

Figure 3: The Results from Content Analysis

Exploring the suitability of the MyPreScience Learning Module, E2 believes that the module serves as an essential educational tool that not only meets national curriculum standards but also provides a fun, interactive, and enriching way for young children to engage with science. This ensures that they develop foundational skills and a curiosity about the world around them, setting the stage for future learning. This is evidenced by the teacher's statements below:

> *"You know what that this module is highly appropriate for preschool-aged children. The projects presented in this module are exemplary. It provides children with early science activity experiences aligned with the competencies of the National Preschool Standard Curriculum, coordinated at the preschool level. Please explain this sentence in deeper elaboration."* – E2

The statement above highlights that E2 believes the suitability of this module lies in its design, which is specifically tailored for preschool-aged children, typically between 4 to 6 years old. This developmental stage is crucial for early childhood, where children are naturally curious and eager to explore their surroundings. The MyPreScience module addresses this curiosity by introducing simple science concepts through hands-on and experiential learning, aligning with their cognitive and developmental needs.

In addition, regarding the module's effectiveness in enhancing children's creativity, E2 believes that the MyPreScience module is a comprehensive educational tool designed to enhance preschool children's creative thinking skills through engaging, project-based activities. By providing resources and encouraging contemplation of outcomes, the module helps children develop critical thinking and problem-solving abilities. The feedback received upon project completion further reinforces their learning and fosters continuous improvement. This is evidenced by the teacher's statements below:

> *"I believe that MyPreScience module fosters children's creative thinking during the early years of preschool by providing resources in a project that stimulates contemplation of subsequent outcomes. Upon the project completion, they will receive feedback based on their implementations." – E2*

Next, considering the usability of this module, E2 believes the module is highly suitable as its content and topics align with the elements established in the National Preschool Standard Document 2017. It is considered useful for use across all levels of kindergarten and preschool education. This can be evidenced by the teacher's statements below:

> *"It is very suitable because the content and topics produced are in accordance with the elements formed in the National Preschool Standard Document 2017. In my view, this module is very suitable for use at all levels of kindergarten and preschool."* – E2

In summary, MyPreScience Learning Module is recognized by E2 as an essential and highly suitable educational tool for preschool-aged children (5–6 years old). It effectively supports early science education by combining hands-on, experiential learning with curriculum alignment to the National Preschool Standard Curriculum. Key aspects of its suitability include fostering curiosity, critical thinking, and creativity through project-based activities, as well as promoting foundational scientific skills in a fun and engaging manner. In addition, E2 emphasizes the module's ability to enhance children's creative thinking by encouraging them to explore, analyse outcomes, and reflect on feedback, which further solidifies their learning. Additionally, the module's content and topics align with the National Preschool Standard Curriculum, making it a valuable resource for use across all kindergarten and preschool levels. These attributes are evidenced by E2's positive feedback, underscoring the module's relevance and effectiveness in early childhood education.

Discussion

Summary of results

Children's Creative Skills before and after using MyPreScience

Children demonstrate better performance after using science learning modules like MyPreScience compared to conventional learning methods due to several critical factors, including pedagogical approaches that are more relevant to the developmental needs of children. This is because active and interactive learning approaches through project-based activities (TPBL) stimulate the development of children's creativity when solving tasks. As evidence, Dai et al. (2023) explain that the integration of technology in classrooms enhances the effectiveness of project-based learning approaches, potentially leading to improved student engagement and learning outcomes based on the creative actions empowered by them while doing activities. This supports the notion that such modules not only align with children's natural learning processes but also foster a more engaging and effective educational environment.

