

DEVELOPMENT OF AN INTEGRATED-THEMATIC- INSTRUCTION STREAM MODULE FOR PRESCHOOL IN MALAYSIA

PHANG WAI LENG

SULTAN IDRIS EDUCATION UNIVERSITY

2025



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Kampus Sultan Abdul Jalil Shah



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THESIS PRESENTED TO QUALIFY FOR DOCTOR OF PHILOSOPHY

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ABSTRACT

This study aims to design and develop a preschool integrated-thematic-instruction STREAM (Science, Technology, Reading, Engineering, Arts, and Mathematics) module to enhance teachers' skills. The Design and Development Research (DDR) approach was employed in this study, which consisted of three phases. The first phase analysed the need for developing the STREAM module for preschool. A survey method was conducted involving 40 early childhood educators and 40 pre-service early childhood educators as respondents. Descriptive statistics were used for analysis. The findings from the needs analysis revealed that the development of the STREAM ITI-Preschool module is necessary to enhance teachers' skills in STREAM ITI-Preschool education. The second phase focused on designing and developing the STREAM ITI-Preschool module, which involved consensus among ten experts on the module's main components through two rounds. Thematic analysis was conducted in the first round, where emerging themes included the need for the STREAM ITI-Preschool module, effective criteria for the module, and trends in teaching strategies and learning topics. The second round employed the Fuzzy Delphi method. The findings indicated that all items recorded a threshold value $d \leq 0.2$, demonstrating agreement among experts with a consensus percentage exceeding 75%. The third phase evaluated the usability of the module based on prospective and pedagogical aspects. Focus group interviews and trainer workshops involving six early childhood educators were conducted to assess the usability of the STREAM ITI-Preschool module. The findings showed that this module can be used by preschool educators due to its thematic and integrated activities that captivate children's interest. In conclusion, the development of the STREAM ITI-Preschool integrated instructional teaching module supports preschool children's learning and the professional development of preschool educators to achieve quality education. The implications of the STREAM ITI-Preschool module highlight its potential to help educators foster preschool children's interest in STREAM learning.





PEMBANGUNAN MODUL STREAM INTEGRATED-THEMATIC- INSTRUCTION PRASEKOLAH DI MALAYSIA

ABSTRAK

Kajian ini bertujuan untuk mereka bentuk dan membangunkan modul instruksional tematik bersepadu STREAM (Science, Technology, Reading, Engineering, Arts, and Mathematics) prasekolah. Pendekatan Penyelidikan Reka Bentuk dan Pembangunan (DDR) digunakan dalam kajian ini dan melibatkan tiga fasa. Fasa pertama ialah menganalisis keperluan pembangunan modul STREAM bagi prasekolah. Kaedah tinjauan melibatkan responden seramai 40 orang pendidik awal kanak-kanak dan 40 orang pra-perkhidmatan pendidik awal kanak-kanak. Analisis yang digunakan ialah statistik deskriptif. Dapatan kajian analisis keperluan mendedahkan bahawa pembangunan modul STREAM ITI-Prasekolah adalah perlu untuk meningkatkan kemahiran guru untuk pendidikan STREAM Prasekolah. Fasa kedua ialah merekabentuk dan membangun modul STREAM ITI-Prasekolah yang melibatkan konsensus sepuluh orang pakar mengenai komponen utama modul STREAM ITI-Prasekolah sebanyak dua pusingan. Analisis bertema digunakan dalam pusingan pertama. Tema yang muncul ialah keperluan modul STREAM ITI-Prasekolah, kriteria berkesan bagi modul STREAM ITI-Prasekolah, dan kecenderungan strategi pengajaran dan topik pembelajaran. Pusingan kedua menggunakan kaedah Fuzzy Delphi. Dapatan kajian menunjukkan bahawa semua item merekodkan nilai Ambang $d \leq 0.2$. Ini menunjukkan bahawa semua item telah dipersetujui oleh pakar dengan konsensus dan memenuhi syarat peratusan konsensus pakar iaitu $> 75\%$. Fasa ketiga menilai kebolegunaan modul berdasarkan aspek prospektif dan pedagogi. Kaedah temubual kumpulan fokus dan bengkel jurulatih kepada enam orang pendidik awal kanak-kanak dilaksanakan bagi menilai kebolegunaan modul STREAM ITI-Prasekolah. Dapatan menunjukkan modul ini dapat digunakan oleh pendidik prasekolah kerana aktiviti bertema dan bersepadu yang menarik minat kanak-kanak. Kesimpulannya, pembangunan modul instruksional tematik bersepadu STREAM ITI-Prasekolah menyokong pembelajaran kanak-kanak prasekolah dan pembangunan profesional pendidik prasekolah bagi mencapai pendidikan berkualiti. Implikasi modul STREAM ITI-Prasekolah dapat membantu pendidik untuk menyemai minat kanak-kanak prasekolah dalam pembelajaran STREAM.



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LIST OF ABBREVIATIONS

DDR	Design and Development Research
ECE	Early Childhood Education
ITI	Integrated-Thematic-Instruction
KSPK	Kurikulum Standard Prasekolah Kebangsaan.
MOE	Ministry of Education
NAEYC	National Association for the Education of Young Children
NPE	National Philosophy of Education
NSPC	National Standard Curriculum
OCED	The Organization for Economic Co-operation and Development





LIST OF APPENDICES

- A Validated Questionnaire – Needs Analysis
- B Interview Questions: Criteria To Develop A “Stream Literacy Module”
- C Participant Information Sheet
- D Expert Panel Validation on The Usability of Preschool Stream Literacy Module in Teaching and Learning





CHAPTER 1

INTRODUCTION

1.1 Introduction

STREAM is the acronym for science, technology, reading, engineering, aesthetics, and mathematics. STREAM education is a unique, comprehensive, multidisciplinary approach integrating various subject areas into teaching and learning. It is a significant approach in the field of modern education. Preschool STREAM education integrates Science, Technology, Reading (wRiting), Aesthetics development, and Mathematics (S.T.R.E.A.M.) into the classroom teaching and learning process, to promote positive educational outcomes and best practices to sustain quality education.

The Ministry of Education (MOE) in Malaysia aims to cultivate innovation and capable human capital to transform the nation into a sustainable, developed country and meet the demand in an ever-changing world. In 2019, STREAM is a new approach introduced by MOE to deliver better STEM education in Malaysia (Wang, 2019). The National Education Blueprint (2013-2025) highlighted that STEM education is a





critical transformation of the educational system project that should be instilled from preschool onwards to enhance the nation's STEM-related workforce. Preschool STREAM is regarded as the stairway to achieving sustainability and developmental goals. Therefore, preschool STREAM education as the early foundation has become essential to be implemented starting from the early years, as it can prepare more children to enter STEM-related fields in the long run. Paying attention to the quality of STREAM education can ensure a prosperous economy in the future of Malaysia.

There is a considerable national interest in preschool STREAM education in Malaysia as the Ministry of Education has even set up its national committee to spearhead STREAM initiatives, especially in education at all levels (Ompok, 2020). According to Yalcin (2022), children can be creative and productive, producing solutions to problems by having prior knowledge, with the emergence of more innovative activities, in design-oriented STREAM applications. The preschool period is when the development of children is the fastest; the basic concepts are acquired quickly (Akçay, 2022). These basic concepts form the foundation for concepts that children will learn in their future lives. Early exposure to STREAM education enables young children to benefit from the integrated and exciting learning experiences, which can contribute to acquiring 21st-century skills, which are crucial to later academic achievement (Dejarnette, 2018; Raja & Bahari, 2017). During the preschool period, young children are naturally equipped with the skills that form the basis for STREAM education (Yucelyigit & Toker, 2020). They are born scientists and engineers as they naturally learn through observation, exploration, and experimentation; they are full of curiosity and enthusiasm for the environment around them (Dilek et al., 2020).





Preschool STREAM education is a philosophy and guiding principle. STREAM is generally considered an interdisciplinary approach. It is a way of thinking towards an interdisciplinary approach, in which Science, Technology, Reading, Engineering, Arts, and Mathematics are integrated in the early childhood programme to provide the young children with a well-rounded education and equip them with the 21st century skills, which are related 4Cs of STREAM learning. These four specific skills were deemed to be the most important. They are known as the “four Cs”, consist of communication, critical thinking, creativity, and collaboration. The interdisciplinary approach involves the integration of knowledge and methods from various disciplines to gain a holistic view of a problem and develop more solutions. In the aspect of education, teacher education programmes that incorporate an interdisciplinary approach prepare them with diverse skills will then set a holistic understanding of educational practices. Naturally, STREAM education has a natural extension of these four skills, which complement each other as an essential part of the learning process. STREAM education teaches and trains children to engage in critical thinking, inquiry, problem-solving, collaboration, and what is often referred to in engineering as “design thinking”. These stand out as skills that all children in schools should have. Hence, all future workers will need to be successful in college, career, and practical life.

Understanding and integrating preschool STREAM education in Malaysia is the priority for our national education programme. It is an ongoing effort to further develop individuals' potential holistically and integratively. It is an approach to a STREAM literacy workforce and literate citizens under the Malaysia Blueprint (2013 – 2025).