Furthermore, children exhibit positive creative development throughout the execution of 8 projects based on the module because it is relevant to their developmental stages. The MyPreScience module is specifically designed based on the cognitive and social developmental stages of preschool children, in accordance with Vygotsky's theory, which emphasizes that children learn better through experiences with their social environment. In a previous study, researchers argued that Vygotsky's theories offer valuable insights into the role of social interaction and cultural tools in cognitive development. They also highlighted the relevance of these theories in contemporary educational practices, suggesting that teachers can use Vygotsky's ideas to create more effective and culturally responsive learning environments (Kozulin et al., 2003). This study is evidenced by how teachers provide opportunities for children to participate transparently in the classroom through their creative ideas, as shown in *Figure 4* below:

Figure 4: Children Did a Volcano Activity Based on Their Own Idea

Based on the figure above, before children developed their creative ideas to solve problems in Science Education Project 1: Exploring Volcano Eruptions, they first gathered initial ideas through a technology-based activity and observed a simulation by the teacher. Subsequently, they were given open opportunities and freedom to make decisions on exploring the eruption based on their ideas, which could be refined through the various activities they observed earlier.

Children's Creative Skills based on Post-Test's Result from 2 Different Group

The differing outcomes between the treatment and control groups indicate that 21st-century learning using the TPBL approach (Meng et al., 2023) is highly impactful in contemporary education. The independent t-test scores reveal that the treatment group achieved higher scores because the children were empowered to openly demonstrate their creative ideas, unlike the children in the control group, who primarily followed their teachers' instructions when making decisions to solve the given tasks. Muhamad and Seng (2019) explain that one key difference between conventional and contemporary learning is that conventional teachers focus more on what children remember, whereas contemporary teachers, aligning with educational trends, place greater emphasis on the learning process where learners work collaboratively with peers and teachers. *Figure 5* illustrates the differences in how children from the control and treatment groups approach the same science activity topic of exploring the chicken cycle.

Action A: Children just listened up to the explanation Action B: Children solved the problem collaboratively

Figure 5: Different Style of Learning between Control (Action A) and Treatment Group (Action B)

Based on Figure 5, it can be observed that teachers from the control group employ teacher-centered learning strategies, whereas the strategy used by teachers from the treatment group is student-centered learning (Cummins, 2009). Teacher-centered learning is a traditional approach in education where the teacher serves as the primary authority figure in the learning process. In this approach, the teacher fully controls the teaching activities, while children act as passive recipients of information. The main focus is on content delivery, achieving curriculum objectives, and mastering basic skills by students (Garrett, 2008). In contrast, student-centered learning is an educational approach that places children at the core of the learning process. This approach prioritizes the needs, interests, talents, and experiences of the children, with the teacher acting as a facilitator or guide rather than the primary source of information. It aims to provide children with opportunities to explore, think critically and creatively, and learn practically (Murphy et al., 2020).

Therefore, this study demonstrates that the implementation of teaching and facilitation activities in science education should prioritize the learning process over learning outcomes. To ensure the continuity of this process, it is appropriate for teachers to adopt a student-centered learning approach (Morel, 2021). In addition, Kerimbayev et al. (2023) highlight the importance of student-centered learning, especially when integrated with modern technologies in distance learning environments. Their systematic review suggests that student-centered approaches foster greater engagement, motivation, and active participation among learners. By placing students at the core of the learning process, these methods encourage autonomy, critical thinking, and collaboration, which are essential skills for the 21st century. The review also emphasizes that student-centered learning can lead to more meaningful and personalized educational experiences, ultimately enhancing overall learning outcomes.

The Effectiveness of TPBL Learning Module

The use of the MyPreScience Learning Module is a modern teaching and facilitation method that emphasizes experiential learning, exploration, and problem-solving with the aid of technology. The TPBL (Technology-Integrated Project-Based Learning) approach in science education supports various aspects of child development, including cognitive, social, and technical skills, making it highly relevant for the educational needs of the 21st century (Akgun, 2013). One of the key benefits is that it empowers children to demonstrate their creativity when solving given tasks. This is because the project approach involves children in solving real-world problems through research, experimentation, and collaboration. Additionally, the use of technology, such as educational videos and creative software, helps children to find information, analyze data, and produce innovative solutions. Jani (2021) explains that the most effective way to integrate technology and project aspects practically is through the flipped classroom method, as studied by Nouri (2016). This can be achieved by introducing technology-based activities for brainstorming and practical project implementation activities for problem-solving. The impact of integrating technology in PBL lies in the role of technological materials used in the classroom as facilitators. These tools nurture the learning and facilitation processes by providing opportunities for designing and implementing science projects, thereby enhancing the overall learning experience (Akgun, 2013).