The role of children in nation-building is important and must be valued. Therefore, it is crucial to equip young children with skills and knowledge to face the changing world towards education for sustainable development. The Sustainable Development Goals (SDGs) or Global Goals were set up in 2015 by the United Nations General Assembly and are intended to be achieved by the year 2030. It is a universal call to action not only to end poverty, but to ensure that SDG4, Quality education, is attained. The usability of suitable pedagogical strategies and activities in the classroom is a vital key in the Malaysian education system (Jaya et al., 2021). Teachers need the transition from conventional pedagogical approaches to STREAM digitalization approaches with child-centred activities. Three targets need to be achieved by the year 2030. One of the targets is sustainability to increase the number of youth and adults who have relevant skills for employment, decent jobs, and entrepreneurship. Secondly, to ensure that all learners acquire the knowledge and skills needed to promote education for sustainable development. Therefore, the National Education Blueprint (2013-2025) highlighted that STREAM education is a critical transformation of the educational system project that should be instilled from preschool onwards to enhance the nation's STREAM-related workforce. The third target is 2030, to substantially increase the supply of qualified STREAM teachers, including through international cooperation for teacher training in developing countries.

1.2 Background of the Study

Nowadays, the educators are always talking about STEM, STEAM, and STREAM, and with good reasons, and the educators are navigating the process of turning STEM into





STEAM, or even STREAM (Ali Trachta, 2018; Diane Kashin, 2017). It was emphasized in a written article (Childcare of Southwest Florida, 2018) that the importance of STEM is to educate and prepare children in the areas of science, technology, engineering, and mathematics. Soon after STEM, STEAM – science, technology, engineering, art, and mathematics. By incorporating art into the mix, this adds the design and creativity needed to look at a situation and develop a plan. This allows children to increase their technical skills while using creative ingenuity. Now let us add the newest acronym, STREAM – science, technology, reading, engineering, arts, and math. This movement recognizes that reading is foundational to all early childhood education in various learning areas. Essentially, STEM, STEAM, and STREAM are being implemented to ensure that young children receive a well-rounded education.



Why is STREAM gaining popularity? STREAM is a holistic approach to education that provides opportunities for young children to apply their learning in real-life situations - learning by doing, with hands-on and minds-on. Why STREAM in early childhood? STREAM pervades every part of young children's lives. STREAM helps young children apply their knowledge and skills to real-world situations. It is far beyond STEM: Integrating an interdisciplinary approach. The researcher in this study regards STREAM as the evolution of active learning in the 21st-century classroom. The evolution of STEM to STREAM education has positively impacted the related fields and disciplines immeasurably (Badmus Olalekan et al., 2020).

According to Ananya Debroy (2017), the total attention to STEM learning has been widening to a new model named STREAM. In addition to the STEM model, it includes Arts or Aesthetics, and the 'Reading and Writing' concept. Initially, it was first





known as STEM, which was then updated by educator bodies into STREAM. This massive change was significant in actively promoting the 21st-century skills in children. To integrate 'R' (Reading and Writing) and 'A' (Arts) into the STEM model is thus necessary, as it has been discovered that both areas assist in any discipline. Same mindset as Kashin (2017), both believed that adding 'Reading' and 'arts' to the STEM model creates a multidisciplinary and holistic approach and acts as a mediator that supports cross-curricular teaching processes (Debroy, 2017). Indeed, this infusing of 'Reading & Writing' into the STREAM model was important because it has been found that writing, like any other art, helps in teaching an entire range of tools for thinking, which are required to be creative in any discipline. Thus, such an update from STEM to STEAM, and from STEAM to STREAM, was indeed critical.



As the educators enter the second decade of the 21st century, countries across the world have been competitively focusing on the improvement of new educational approaches, which are known as STREAM. This practical approach is to sustain quality education to prescribe a set of meaningful activities or practices as well as to enhance opportunities for innovation, research, and development. All the educators We must initiate a curricular vision that meets a new spectrum of vital interests, if the 4Cs: creativity, collaboration, communication, and critical thinking skills all touted as the hallmark skills for 21st century success, then preschool educators should ensure that the STEM education is drawn closer to Reading (wRiting) and Aesthetic (Arts). The reason is that these skills are important for encouraging active thinking and providing opportunities for young children to develop into confident, capable learners in the modern society (Debroy, n.d.).





1.2.1 STEM-STREAM in Preschool Education

In this modern era of technological advancement, STREAM education has a positive educational impact on producing manpower that has the necessary qualifications to meet the demands of the STREAM workforce. Since the fourth industrial revolution, the tremendous evolution of the technological aspect has rapidly changed our lives, especially the labour market and the nature of work (Idris & Bacotang,2023). STREAM emphasises the importance of science, technology, engineering, and mathematics education. The objective of STREAM education is to foster children's ability to collaborate with others as well as develop a critical thinking mindset that produces creative and innovative solutions to address complex real-life problems effectively. It is an interdisciplinary approach that influences every education level, and it includes different forms of modern teaching and learning methods, such as inquiry-based learning and project-based learning. STREAM education can be integrated with Sustainable Development Goals (SDGs), as both have deep connections since it allows young children to apply STREAM concepts and knowledge to solve real-world problems while contributing to society through informative and practical learning experiences.

STREAM education is an integrated approach with a holistic approach. It allows young children to understand the world differently, in a way that is free from the socially constructed delineation of disciplines. Think of yourself as the Avatar, mastering all six elements. In particular, educators should focus on the learning theories of information processing, constructivism, and sociocultural theory for good reasons because through STEM-STREAM activities, young children develop key skills, including decision





making, critical thinking, as well as creativity skills. Moreover, the focus of STREAM education is hands-on, problem-based learning. Preschool STREAM is an interdisciplinary approach that helps and prepares young children to succeed in college and their future careers. STEM-STREAM in education is both a curriculum and a pedagogy. The curriculum includes cross-curricular real-world challenges for young children to solve.

1.2.2 National Education Philosophy in Malaysia

Education in Malaysia is an ongoing effort towards further developing the potential of individuals in a holistic and integrated manner, to produce intellectually, spiritually, emotionally, and physically balanced and harmonic individuals based on a firm belief in and devotion to God. Such an effort is designed to produce Malaysian citizens who are knowledgeable and competent, who possess high moral standards and who are responsible and capable of achieving a high level of personal well-being as well as being able to contribute to the harmony and betterment of the family, the society, and the nation at large. (Education Act, 1996 (Act 550))

Teacher education in Malaysia is an on-going effort towards producing teachers who are of high moral standards, who possess progressive and scientific vision, who are committed to uphold national aspirations and cultural heritage, who ensure the development of individuals, and who preserve a united, democratic, progressive, and disciplined society (Ministry of Education, 2001). The construction of the preschool ITI-STREAM module is based on the guide driven by the Preschool Curriculum Standard Document, which highlights the embedded thematic approach (KSPK, 2017),





and driven by the National Philosophy of Education (MOE, 2001) that is moving towards a holistic and integrated manner. The preschool teachers should believe that the potential of individuals can be developed through the process of education. These individuals' potentials cover all intellectual, spiritual, emotional, and physical aspects. Holistic development by integrating all the potential of individuals in such a manner will produce balanced and harmonious citizens. Following this, another important factor that could not be ignored was the influence of the development of the international education system. For example, the education programmes such as democratization and globalization of education, and lifelong learning, which were discussed and adopted by UNESCO in the eighties. The influence of these international factors can be identified at the beginning of the National Philosophy of Education (MOE, 2001): “Education in Malaysia is an ongoing effort”, which reflects the concept of lifelong education concerning globalization of education. Hence, the focus of a STREAM education that relates to the 21st-century skills that involve good communication, collaboration, creativity, and critical thinking is much encouraged (Malaysia Blueprint, 2013 -2025).

Preschool STEM-STREAM education has been officially announced in the educational policy in Malaysia since 2013 (Malaysia Blueprint 2013-2025). The National Preschool Standards-Based Curriculum is developed based on six learning strands: Communication, Spirituality, Attitudes and Values, Humanity, Personal Competence, Physical Development and Aesthetics, and Science and Technology. These six learning strands are the main domains that complement one another and are integrated with critical, creative, and innovative thinking. The integration aims to





develop human capital that appreciates moral values based on religion, knowledge, competence, creative and critical thinking, and innovation.

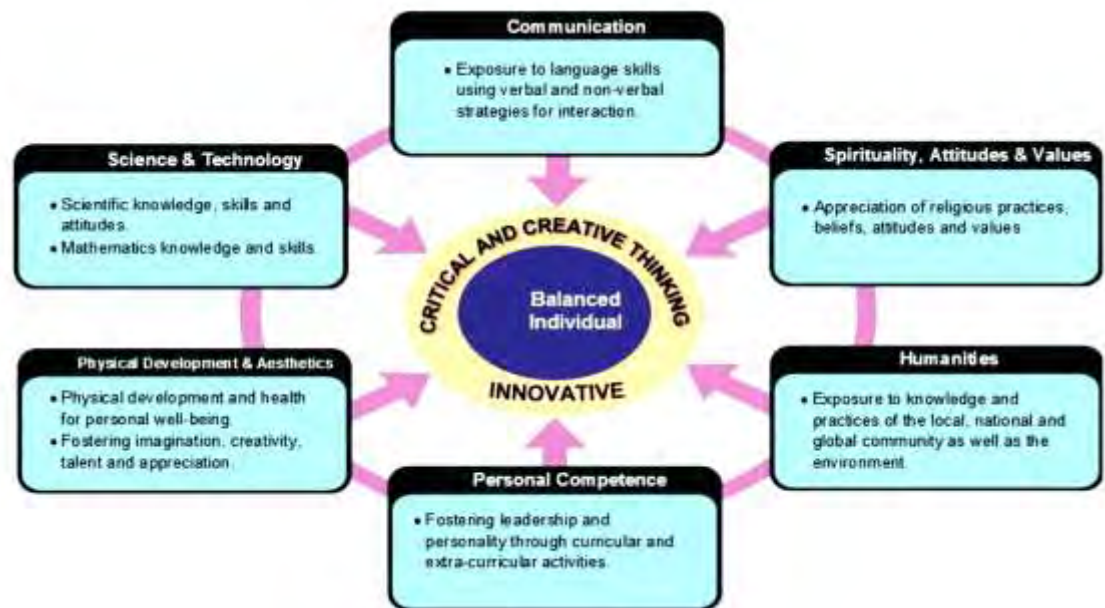
1.2.3 The National Preschool Curriculum Standard-Based Curriculum

Preschool STEM-STREAM education is embedded in the preschool curriculum under the strand of Science and Technology. In the cross-curricular elements, integration of science and technology in the teaching and learning process covers knowledge of science and technology, scientific skills, scientific attitudes, and the use of technology in teaching and learning. Early science emphasises much on the formation of the mastery of science process skills and scientific attitudes through investigation of the living world, material world, and physical world (KSPK, 2017).



The following Figure 1.1 is the Framework for National Preschool Standards-Based Curriculum, in which Science and Technology focus on scientific knowledge and attitudes, as well as mathematics knowledge and skills.



Figure 1.1*The Framework for National Preschool Standards-Based Curriculum***1.2.4 Why Must STEM be Expanded to STREAM?**

STREAM education is gaining popularity in early childhood education as a unique instructional approach that integrates thematic and disciplinary patterns into classroom practice (Debroy, n.d.). The inclusion of "Reading and wRiting" in STREAM provides children with more opportunities for inquiry, communication, critical thinking, and creative problem-solving, emphasizing 21st-century skills (Debroy, n.d.). The idea that language skills support school readiness, predicting later self-regulation and academic success, is widely accepted (Ramsook et al., 2022).

The researcher strongly believes that the power of education can greatly improve and transform lives and equip our young children with the desired skills, knowledge, and values to tackle the global changes. The education system is supposed



to benefit young children everywhere, providing them with the opportunity for real-life learning in our national curriculum and around the world.

For early education, the preschool teachers should not sacrifice reading and writing, as well as the arts, because they are undoubtedly important for whole child development. By incorporating “R”- Reading and Writing; and “A”- Arts or Aesthetic into the mix, this adds to the National Preschool Standard-Based Curriculum with the Communication Strand in which to promote Reading and wRiting skills; as well as the physical Development and Aesthetics to foster creativity and talents (KSPK 2017). Therefore, with such a preschool curriculum and pedagogy to turn STEM to STEAM and further into STREAM is a good driving force to build the holistic approach of modern preschool curriculum, and work towards the national philosophy of education for the 21st-century classroom. In the Malaysian context, the educational system is currently transforming to develop a refined articulation of the specific skills and attributes that young children would need to thrive in tomorrow’s economy and globalised world. Abdullah (2014) reviewed those children of today have evolved their approach to learning compared to their predecessors. Yaacob (2016) further emphasised that the vision of teacher training institutions is to implement a quality teacher education system to produce competent professionals who are ready to uphold the aspirations of the Malaysian educational system.

Why aesthetic or creativity development is important in early childhood education? Most of the time, preschool teachers promote creativity with art and craft activities. Here are several reasons why fostering creativity in preschoolers is important:





(i) Expression of Individuality

Creative activities provide preschoolers with opportunities to express themselves and their unique ideas, feelings, and experiences. Through art, music, storytelling, and imaginative play, children can explore and communicate their thoughts and emotions in meaningful ways.

(ii) Cognitive Development

Engaging in creative activities stimulates cognitive development by encouraging critical thinking, problem-solving, and decision-making skills. When children experiment with different materials, textures, colors, and shapes, they learn to make choices, explore cause-and-effect relationships, and develop spatial awareness and visual-spatial skills.



(iii) Imagination and Innovation

Creativity nurtures imagination and innovation by encouraging children to think outside the box and envision new possibilities. Through imaginative play and open-ended activities, children learn to create, invent, and problem-solve, laying the groundwork for future innovation and creativity in various domains.

(iv) Self-Confidence and Self-Esteem

Participating in creative activities boosts preschoolers' self-confidence and self-esteem by providing opportunities for success and self-expression. When children create something unique and receive positive feedback from teachers, peers, and caregivers, they develop a sense of pride and accomplishment, which contributes to their overall well-being and sense of self-worth.





(v) Social and Emotional Development

Creative activities promote social and emotional development by encouraging cooperation, collaboration, and empathy. When children engage in group projects, they learn to share materials, take turns, and respect others' ideas and perspectives. Creative expression also serves as an outlet for processing emotions, reducing stress, and fostering emotional resilience.

(vi) Fine and Gross Motor Skills

Creative activities support the development of fine and gross motor skills by encouraging children to use their hands, fingers, and bodies in purposeful ways. Whether painting, drawing, cutting, or sculpting, children develop coordination, dexterity, and muscle strength through hands-on creative experiences.



(vii) Appreciation for the Arts and Culture

Exposing preschoolers to various forms of art, music, literature, and cultural traditions cultivates an appreciation for the arts and culture. By exploring diverse artistic expressions and cultural practices, children develop empathy, tolerance, and a broader understanding of the world around them.

(viii) Preparation for Lifelong Learning

Fostering creativity in preschoolers lays the foundation for lifelong learning and success. Creative thinking, flexibility, and adaptability are essential skills for navigating an ever-changing world and solving complex problems. By nurturing creativity in early childhood, educators and parents help prepare children for future academic, professional, and personal endeavors.





Overall, creative development among preschoolers is vital for their cognitive, social, emotional, and physical development. By providing opportunities for creative expression, exploration, and experimentation, educators and parents support children's holistic growth and empower them to become imaginative, innovative, and confident individuals.

The letter 'R' in STREAM stands for reading. Why is early reading important for young children? Early literacy and reading in preschools play a crucial role in laying the foundation for children's lifelong learning and success. Here are several reasons why early literacy and reading are important in preschool education:

(i) Language Development

Reading to young children introduces them to a rich vocabulary and helps them develop language skills. Exposure to a variety of words and language patterns through books and stories enhances children's oral language proficiency, which is essential for communication and social interaction.

(ii) Cognitive Development

Reading promotes cognitive development by stimulating children's thinking and imagination. When children engage with books, they learn to make connections, infer meaning, and think critically about the world around them. Reading also helps develop memory, concentration, and problem-solving skills.





(iii) Preparation for School Success

Early literacy skills, such as phonological awareness, letter recognition, and print awareness, are strong predictors of later academic achievement. Children who enter school with a strong foundation in literacy are better prepared to succeed in reading, writing, and other academic subjects.

(iv) Promotion of a Love for Learning

Reading fosters a love for learning by making the learning process enjoyable and engaging. When children experience the joy of reading, they develop a positive attitude towards books, learning, and school, which can have a lasting impact on their academic motivation and achievement.

(v) Parent-Child Bonding

Reading together provides opportunities for bonding between parents or caregivers and children. Shared reading experiences create special moments of closeness and intimacy, strengthening the parent-child relationship and promoting positive interactions between family members.

(vi) Cultural and Social Awareness

Books expose children to diverse cultures, perspectives, and experiences, helping them develop empathy, understanding, and respect for others. Through stories, children learn about different ways of life, traditions, and values, fostering cultural awareness and social-emotional learning.





(vii) Enhancement of Literacy Skills

Reading aloud to children helps develop early literacy skills, such as phonemic awareness, vocabulary, comprehension, and fluency. These foundational skills are essential for learning to read and write and are the building blocks of literacy development.

(viii) Prevention of Reading Difficulties

Early intervention through literacy-rich environments and exposure to books can help prevent reading difficulties and learning challenges later in life. By nurturing early literacy skills in preschool, educators and parents can identify and address potential literacy issues before they become significant barriers to learning.

In conclusion, early literacy and reading in preschools are essential for promoting language development, cognitive growth, school readiness, a love for learning, parent-child bonding, cultural awareness, and the prevention of reading difficulties. By investing in early literacy experiences, educators and parents can give children a strong foundation for academic success and lifelong learning.

1.2.5 Preschool STREAM for Future Learning and Future Workforce

According to the World Economic Forum (2016), educators need to ensure that children in school are provided with the tools, such as 21st-century domain skills, to keep up with the ever-changing world of technology. The foundation of a nation's educational system is critical for its long-term development and prosperity. In today's rapidly





evolving world, early exposure to STEM (Science, Technology, Engineering, and Mathematics) education is becoming increasingly important. Adding “R” and “A” to STEAM, and to create STREAM in preschool education, aims to expand the scope of learning and able to foster more well-rounded development in young children. The “R” emphasizes the importance of foundational literacy skills, including comprehension, vocabulary, and language abilities; while the “A” highlights the role of artistic expression and creativity that encourage creative thinking, self-expression that foster a more holistic approach to learning. In simpler terms, preschool STREAM education plays a pivotal role in shaping young minds, fostering essential skills, and preparing children for future learning and the workforce. This study explores the significance of preschool STEM education in contributing to lifelong learning and equipping the future workforce with the necessary skills to thrive in a competitive global economy. Building Foundational Skills is important for STREAM to support further learning. Preschool is a critical period for cognitive development, and introducing STREAM concepts during this stage lays the groundwork for future academic success. Early STREAM education helps children develop foundational skills such as critical thinking, problem-solving, and creativity. These skills are not only essential for STREAM subjects but are also transferable to other areas of learning and life.