Implications

The incorporation of the TPBL approach in educational practices has significant ramifications for children, educators, and the educational system overall. This approach provides considerable advantages but also requires modifications in pedagogical tactics and budget allocation. A significant aspect is the improvement of 21st-century abilities in children. The TPBL approach to science education encourages learners to address real-world challenges, necessitating the application of critical and creative thinking skills (Mabe et al., 2022). For example, when children undertake a study project to rebuild a terrarium, they have to analyze data using educational videos, collaborate with peers in designing and building of the terrarium, and use their own ideas in its creation. Such activities refine their cognitive abilities and offer an opportunity for independent problem-solving.

Additionally, the application of TPBL in education significantly affects educators, notably regarding their duties and responsibilities in the classroom (Muzana et al., 2021). Educators are no longer mere transmitters of knowledge; they must evolve into more dynamic roles as facilitators of learning. This transition entails not only acquiring new competencies but also transforming the planning and execution of more participatory and successful educational activities. In this approach, educators no longer merely teach directly; rather, they enhance the learning process of the pupils. Educators, as facilitators, must cultivate a learning environment that fosters discovery, autonomous learning, and collaboration among students, and it should be aligned with 21^{st} century learning (Lapcharoen, 2021). They must create an environment that allows children to take the initiative in learning, investigate novel concepts, and address challenges through their projects.

Next, the final implication pertains to the educational system. TPBL significantly influences the entire educational system. This approach provides multiple advantages for improving learning quality, although it necessitates substantial modifications in infrastructure and support within the educational system (Meng et al., 2023). A fundamental implication is the necessity for sufficient technology infrastructure to facilitate the seamless and efficient execution of this method. For technology to be effective in PBL, schools must have reliable internet access. Dependable internet access is essential for utilizing technology tools in education, particularly for tasks necessitating online research or collaboration with external entities. In the absence of stable internet connectivity, children may encounter challenges in obtaining essential information, engaging in online activities, or interacting with their peers and educators. Consequently, educational institutions must guarantee that the internet connectivity across the campus is adequate and capable of facilitating uninterrupted technological utilization.

Conclusion

The TPBL in early science learning has shown a significant positive impact on children's creative thinking skills. This approach transforms the traditional teacher-centered learning environment into a dynamic, interactive space where children engage in real-world problem-solving through research, experimentation, and collaboration. The use of technological tools enhances the learning experience by providing access to diverse resources, facilitating data analysis, and enabling the creation of innovative solutions. As demonstrated in the study, this method not only increases children's engagement and motivation but also fosters critical and creative thinking. The transition from passive information receivers to active participants in the learning process empowers children to take initiative, explore new ideas, and develop problem-solving skills, thereby preparing them for future educational and life challenges. These findings underscore the importance of integrating technology and PBL into educational practices to nurture essential 21st-century skills in young learners.

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Appendix A: The Approval of Conducting a Research Issued by the Ministry of Education Malaysia

MINISTRY OF EDUCATION MALAYSIA EDUCATION POLICY PLANNING AND RESEARCH DIVISION LEVELS 1-4, BLOCK E8 GOVERNMENT COMPLEX PARCEL E FEDERAL GOVERNMENT ADMINISTRATIVE CENTRE 62604 PUTRAJAYA

TEL : 0388846591
FAX : 0388846579

Our Ref. : KPM.600-3/2/3-eras(20219)
Date : May 12, 2024

MUHAMMAD NUR AZAM BIN GHAZALI
IC. NO.: 960518****

D/A KG PERMATANG PASIR, GUNUNG 16090 BACHOK KELANTAN Sir, CONDITIONAL APPROVAL TO CONDUCT A STUDY: THE EFFECTIVENESS OF A PROJECT-BASED LEARNING SCIENCE MODULE TO PROMOTE SOCIAL INTERACTION, CREATIVITY AND LEARNING MOTIVATION AMONG PRESCHOOL CHILDREN

The above is referred to.