The evolution from STEM to STREAM activities not just encourages reading and aesthetic development, but also encourages children to ask questions, explore various solutions, think creatively, and logically. For instance, simple experiments and building projects require children to hypothesize, test, and analyze outcomes. These activities help them understand cause-and-effect relationships and develop systematic





approaches to solving problems. This helps to promote critical thinking and problem-solving.

Besides, STREAM education fosters creativity by encouraging children to think outside the box and explore new ideas. Activities such as building structures with blocks or creating simple machines stimulate imaginative thinking and innovation. This creative mindset is crucial for adapting to new challenges and developing novel solutions in any field. Integrating STREAM education in preschool enhances overall early learning experiences by making learning engaging and relevant. Young children are naturally curious, and STREAM activities tap into this curiosity by providing hands-on, experiential learning opportunities. This approach makes abstract concepts more tangible and understandable. Furthermore, it promotes engagement and motivation. For example, hands-on STREAM activities captivate children's interest and motivate them to learn. When children are actively engaged in building, experimenting, and exploring, they are more likely to retain information and develop a love for learning. This intrinsic motivation is vital for sustaining long-term educational engagement.

Preschool STREAM education also promotes interdisciplinary studies and learning by integrating science, technology, reading, engineering, arts, and mathematics into cohesive learning experiences. For example, a simple gardening project can teach children about biology (plant growth), mathematics (measuring soil and water), and engineering (designing planting layouts). This holistic approach helps children see the interconnectedness of different subjects and enhances their overall learning experience.





This is important to keep up with the rapid pace of technology progress in our country; the teaching and learning methods in STREAM STREAM-related field, in particular, will need to be improved (Mustafa et al., 2022). The researchers further discussed the integration of STREAM education and Industry 4.0 in early childhood education in Malaysia that the integration of STREAM discipline into school curricula is the most important problem on educators' concern today as how the preschool instructors view and implement STREAM education in the early childhood classroom, will have an impact on the quality of STREAM education offered to the children. Therefore, this study emphasized the understanding that improving STREAM education, starting from early childhood education, can help teachers better prepare for the implementation of an appropriate strategy and plan in time. It is crucial to steer clear of STREAM-related fields before pursuing primary and postsecondary education. The future workforce will be dominated by fields requiring strong STREAM skills. As technology continues to advance, there will be an increasing demand for professionals who can innovate, analyze data, and solve complex problems. Preschool STREAM education is a crucial step in preparing children for these future roles by instilling a solid foundation in STREAM subjects and skills.

Introducing STREAM concepts early helps children develop interest and proficiency in these subjects. Research shows that early positive experiences with STREAM can lead to sustained interest and higher achievement in these fields throughout their academic careers. This early foundation is essential for pursuing advanced studies and careers in STREAM-related fields.





The 21st-century skills developed through STREAM education, such as critical thinking, collaboration, and digital literacy, are highly valued in the modern workforce. Employers seek individuals who can adapt to new technologies, work effectively in teams, and approach problems with innovative solutions. Preschool STREAM education helps cultivate these skills from a young age, ensuring that children are well-prepared for future career demands. Early STREAM education also plays a vital role in promoting gender and diversity inclusion in the STEM fields. By providing equal opportunities and encouraging all children, regardless of gender or background, to engage in STREAM activities, we can address the existing disparities in these fields. Early exposure helps break down stereotypes and fosters an inclusive environment where all children can envision themselves in STREAM careers.



The benefits of preschool STREAM education extend beyond individual learning and career prospects. A society with a strong foundation in STREAM education is better equipped to tackle global challenges, drive innovation, and maintain economic competitiveness. Countries that prioritize STREAM education from an early age tend to have more innovative and dynamic economies. A workforce with strong STREAM skills contributes to technological advancements, research and development, and economic growth. By investing in preschool STREAM education, the educators are investing in the future economic prosperity of our society.

Many educators are addressing the global challenges in the new changing world, such as climate change, healthcare, and sustainable development, which require STEM-STREAM-based solutions. Educating preschool children in STREAM from an early age prepares them to be the future scientists, engineers, and problem-solvers who will





address these critical issues. Early STREAM education fosters a generation of informed and capable individuals ready to contribute to a better world.

The significance of preschool STREAM education in contributing to future learning and the future workforce should be reinforced. By building foundational skills, enhancing early learning experiences, and preparing children for the demands of the future workforce, preschool STREAM education sets the stage for lifelong success. Moreover, the long-term societal benefits, including innovation, economic growth, and the ability to address global challenges, underscore the importance of prioritizing STREAM education from an early age. As we look to the future, investing in preschool STEM education is not just an educational imperative but a strategic necessity for the sustained development and prosperity of our society.



1.3 Problem Statement

Most Malaysian schools use a silo or embedded approach instead of an integrated STREAM approach, which is more effective. (Aspin et al., 2022). Additionally, previous research (Ong et al., 2016) had highlighted a lack of expertise and continuous training needed to support teachers in effectively implementing preschool STREAM education in the local context.

Several research studies continuously report that the learners' interest and motivation in STEAM are declining in countries like Australia, Malaysia, and India (Kurniati et al., 2022; Thomas & Watters, 2015). Further investigation revealed that





Malaysia's predominant learning mode is still rote learning because teacher-centered classrooms focus on teachers' scaffolding and guidance, as rote learning has yielded high-performance results in international exams (OECD, 2018). According to Ng, A. (2024), those STREAM practices and activities can be achieved through professional development to empower early childhood practitioners (Aldemir & Kermani, 2017; Ong et al., 2016). Moreover, his study further reviewed those practitioners may undo their anxiety or negative perception and start developing a new attitude towards integrating and teaching STREAM, such as understanding the need to nurture curiosity and creativity in early childhood classrooms (Murphy et al., 2019). His study indicated that future studies should include a continuous investigation to support early childhood practitioners to facilitate as well as to deliver STEAM integration both inclusively and sustainably.



According to the AWANI International Columnist (2024), Malaysia's future in our technology-driven world hinges on nurturing a new generation of STEM innovators. By addressing the root causes of declining interest in these fields, particularly through curriculum reform, we can pave the way for a more advanced nation. This transformation isn't just about changing what teachers teach, but how they teach it - rekindling curiosity and equipping youth with essential skills for a rapidly evolving landscape. Now is the time to take action; rethinking teachers' approach to STEM education is crucial for Malaysia to remain globally competitive. Malaysian children's preparedness for future challenges and opportunities, and indeed our nation's progress and prosperity, depend on the successful implementation of these vital educational reforms.





In addition, the need for STREAM integration is still prevalent in Asian countries to promote 21st-century problem-solving and critical thinking skills to prepare the next generation to face the future issues and challenges (Hsu & Fang, 2019). According to Phang et al. (2023), current private preschool teachers in the local context are concerned most about the lack of teachers' expertise to support them in integrating and implementing STREAM learning activities. It is because they lack the opportunity to participate in the STEM/STREAM-related professional development training and lack sufficient knowledge to implement STREAM lessons and learning activities in their preschool classrooms.

This evidence shows the lack of support for expertise and training underscores the necessity for reliable and effective STREAM teaching and learning modules to enhance teachers' skills for STREAM education. We should not undermine the high degree of indication for the lack of teachers' expertise for integrating and implementing STREAM activities, as well as the issues and challenges faced by the preschool teachers, which is alarming. In short, there is a need to provide supportive, empirically validated resources and effective materials to sustain Preschool STREAM education as a frame of mind for effective implementation and desired learning outcomes (Wai Leng et al., 2023)

The Malaysian Blueprint (2013-2025) has positively impacted the implementation of STREAM education across all levels of education. However, when it comes to early childhood education, there are benefits and challenges to implementing STREAM education. With the support of the Malaysian blueprint, there is indirect promotion and increased awareness of STREAM education in early





childhood education. STREAM education must be taught starting in preschools, as it provides teachers with opportunities to encourage children to participate in STEM-related activities and programs. Additionally, exposure to STREAM at an early age helps children develop critical and logical thinking skills, problem-solving abilities, and creativity, while also fostering curiosity and effective communication, leading to holistic development (Ghazali et al., 2023).

The Malaysian Blueprint's support has brought about significant reform in the education system, yet there remain unaddressed challenges in STREAM education. The lack of qualified and trained teachers who can teach effectively in STREAM subjects is such a challenge. As they lack the knowledge and skills to implement whatever is required in STREAM education effectively, the implementation is indeed affected.

Additionally, the lack of resources and facilities poses a significant obstacle. Without adequate materials and infrastructure support, it becomes challenging to implement STREAM education where there is a need to use technology in an integrated manner that encompasses scientific attitudes and science process skills. Consequently, this can lead to low interest and low engagement from children (Idris & Bacotang, 2023). To make the integration of STREAM persist for a longer period, this necessitates a thoughtful plan for a longer-term monitoring of the pedagogical aspect. Hence, teachers should be given support with a “booster dose” periodically to ensure continuous impact in their classroom practices (Ong et al., 2016)

Effective STREAM implementation could engage and inspire young children of all learning abilities and diverse backgrounds. The goal for preschool education is to produce STREAM-literate learners who are capable of thinking logically, using new





ideas, solving problems creatively and innovatively through an integrated learning, and immersing young children in hands-on inquiry and open-ended exploration. Early exposure to STREAM education enables young children to benefit from the integrated and exciting learning experiences, which can contribute to acquiring the 21st-century skills such as communication, critical thinking, collaboration, and creativity, which are crucial to later academic achievement (Dejarnette, 2018; Raja & Bahari, 2017). This approach allows children to learn from real-life situations and explore the immediate environments around them. The ultimate purpose of STREAM is to provide opportunities for children to acquire the skills of decision making, problem solving, leadership, and to become critical thinkers. During the preschool period, young children are naturally equipped with the skills that form the basis for STREAM education (Yucelyigit & Toker, 2020). They are potential scientists and engineers as they naturally learn through observation, exploration, and experimentation; they are full of curiosity and enthusiasm for the environment around them (Dilek et al., 2020). By providing early childhood-aged children with a meaningful hands-on STREAM experience, it encourages a positive impact on their dispositions and perceptions towards STREAM (Spyropoulou et al., 2020). In the teaching and learning process, teachers are the key agents in shaping and determining the quality of education and effective learning.

Previous studies had indicated that preschool teachers have a positive perspective towards STREAM education, yet teachers lack confidence to implement STREAM lessons in the preschool classroom (Baltsavias & Kyridis, 2020). The findings of Ong et al. (2016) also outlined the necessity of Malaysia's Ministry of Education to review the existing National curriculum to identify the gaps in implementing STREAM education in the private preschool context. It is undeniable





that the teachers' ability and the pedagogical approach used to promote the integration of STREAM learning will significantly impact the success of STREAM education. Several indications point toward that current educational pathway are not significantly leading to a sufficiently large as well as well-trained STREAM workforce to achieve this ambitious goal to produce new citizenry and workforce of problem-solvers, innovators who are self-reliant and able to think logically as one of the foundations that drive innovative to be excel in these area (Schleicher, A., 2007). Furthermore, the previous findings revealed STREAM learning can be applied using some integration patterns including silo, embedded and integrated approach. In addition, integrated approaches can produce children with high interest and motivation to learn Science and enhance the academic achievement of children in this learning area (Aspin et al., 2022). Moreover, the current policies and practices that document reasonable access to the best STEM teaching and learning are not well known yet. Hence, the states, districts, and schools are struggling to provide learners with the STREAM experiences that are required for the 21st century. Policy makers should make STREAM education a top priority to guarantee that learners in the local context receive a justifiable quality STREAM education with opportunities (Malaysia Blueprint 2013-2025). This should include the learners who can be inspired, with inspiration and show interest in science, technology, engineering, and mathematics, with amber of opportunity to reach their full potential.

Although studies reviewed, those preschool teachers have STREAM practices in the classrooms. However, there was still a lack of evidence on how preschool teachers taught STREAM lessons effectively. This study provides insights into how the STREAM effort can be achieved through using a practical STREAM module for better





theory and practice. The design and development of the module would provide an overview of the Integrated Thematic Instructions (ITI) to enable preschool teachers to understand our educational policy agenda and address our Malaysia Blueprint (2013-2025) basic goals and orientation towards quality education. Overall, the basic ITI STREAM module is designed for preschool teachers to enhance STREAM teaching practice. It also helps preschool teachers to be more ready for STREAM education. This module serves to increase the competency of teaching, including the pedagogical content knowledge (PCK) for integrated thematic content, teaching strategies, and teachers' own STREAM literacy development. Furthermore, the ITI-STREAM module can be used to improve the efficacy level among preschool teachers for effective classroom practices and to overcome the challenges highlighted in the study.



This research concerns the implementation of preschool STREAM education and the challenges faced by the preschool teachers. Currently, the attention and demand for STREAM education are gradually increasing due to the complex challenges and problems that exist in our world today (Bahrum et al., 2017; Khalil & Osman, 2017). To support and tackle the global challenges, it is not only requiring the nations to work together in achieving improved results, but also to focus on the sustainability of the implementation of STREAM education to all ages. "Quality Education" is indicated in the UNESCO framework- 17 Sustainable Development Goals (SDGs) to develop the quality education system in promoting life-long learning opportunities for all children, from early childhood to tertiary education (UNESCO, 2017). Therefore, education plays a vital part in achieving SDGs and supporting the sustainable development of the STREAM education approach.





This is to emphasize that the previous research findings revealed that concerted effort is needed to develop and validate more STEM-STREAM projects for the consumption of the early childhood teachers across the various early childcare centres in Malaysia (Ong et al., 2016). The uncertainty refers to the continuous practice of STEM-STREAM integration. This necessitates a thoughtful plan for long-term monitoring, and those teachers should be given a STEM-STREAM integration training, provided with a “booster dose” periodically to ensure continuous impact in the preschool classroom setting. Classroom practices are the educational process for effective teaching and learning, as it is fundamental to young children’s learning (Wai Leng et al., 2021). It was highlighted that there is a need for the raising of teacher awareness on the interdisciplinary nature of preschool STREAM practice. More STREAM professional workshops should be conducted to provide insights into the support required for teachers to adopt an innovative, effective project-based approach and action research to nurture and develop the early stream (science, technology, reading, engineering, aesthetics, mathematics) competency among the young children. Therefore, it is important for education training institutions to influence the innovative teaching of STREAM in early childhood (Ong et al., 2016).

STREAM education is one of the agendas emphasized in the implementation of the Malaysian Education Development Plan (PPPM) 2013-2025. The related research was supported by the Ministry of Education (MOE) in examining the development of STREAM education and the challenges of the implementation of STREAM education in Malaysia. The study revealed there are three types of STREAM approach namely, silo, embedded and integrated STREAM approach.





Silo STREAM Approach: The silo approach is an approach that separates STEM components, where all STREAM elements are taught individually or separately (Winarni et al., 2016). The silo approach is more geared towards teacher-centered learning (Yadav et al., 2017). Learning that focuses on particular subjects enables children to gain a deeper understanding. Furthermore, research from (Halim et al., 2018) shows that interest in Science and Mathematics learning among Malaysian school children is declining and reasons for the decline include learning in silo and not integrated.

Embedded STREAM Approach: According to Khairani et al. (2018), STREAM learning through this approach focuses more on only one STREAM element, while other STEM elements are only used as additional information to complement school children's understanding better against the STREAM elements. This helps children's knowledge more deeply on one of the STREAM elements, but not on the other STREAM elements. However, the weakness in an embedded approach leads to separate learning. If children cannot relate additional elements to crucial elements, they are at risk of getting only part of the entire learning process, and school children cannot associate the embedded content with the context of the lesson.

Integrated STREAM Approach: The integrated approach is the best approach to STREAM learning (Winarni et al., 2016) because the integrated approach combines every element contained in STREAM and taught in one subject. This pattern combines STREAM materials in the classroom while at the same time combining them with curriculum content (Angraini & Huzafah, 2017). An integrated approach is published





to increase children's interest in STEM learning, especially in the early stages of learning development.

According to previous study (Chumdari, Anitah, Budiyo, & Suryani, 2018), Kovalik (2014) suggested the effectiveness of integrated thematic instructional model because it facilitates the school to promote democratic life and to meet the needs of the 21st century. In addition, Smith et al. (2007) also claimed it as the best instructional method, which allows children to experience the process of knowledge creation.

Today's education stresses the necessity of interdisciplinary learning, which the S.T.R.E.A.M. approach promotes in learning. Following interdisciplinary learning is the thematic-based direction that encourages all the various learning areas of the syllabus to be connected within a topic/theme (Singh & Rashid, 2023). Although STEM has been empowered through the Malaysia Education Blueprint (2013-2025), from early childhood education, primary school education, to secondary school education. However, the children are still not interested to learn STEM subjects ultimately. Issues related to the low achievement of children in Malaysia as mentioned by Aspin et al. (2023) such as lack of motivation and interest showed that Malaysia's level of education still needs to be improved and developed at the maximum level, and further research should focus on the implementation of integrated STREAM activities that can help children to improve their interest, motivation and learning towards STREAM.

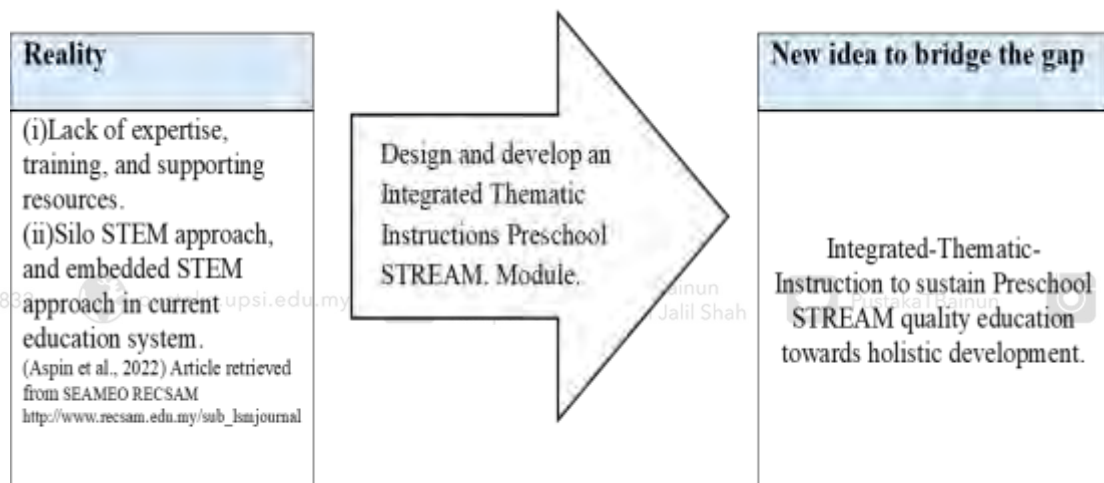
Integrated Thematic Instruction (ITI) is a comprehensive school model designed by Susan Kovalik (1994) to increase children's or learners' performance and teacher



satisfaction. The Integrated Thematic Instruction is crucial in supporting the preschool teachers to formulate the ideas of STREAM education stated in the Malaysia Blueprint (2013-2025) into actual practice, hence bringing the gap between the theory and practice in the preschool settings to promote and maintain STREAM education interest in early childhood education, as illustrated in Figure 1.2.