2. Please be informed that your application to conduct the study as below has been approved with the following conditions:

" THIS APPROVAL IS DEPENDENT ON THE PERMISSION OF THE DIRECTOR OF THE NPR AND THE DISCRETION OF THE SCHOOL ADMINISTRATOR. DATA COLLECTION SHOULD NOT INTERFERE WITH THE TEACHING AND LEARNING ACTIVITIES OF THE STUDENTS. THE RESEARCHER MUST OBTAIN WRITTEN PERMISSION FROM THE PARENTS OF THE STUDENTS INVOLVED IN THIS STUDY. SCHOOL ADMINISTRATORS NEED TO RESEARCH THE SUITABILITY OF THE MODULE DEVELOPED BEFORE USING IT BY THE STUDENTS. THE NAME ITEM ON THE INTERVIEW INSTRUMENT SHOULD ISSUED TO PROTECT RESPONDENTS' PERSONAL DATA. "

3. Approval is based on the research proposal paper and research instruments submitted by you to this section. However, this approval depends on the permission of the State Education Department and the relevant Principal/Headmaster.

4. This approval letter is valid for use from 1 July 2024 to 25 December 2024

5. You are required to submit a copy of the final study report in hardcopy form along with a softcopy in pdf format on a CD to this Division. You are also reminded to obtain prior permission from this Division if part or all of the study findings are to be published in any forum, seminar or announced to the mass media.

That's all for your information and further action. Thank you.

"SERVING FOR THE COUNTRY"

I am the one who carries out the trust,

Principal Senior Assistant Director, Policy Research and Evaluation Sector, Director of the Educational Policy Planning and Research Division, Ministry of Education, Malaysia

copy to:-
KELANTAN EDUCATION DEPARTMENT

* THIS LETTER IS COMPUTER GENERATED AND NO SIGNATURE IS REQUIRED *

Appendix B: The Approval of Conducting a Research Issued by the Kelantan State Education Department (Malay Language Version)

THE MINISTRY OF EDUCATION MALAYSIA
Kelantan State Education Department
Bandar Baru Tunjong,
16010 Kota Bharu, Kelantan

Tel : 09-7418000
Fax : 09-7482554
Website: jpnkelantan.moe.gov .my

Ref. Us: JPNKN.600-1/1/2 Vol.2(20)
Date : 22 May 2024

MUHAMMAD NUR AZAM BIN GHAZALI
NO. K / P: 960518-03-6103

D / A KG RIDGE SAND, MOUNTAIN
16090 BACHOK
KELANTAN

Sir / Madam,

PERMISSION TO CONDUCT STUDIES IN SCHOOLS, TEACHER EDUCATION INSTITUTIONS, STATE EDUCATION DEPARTMENTS AND DIVISIONS OF THE MINISTRY OF EDUCATION

It is with great respect that I refer to your letter of request regarding the above.

2. Permission letter from the director of Education Policy Planning & Research Division, Ministry of Education Malaysia, reference: Moe.600-3/2/3 - eras (20219) dated May 12, 2024 related.

3. The State Department of Education has no control over research: "the EFFECTIVENESS of PROJECT-BASED LEARNING MODULE TO PROMOTE SOCIAL INTERACTION, CREATIVITY AND LEARNING MOTIVATION AMONG PRESCHOOL CHILDREN."approved.

4. This list is based on the number of studies / submitted to this department for the period from 1 July 2024 to 25 December 2024.

5. The schools involved are: primary schools in the state of Kelantan.

6. You are advised to talk to the principal first schools prior to the study.

That's all, thank you.

"MALAYSIA MADANI"

"SERVING THE COUNTRY"

I run the trust,

(HJ. MOHAMAD BIN ABD. WAHAB B.S.K., A.S.K.)
Deputy Director Of Education
PPD planning and management sector
b.P Director of Education
Kelantan State Education Department

s.k.:
i. Director Of Education Kelantan.
ii. Director, Education Policy Planning & Research Division. Ministry Of Education Malaysia.
iii. District Education Officer: PPD concerned.
iv. The Principal / Principal of the school

"QUALITY EDUCATION AND A HEALTHY ENVIRONMENT"