Figure 1.2

The ITI-STREAM module to bridge the gap between reality and the ideal into actual practice



This study will raise awareness of the Malaysian society policy makers, curriculum developers, preschool teachers, and the public at large towards the importance of Integrated preschool STREAM education as opposed to the single disciplinary approach in the early childhood classroom. This study also aims to draw the attention of individuals and groups interested in developing and implementing educational STREAM as the foundation of early childhood education, as one of the key forces to drive and sustain the growth of STREAM education. Furthermore, activities conducted in STEM also play a major role in these challenges. The silo and unintegrated



STEM activities making STEM-STREAM problem even worse (Aspin et al., 2022). Therefore, this study suggested further research on the implementation of integrated STREAM.

In addition, this study addresses the critical need for developing an integrated STREAM module aligned with the National Philosophy of Education. It underscores the significance of engaging children in language activities such as reading, storytelling, and poem reciting, and more, which are fundamental for nurturing flexible communication skills. Moreover, the study endeavors to bolster teacher resilience through comprehensive training and seminars, aiming to deepen their expertise and enthusiasm for preschool STREAM education. These requirements must be met if Malaysia is to continue progressing toward becoming a developed country. It is important to nurture young children's curiosity and interest in STREAM-related learning areas from an early age. Early preparation plays a crucial role in helping children advance in STREAM fields and equipping them to pursue postsecondary education later in life (Mustafa et al., 2022).

1.4 Purpose of the Study

This study aims to develop an Integrated Thematic Instruction- STREAM module (ITI-STREAM module) to promote teaching using an integrated thematic approach. This is to address the preschool education, which is an ongoing effort towards further developing the potential of individuals in a holistic and integrated manner (Education Act 1996). It is focusing on helping preschool teachers in planning and implementing





STREAM lessons and activities to improve their teaching. Furthermore, this module will serve as a guide that aims to enhance pre-service teachers' skills of planning and implementation, teaching and learning, teaching materials preparation, and teaching strategies that involve preschool STREAM activities. This research highlights integrated and comprehensive learning on specific topics or themes, using the scientific method as the foundation for learning.

In this study, the Design and Development Research is employed. Design and Development Research (DDR) provides a structured, iterative approach to developing and refining solutions, products, and models, particularly in fields like education and technology, aligning with Malaysia's focus on innovation and technological advancement. This study is a design and development research that employed a design and development model by Richey and Klein (2007). Richey and Klein (2007) describe design and development research as a systematic approach to studying the processes of designing, developing, and evaluating products. The DDR approach, as described by Richey and Klein (2007) and others (Mohd Ridhuan Mohd Jamil & Nurul Rabihah Mat Noh, 2020; Saedah Siraj et al., 2020), is particularly suited for the iterative development of instructional products, processes, and tools.

A group of experts in the related early childhood education field was involved in this study, who would be responsible for evaluating the module that was developed. The design and development of this module involved three distinctive phases, namely Phase 1: Needs analysis, Phase 2: Design and development, and Phase 3: Evaluation.





1.4.1 Research Objectives

The main focus of the present study was to develop an ITI-STREAM Module to provide pedagogical support for preschool teachers. Based on the design and development research (DDR) approach (Richey & Klein, 2007), the study consisted of three different phases. The main objectives guiding each consecutive phase were as follows:

A. Phase One: Needs Analysis

To determine the needs for the ITI-STREAM Module in the context of the study, the objective of the first phase was:

1. To identify the need to develop the preschool ITI-STREAM module for teachers' skills enhancement.



B. Phase Two: Design and Development

This phase involved the design and development of the preschool ITI-STREAM module according to the findings obtained from the needs analysis phase.

2. To determine the appropriate preschool ITI-STREAM module design based on the experts' consensus
3. To validate the component and content of the preschool ITI-STREAM module

C. Phase Three: Evaluation

In this phase, usability of the preschool ITI-STREAM module was evaluated following the implementation of the module prototype developed in the Phase Two – Design and Development Phase





4. To evaluate the usability of the preschool ITI-STREAM module for quality education.

1.4.2 Research Questions

To achieve the research objectives as outlined above, the research questions are formulated based on the three phases of the design and development of the research approach. The research questions for this study were devised as follows:

A. Phase one: Needs analysis

The following research questions are the kickstart to identify the needs to develop the preschool ITI-STREAM module for teachers' skills enhancement.



1. What are the preschool teachers' perceptions of implementing STREAM education
In preschool settings?
2. What are the preschool teachers' perceptions of the challenges in implementing
STREAM in preschool settings?
3. What are the differences between pre-service teachers' and in-service perceptions of
Implementing STREAM education in preschool settings?





B. Phase 2: Design and development

3. What is the appropriate preschool ITI-STREAM module design based on the experts' consensus?
4. How do the experts review the initial and developed preschool ITI-STREAM module?

C. Phase 3: Evaluation

5. What is the usability of the preschool ITI-STREAM module for quality education?

The following Table 1.1 shows the overall research objectives and research questions in different phases.



Table 1.1

Research Objectives and Research Questions in different phases

Design and Development Research 3 Phases)	Main Guiding Research Objectives	Research Questions
Phase 1: Needs analysis.	To identify the needs to develop the preschool ITI-STREAM module for teachers' skills enhancement.	<ol style="list-style-type: none"> 1. What are the preschool teachers' perceptions of implementing STREAM education in preschool settings? 2. What are preschool teachers' perceptions of the challenges in implementing STREAM in Preschool settings? 3. What are the differences between pre-service teachers' and in-service perceptions of Implementing STREAM education in preschool settings?



Design and Development Research 3 Phases)	Main Guiding Research Objectives	Research Questions
Phase 2: Design and development	To determine the appropriate ITI-STREAM module design based on the experts' consensus	3. What is the appropriate preschool ITI-STREAM module design based on the experts' consensus?
	To validate the component and content of the preschool ITI-STREAM module	4. How do the experts' reviews towards the initial and developed preschool ITI-STREAM module?
Phase 3: Evaluation	To evaluate the usability of the module to enhance preschool ITI-STREAM for quality education	5. What is the usability of the preschool ITI-STREAM module for quality education?

1.5 Significance of the Study

In the realm of preschool education, the importance of scientific skills and knowledge cannot be overstated. These two elements are fundamental to the effective delivery of STREAM (Science, Technology, Reading, Engineering, Aesthetic, and Mathematics) education, particularly in the context of Malaysia's educational landscape.

Why do scientific skills and knowledge matter? In the context of preschool education, skillful teachers are better equipped to handle the diverse needs of young children, manage classroom dynamics, and implement innovative teaching strategies. The presence of teachers with scientific skills and knowledge in the classroom fosters a supportive and nurturing environment, which is essential for the holistic development of preschool children.

The Significance of Teacher Knowledge in STREAM is never to be underestimated. The knowledge possessed by teachers in STREAM subjects is equally



vital. Early childhood is a critical period for cognitive development, and exposing children to STREAM concepts during these formative years lays the foundation for future academic success and interest in these fields. Teachers with a strong grasp of STREAM learning can effectively introduce complex concepts in a simplified manner that is accessible to young children. This foundational knowledge helps children develop problem-solving skills, critical thinking, and creativity. Moreover, knowledgeable teachers are more confident in their ability to design and implement engaging STREAM activities, fostering a sense of curiosity and excitement in their children. The significance of teacher knowledge in STREAM extends beyond content delivery; it also involves understanding pedagogical techniques that are age-appropriate and culturally relevant, thereby enhancing the overall learning experience.



The interplay between teachers' scientific skills and knowledge is pivotal for the success of STREAM education in preschools. Preschool teachers who are well-versed in STREAM are better prepared to navigate the challenges inherent in educational environments, such as limited resources, varying learner abilities, and evolving curricular demands. This combination enables them to maintain high standards of teaching and adapt their instructional strategies to meet the needs of all children. For instance, a skillful and knowledgeable teacher can creatively use everyday materials to conduct engaging science experiments, despite a lack of formal resources. Furthermore, they can persist in their efforts to provide high-quality education, even when faced with setbacks, thus ensuring that young children receive consistent and effective STREAM instruction.





The importance of teachers' scientific skills and knowledge in the context of preschool STREAM education cannot be understated. Teachers' scientific skills and knowledge encompass both their expertise in scientific concepts and their ability to effectively teach and facilitate scientific enquiries. This includes knowing and applying the scientific processes, content knowledge, as well as possessing pedagogical skills to engage children in learning. These attributes are essential for creating a dynamic and supportive learning environment that nurtures young children's curiosity and lays the groundwork for their future academic and professional success in STREAM fields. Investing in the development of these qualities among preschool teachers is crucial for the advancement and progress of STREAM education in Malaysia towards the desired future STREAM literacy workforce.



The researcher strongly believes that a preschool STREAM module or toolkit can build and enhance preschool teachers' STREAM skills and knowledge. The introduction and design, and development of this ITI-STEAM module is to enhance STREAM basic skills and knowledge among the preschool teachers. It is an essential step toward fostering preschool STREAM education in Malaysia. Such a module not only equips teachers with the necessary resources and strategies to effectively teach STREAM but also fosters their ability to withstand and adapt to the various challenges they encounter for professional development. The module was developed with good intentions to empower preschool teachers and, by extension, enrich the STREAM experiences of young children for best practices in the classroom.

A well-designed preschool STREAM module is essential for enhancing teachers' subject matter expertise. This module typically includes comprehensive lesson





plans, hands-on activity guides, and interactive resources that cover fundamental STREAM concepts in an accessible and engaging manner. By providing structured yet flexible content, this module helps preschool teachers build a solid understanding of STREAM, enabling them to convey complex ideas in a simplified form for effective teaching and learning.

Furthermore, this module offers teachers continuous learning opportunities for decision-making and critical thinking. The resources not only update teachers on the latest STREAM education trends and techniques but also provide practical demonstrations of effective teaching methods. This ongoing professional development ensures that teachers are well-prepared to deliver high-quality preschool STREAM education, fostering a deep and lasting interest in preschool STREAM education among preschoolers.



In addition to enhancing STREAM skills and knowledge, the design and development of a preschool STREAM module play a crucial role in building teacher skills and knowledge. Teaching young children is inherently challenging, requiring educators to be adaptable, patient, and resourceful. A comprehensive module supports teachers by providing structured guidance and a variety of resources that can be tailored to different classroom settings and children's needs. This level of preparedness helps reduce the stress associated with lesson planning and delivery, allowing teachers to focus on creating more engaging and supportive learning environments.

By addressing the holistic needs of teachers, the module will help educators to become competent in navigating the complexities of preschool STREAM education.





Early science teachers are better equipped to handle unexpected challenges, maintain a positive classroom atmosphere, and remain committed to their educational mission to make preschool STREAM education a success in teaching and learning.

Implementing a preschool STREAM module also involves integrating the materials and resources into the existing curriculum and providing ideas for teachers on how to use them effectively. Schools and educational institutions play a vital role in facilitating this process by offering support and creating an environment that encourages innovation and collaboration among teachers.

The benefits of using this module are manifold, as it offers a clear framework and a wealth of resources that simplify lesson planning and enhance instructional quality. This support boosts preschool teachers' confidence and competence in delivering STREAM education, leading to more effective teaching outcomes. For young children, the presence of well-prepared and resilient teachers translates into a more stimulating and supportive learning environment. Engaging and well-structured preschool STREAM activities foster curiosity, critical thinking, and problem-solving skills, laying a strong foundation for future academic success.

Preschool education has been recognized as the most critical period in child development, as quality preschool education makes a significant contribution to the development of the whole child (Wai Leng et al., 2021). The mission of Malaysian preschool education is to always emphasize the holistic approach with a developmentally appropriate preschool programme. Hence, Preschool STREAM Education for sustainable development is regarded as a lifelong learning process and an integral part of quality education. It enhances cognitive, social, and emotional





development, behavioral (skills, values & attitudes) dimensions of learning. STREAM is holistic and transformational, encompassing learning content, pedagogical, the learning environment itself, and societal transformation. It empowered learners with skills and knowledge, values, and attitudes to take informed decisions and make responsible actions towards environmental integrity, and a ‘just’ society. Education for sustainable development is recognized as a key enabler of all sustainable development goals to transform society (UNESCO, 20176). An integrated-thematic STREAM approach is promising for sustainable development education. How the children learn best and build a better brain relies on stimulating increased interest and enthusiastic participation in academic activities (Muthukrishnan et al., 2019). It is believed that the role of STREAM education in preschools helps young children to understand the relevance of early science in their daily life and enhances their fun learning and interest in addressing the real-life situations around them.



Understanding and integrating preschool STREAM education in Malaysia is the priority for our national education programme. It is an ongoing effort towards further developing the potential of individuals in a holistic and integrated manner (Education Act 1996). It is a positive approach towards the STREAM literacy workforce and literate citizens under the Malaysia Blueprint (2013 – 2025).

The preschool ITI-STREAM module developed can be used as a reference and guide for various parties who were involved in the preschool educational institutions, such as in-service teachers, pre-service teachers, teachers’ associations, and the Ministry of Education (MOE).





This module will ease teachers with better preparation and provide ideas on planning and implementing STREAM activities in preschool classroom settings. The preschool teachers can adopt and modify the module to suit the needs of the school's programme. This module will help them to deliver the STREAM lessons more effectively. This module is especially appropriate for pre-service teachers or novice teachers as it could serve as a basis for them to master the integrated thematic approach to teaching preschool STREAM lessons and conducting activities in class.

Furthermore, activities conducted in STEM also play a major role in these challenges. The silo and unintegrated STEM activities making STEM-STREAM problem even worse (Aspin et al., 2022). Therefore, this study suggested further research on the implementation of integrated STREAM.



1.6 Conceptual Framework

A conceptual framework is a system of concepts, assumptions, expectations, beliefs, and theories that supports and informs the research (Maxwell, 2005). It was based on the variables of the study, outlining the flow of the overall study. In line with the structure of the DDR study, the conceptual framework begins with the Phase One – Needs Analysis to ascertain the need for the development of the Preschool ITI STREAM Module, which will be discussed in Chapter 4.

Moving on to Phase Two, which is interrelated with Phase One, the module will be designed and developed to cater to the needs of the practice. In this phase, the





variables in the design and development phase included the experts' consensus and review of the module for appropriateness, which would be discussed in Chapter 5.

The last phase, which was Phase Three that encompassed the evaluation of the module. The variables involved the teachers' evaluation and the module usability. The evaluation will lead to the final product of the study, which is the developed Preschool ITI STREAM Module that will be discussed in Chapter 6.

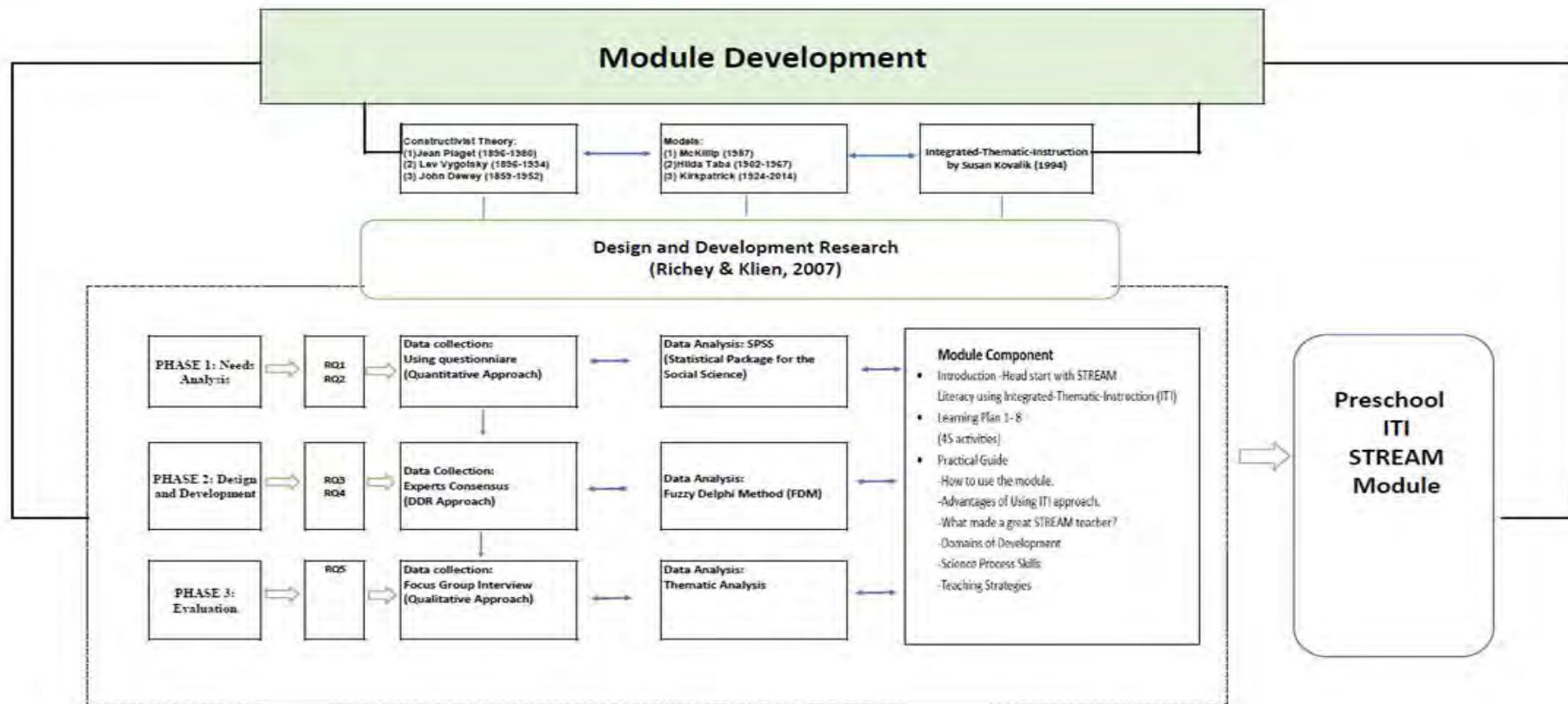
The conceptual framework in this study serves as a guide, and it is rooted in the following knowledge representation for the design and development of the Preschool ITI STREAM Module. In addition, solid supporting theories and models within the conceptual framework to complete the study are required to ensure the success of the research. Overall, the focus of this study is to develop an ITI-STREAM Module to enhance the skills of planning and developing STREAM activities among preschool teachers. The developed module will help to facilitate and scaffold teachers on how to prepare and plan relevant STREAM activities for young children.

The conceptual framework, as shown in the following Figure 1.3, illustrates the process through which the various variables in different phases of the study interact, progress, and finally lead to the final product of the study, namely the Preschool ITI-STREAM Module. The role of each supporting theory and model will be explicitly interpreted in Chapter 2.



Figure 1.3

Conceptual framework for DDR (Topic: Development of preschool ITI STREAM module for teachers' skills enhancement)





1.7 Scope of the Study

In this present study, the focus of the module design and development involves the integrated-thematic instruction, science process skills, and scientific attitudes. It also includes the domains of development, such as cognitive, physical, social, and emotional development. The early science process skills involved are observing, communicating, classifying, measuring, inferring, and predicting (KSPK, 2017). The young children are expected to work scientifically with scientific attitudes such as curiosity with learning interest, persistence, decision-making, and problem-solving.

The designing and developing of the ITI-STREAM module activities focused on thematic webbing and integration across other curriculum strands. Next, the module was specially catered for preschoolers in the context of the study. The preschool teachers can promote STREAM activities with the enrichment programmes in schools or during co-curricular activities. Teachers were encouraged to employ teaching strategies such as project-based learning, inquiry-based learning with hands-on and experiential learning activities to strengthen the early science competency, as well as to improve and promote in-depth STREAM education among the young children. The designed activities integrated at least two or more learning areas that include science, technology, reading, engineering, arts, and mathematics (STREAM) in the teaching and learning. The themes that have been chosen have allowed young children to understand the realities of life and helped them to understand the real world around them, that situations in life are generally interrelated and not isolated. In addition, the teaching and learning process is focused on “learning by doing”, which shall engage children





involved in activities with exploration, investigation, questioning, and discovery of new knowledge.

1.8 Limitation of the Study

This study employed the “product and tool research,” which is under the design and development approach (Richey & Klein, 2014). This research acknowledges several limitations that may have affected the overall comprehensiveness and generalizability of the findings.

Firstly, the needs analysis was conducted with a relatively small sample size of only 80 participants, selected through convenient sampling within limited geographical areas. While the current scope provided valuable initial insights, the findings may be further enriched by including a more diverse and larger group of participants, particularly from different states or remote regions. Broader representation could offer a more comprehensive understanding of the needs and challenges across varied educational contexts.

Secondly, the workshop training component could have benefited from involving more participants from various backgrounds or regions. A larger and more diverse group would have allowed for a wider range of feedback, offering deeper and more varied perspectives on the practicality and effectiveness of the preschool ITI STREAM module.





Fourthly, in designing and developing the preschool ITI-STREAM Module, this research is focused and tailored on preschool teachers' planning, designing, and developing of ITI-STREAM activities to enhance skills and professional development. The assessment and evaluation of young children's early science learning outcomes were not the main focus of this context of study and were not studied in this research.

Lastly, the teaching module was only available in English, which may have limited accessibility and usability for some users. Translating the module into the national language or providing a bilingual version would have enhanced user-friendliness and ensured broader applicability across different linguistic groups. Addressing these limitations in future research could significantly strengthen the development and evaluation of the STREAM module.



Nevertheless, it is important to be aware that this module serves as guidance for the preschool teachers, especially the pre-service teachers. The ITI-STREAM Module was developed by the researcher based on the identified needs of the selected teachers in the field of early childhood educational settings and the consensus of the experts involved in the Delphi study. This module could be adapted and modified accordingly based on the respective needs of the preschool centres with different natures and settings. However, the lessons delivery also depends on the level of understanding and competency of the pre-school teachers, the level of multiple intelligences of the children, as well as the level of support from the preschools for STREAM practices.





1.9 Definition of Terms

The purpose of the definition of terms is to establish a shared understanding of the study's key elements. This section is to concisely explain the key concepts, variables, and terminology used throughout the study.

1.9.1 Preschool

A school for young children before entering formal primary school education. Preschool in this context of study denotes the Malaysian private early childhood education programme that provides education for preschoolers from 4 to 6 years old.

The public and international preschools, as well as the nursery or childcare services below 4 years old, however, were not included in the scope of the study.

1.9.2 Preschool Teacher

An educator or instructor who is employed to take care of and teach young children aged 4 to 6 in classroom settings. Resilience is the foundation stone for preschool teachers wanting to perform their duty at best, and with skills and knowledge, role model resilient behaviours to learners, including teacher leadership roles.





1.9.3 STREAM Education

STREAM evolved from STEM and STEAM. It is a unique teaching and learning approach that brings together the six strands, which can actively promote 21st-century skills in preschool education. STREAM education is an approach to learning that uses the six strands, such as Science, Technology, Reading, Engineering, Aesthetics, and Mathematics, as access points for guiding inquiries and critical thinking. This acronym, STREAM, is nowadays a structured reality, and the meaning is known by most innovative schools. The approach of STREAM education expects the children to acquire the ability to create, invent, design, and solve problems (Badmus, 2020). Using STREAM education in the 21st century results in learners who take thoughtful risks, engage in experiential learning, persist in problem solving, embrace collaboration, and through the creative process.



1.9.4 Integrated Thematic Instruction (ITI)

Integrated Thematic Instruction (ITI) is a comprehensive school model designed by Susan Kovalik (1994) to increase learner performance and teacher satisfaction. The primary purpose of the model is to teach children in a way that will gain an authentic understanding of core content areas and develop responsible citizenship. Over the past 25 years, ITI has been implemented in thousands of schools across America, Europe, and Asia. The ITI model is a brain-compatible instructional model grounded in the biology of effective instructional strategies, cross-curriculum thematic instruction, and the development of conceptual curriculum. In addition, it focuses on the active





involvement of young children in the learning process and directs them to become accustomed to existing regularities (Anggraeni, Roza, & Furkan, 2023). Through integrated-thematic instruction, young children can gain experiences that help them discover knowledge holistically, meaningfully, authentically, and enthusiastically. It was further stressed that integrating thematic instructions or an approach would bridge the school and daily life learning experiences. Based on Susan Kovalik (1994), some countries have implemented thematic curricula, such as the UK, which introduced thematic teaching since 1990 to break down the traditional subject barriers to make learning more meaningful and stimulating to young children. Moreover, the previous study reported that the main challenge UK teachers face in implementing the thematic curriculum is the integrated approach. Most teachers felt incompetent to teach by integrating subjects as they did not master some of the learning areas well. Therefore, it is important to be aware that teachers who are accepting the new curriculum will need to accept the change and should change their perceptions to improve their pedagogical practices in the classroom.

1.9.5 Design and development research

Design and development research seeks to create knowledge grounded in data systematically derived from practice. We define this type of research as: the systematic study of design, development, and evaluation processes to establish an empirical basis for the creation of instructional and non-instructional products and tools and new or enhanced models that govern their development (Richey, R.C., Klein, J., & Nelson, 2014)





1.9.6 Interdisciplinary Studies

The term “Interdisciplinary” is applied within education and training pedagogies to describe studies that use methods and insights of several established disciplines or traditional fields of study. In short, interdisciplinary studies involve the combination of multiple academic disciplines into one activity from several fields or learning areas by drawing on knowledge and thinking across the boundaries. It involves teachers and children in the goals of connecting or integrating the academic school of thoughts to pursue a common understanding to accomplish the task. Likewise, interdisciplinary in this study applied to STREAM education by integrating the perspectives of at least one learning area or more.

Interdisciplinary has the historical antecedents, most notably in Greek philosophy. Since 1990, it was attested that “The roots of the concepts lie in several ideas that resonate through modern discourse, that the ideas of a unified science, general knowledge, synthesis and the integration of knowledge” (Klein, Julie Thompson, 1990). However, the interdisciplinary programmes might not be successful due to most teachers being trained in the traditional disciplines; therefore, they lack experience and will not know how to appreciate the differences and perspectives and methods of interdisciplinary approaches (Urbanska et al., 2019). Thus, these places barriers for those who choose interdisciplinary or multidisciplinary approaches in their work.





1.9.7 Skills Enhancement

Enhancing preschool teachers' skills to effectively implement a STREAM (Science, Technology, Reading, Engineering, Art, and Mathematics) approach is crucial for early childhood education. This requires providing teachers with training and support in integrating these subjects into their curriculum and developing the necessary skills to engage young children in inquiry-based learning.

1.10 Chapter Summary

Generally, this chapter provided the background of the study, the importance of the study with the needs analysis, and the gap between the reality and ideal classroom practice for preschool STREAM education. The problem is identified with different objectives stated according to different stages of design and development of the ITI-Preschool STREAM Module. It is believed that the design and development of the ITI-STREAM Module could help preschool teachers in planning the STREAM teaching more effectively. Preschool teachers can apply this module in their teaching. It could fill the gap between the actual practice and the ideal way to create STREAM.

In conclusion, this chapter summarised an overview of the research, outlining the problem statement, objectives, and the significance of the study, which set the foundation for the detailed exploration of the topic in subsequent chapters. The next chapter will explore related literature and relevant theories that support this study.

